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## Manuszeal Healthcare Academy

Dr. Kishore Kumar. D, MPT(Hand), PhD, M.D (Acu) is the founder and director of Manuszeal Healthcare Academy (Institution of Advanced Learning and Research). The academy was established on 23.09.2021 at Chennai, India.

The mission is to disseminate Comprehensive knowledge and Skills in Physiotherapy & other medical disciplines from Eminent Healthcare Professionals across the Globe to the Students and Professionals of Physiotherapy fraternity.

The Vision is to Achieve Global Excellence in Rehabilitation Services for the Patient Community and in Physiotherapy Education through Knowledge Sharing about Advancements and Innovations in Healthcare Specialities for the betterment of the Community.

Manuszeal Healthcare Academy extends hearty gratitude to all the academicians, clinical therapists & research scholars who strived to share their research reports through this conference with their scientific paper presentations. I extend my heartfelt thanks to the reviewers who worked immensely for past 6 months to review those 161 scientific papers. It was my honour to collaborate with Indian Journal of Physiotherapy and Occupational therapy (IJPOT) during the Event of International Physiotherapy Conference **IPCON 2023 held** with the Theme " Exploring Physiotherapy – A Global Perspective" held on August 1$^{st}$ to 4$^{th}$ at Chettinad School of Physiotherapy, CARE, Kelambakkam

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Original Article

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# Effectiveness of Lumbar Stabilization Exercise in Improving Lumbar Spine Endurance by Using Sorenson's Test and EMG Analysis for People with Chronic Low Back Ache

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**Abstract**

**Background:** Strength endurance in lower back region is the most important factor for chronic low - back pain. There are several treatments for strengthening low back muscle. Strength and endurance that have proven benefit in CLBP patients; however, there are very few studies that focus on lumbar stabilization exercises.

**Purpose:** The intention of this study was to improve the strength and endurance more effectively than usual programs by performing lumbar stabilization exercises.

**Materials And Methods:** This Quasi-Experimental study had 40 participants with persistent LBP, aged 25 to 50, divided into lumbar stability (n=20) and lumbar strengthening (n=20) groups. sEMG measured strength endurance, NPRS scale measured pain, before and after intervention**.**

**Results:** Lumbar stabilization exercises (Group A) were significantly more effective than static stretching and strengthening exercises (Group B) in treating persistent low back pain, with $p<0.001$ in outcome measures.

**Conclusion:** Lumbar stabilization exercises have been demonstrated to be more effective than conventional therapies in patients with CLBP.

**Keywords:** Chronic low back ache (CLBP), surface Electromyography, strength endurance

## Introduction

One of the most prevalent musculoskeletal conditions is low back pain, which can cause soreness or discomfort in the hip, buttocks, or lumbar area [1]. It develops as a result of intense physical activity, frequent twisting, bending, and carrying motions, and prolonged periods of stiffness. Psychological issues including anxiety, depression, and/or fear might also have an impact on it [2]. One of the main factors contributing to disability is chronic low back ache. Lumbago or paraspinal muscular hypertonicity is not the only cause of back pain. Since back pain affects 12 to 33% of people at any given time and is mechanical in 90% of cases, back pain is likely to receive the majority of medical attention [3].

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CLBP affects more than 500 million people globally. Prevalence of CLBP was 4.2% in people between the ages of 24 and 39 and 19.6% in people between the ages of 20 and 59. Most people's back pain subsides on its own. Studies on prevalence of low back pain across India showed 6.2% to 92%[4]. The higher prevalence for LBP in school girls than in school boys is probably caused by psychological factors, female hormone changes, and menstruation. After menopause, females exhibited a greater incidence with LBP than males as compared with young and elderly individuals [5].

However, a significant percentage of these patients eventually develop persistent symptoms. Every case of CLBP includes the symptom of pain, which must last for at least 3 months or manifest itself episodically throughout a 6-month period without any 29 obvious pathoanatomical causes. Studies on back pain in younger age groups typically concentrate on instances of the condition caused by secondary causes, particularly those connected to inflammatory diseases[4]. When an individual is resting, the biomechanical properties of muscles and fascia are intrinsic components associated with this tissue, and in the back, these properties play a vital role in maintaining spine stability[6].

The restoration of appropriate kinetic function is thought to depend heavily on core stability exercises, which have gained popularity as a type of therapeutic exercise [8]. Patients with CLBP have been advised to perform trunk stability exercises to increase their quality of lumbar segmental motion, lower their pain, and lessen their disability [9]. During isometric contractions, the erector spinae and longissimus muscle fibres have been recruited in both upper and lower portions of lumbar spine [10]. These results suggest that the localised control of superficial lumbar muscles may have a considerable impact on trunk motions. There is some research evidence for exercises such as dead bug, trunk curl, quadruped and pelvic bridging which could help in relieving pain and also enhancing the functional performance[11].

A technique called superficial electromyography (s EMG) was employed to assess changes in the lumbar stabilizing muscles' endurance. Rectus abdominis, Oblique muscles and Erector spinae muscle activity was recorded using surface electromyographic (EMG) technology [12]. McGill et al conducted a study on male college students to determine the normative reference values for spinal flexor and extensor muscular endurance test timings, which revealed a ratio of 0.99:1.00[13]. The rectus abdominis, external obliques, the erector spinae are some of the muscle groups that make up the core [14,15].Low back endurance has been linked in reducing LBP, according to studies[16,17]. In order to prevent and treat a variety of lumbar spine and musculoskeletal diseases, strengthening of these core muscles has been recommended[18]. The core muscles are the centre of the body where the most kinetic chain transfers force to the extremities during physical activity[19].

As a result, the current study compares how well spinal stabilization exercises and traditional workouts work to increase strength and endurance in those with CLBP. According to surface electromyography, we believe that combining spinal stabilization workouts with general strengthening activities would improve lumbar strength endurance more effectively.

## Aim

The primary objective of this research investigation is to see how lumbar stabilization exercise influences individuals in improving lumbar spine endurance using surface EMG with conventional lumbar strengthening exercise in subjects with CLBP.

## Material and Method

This study was conducted at Saveetha Medical College and Hospital (SIMATS), Thandalam, Chennai, in the outpatient department from May 18 2022 to July 23 2022. Following the determination of their eligibility based on the inclusion and exclusion criteria, a total of 30 subjects were invited to participate in the study. The subjects who agreed to participate were split into Group A and Group B.

**Inclusion criteria:**

- Those who have CLBP lasting more than three months.
- Both genders belong to the 25–50 age.
- Patients with CLBP were the study's participants, and the study's design was an RCT.

**Exclusion criteria:**

- The sample size was no more than 40 subjects.
- Participants had clinical signs of spondylolisthesis, lumbar stenosis, infectious pathologies in the spine, or inflammatory diseases with spine involvement.
- Participants had previously undergone spinal surgery.

## Outcome measures

**Verbal Numeric Pain Rating Scale (NPRS)**

The patient or individual experiencing pain is asked to rate their pain intensity on a scale of 0 to 10, where: 0: No pain 1-3: Mild pain (noticeable, but not bothersome) 4-6: Moderate pain (interferes with daily activities) 7-9: Severe pain (disabling and difficult to tolerate) 10: Worst possible pain.

**Surface Electromyography:**

High density-surface EMG (HD-sEMG) is a non-invasive technique to measure electrical muscle activity with multiple (more than two) closely spaced electrodes overlying a restricted area of the skin. The clinical studies concerned muscle fatigue, motor neuron diseases (MND), neuropathies, myopathies (mainly in patients with channelopathies), spontaneous muscle activity and MU firing rates. In this Rectus Abdominis, Erector spinae and External Oblique muscles were taken for analysing the strength endurance for chronic low back pain patients before and after the exercise protocol was performed.

## Procedure

Participants were divided into two groups using randomization. One blinded randomization was used to choose which intervention was written and placed in an envelope.

From this, Group A receives the exercise programme for spinal stabilization (Intervention group) while Group B receives the exercise programme for spinal strengthening (Conventional group).

Each group will be evaluated using surface electromyography for pre- and post-test results prior to the treatment programme. We chose 4 lumbar stabilization exercises that are frequently advised. After analysing a number of different core strengthening exercises, workouts were chosen based on a number of parameters. Exercises that could easily have their intensity increased gradually and had adjustments that were simple for the participants to understand were mostly chosen. The programme consisted of positions such as supine and prone lying. The curl up and the bird dog exercises were performed in the supine position, while the Superman and the bird dog exercises were performed in the prone position. Dead bug was performed for 20 times throughout the course of three sets. Duration of the session was 30 mins for 3 days per week. Initial sets and repetition were 1 set, 10 repetitions. Initial intensity of exercises was light to moderate (67-65% of 1 RM).



**Fig 1: SUPERMAN EXERCISE**



**Fig 2: BIRD DOG EXERCISE**



**Fig 3: CURL UP EXERCISE**



**Fig 4: DEAD BUG EXERCISE**



**Fig 5: BACK EXTENSION EXERCISE**



**Fig 6 : PELVIC TILT EXERCISE**

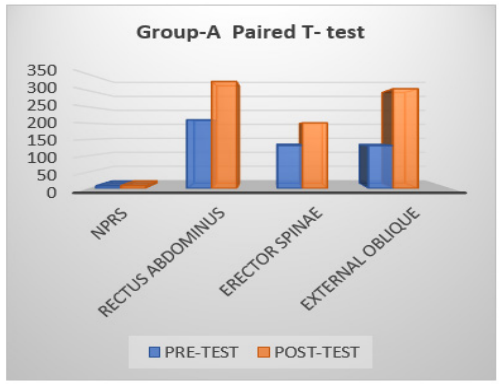


**Fig 7: KNEE TO CHEST EXERCISE**

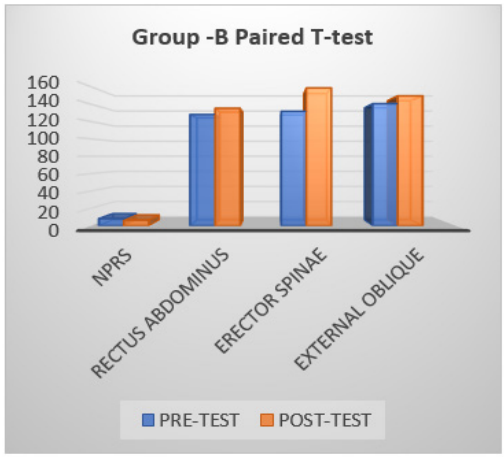


**Fig 8: GOOD MORNING EXERCISE**

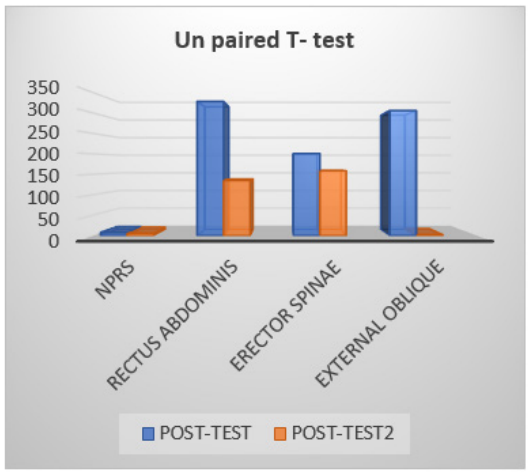
## Data Analysis




**Graph No. 1: INTERPRETATION: Graph No.1 shows that the values are extremely statistically significant.**




**Graph No. 2: INTERPRETATION: Graph No.2 shows that the values are extremely statistically significant.**




**Graph No. 3:** INTERPRETATION: Graph No.3 shows that the values are extremely statistically significant.

## Result

In a study on chronic low back pain, 40 individuals were split into two groups. Group A received Spinal stabilization exercise, with NPRS decreasing significantly from 7.93 to 3.47 ($p < 0.0001$). Surface EMG showed increased muscle activity. Group B, treated with static stretching and strengthening, also saw a reduction in NPRS from 8.27 to 6.67 ($p < 0.0001$) and moderate EMG changes.

## Discussion

This study focused on the potential benefits of lumbar stabilization exercises for patients with persistent chronic low back pain (CLBP). It aimed to assess the effectiveness of spinal stabilization exercises in combination with general exercise for treating CLBP. The research included 40 individuals, with 20 participants in each group, and the allocation was done using the Convenient Sampling method. Both Group A and Group B consisted of 10 men and 10 women.

The study participants had a mean age of 30 in Group A and 40 in Group B. The researchers used the Numerical Pain Rating Scale (NPRS) and Strength Endurance as outcome measures, evaluating the participants every other day over a 45-day period. Pre and post analyses were conducted on the 1st and 45th days.

The findings revealed significant improvements in the endurance capacity of stabilizing muscles and a reduction in pain in both groups. However, the group receiving lumbar stabilization exercises (Group A) demonstrated a substantial increase in strength endurance compared to the group undergoing static stretching and strengthening exercises (Group B). This suggests that lumbar stabilization exercises may be particularly beneficial for patients with CLBP.

In contrast, the pain rating for the stretching and strengthening exercises in Group B did not change significantly. This could be attributed to the nature of static stretching, which primarily focuses on muscle lengthening rather than endurance. Some research suggests that improved range of motion (ROM) may result from increased tolerance for stretching, rather than just muscle lengthening.

The study highlights the importance of standardized classification systems for CLBP, as clinical manifestations vary significantly. Utilizing more uniform groupings of patients with CLBP may enhance treatment outcomes. The research indicates that both lumbar stabilization exercises and general exercise interventions can effectively alleviate discomfort associated with CLBP in a relatively short time frame.

In summary, the study emphasizes the potential benefits of lumbar stabilization exercises in managing persistent low back pain by enhancing muscle endurance. Incorporating such exercises in treatment plans for patients with CLBP can lead to positive outcomes and improved physical therapy approaches.

## Conclusion

According to the findings, Group A (Lumbar stabilization exercise) is far more beneficial than Group B (static stretching and strengthening exercise) in treating persons with persistent low back pain.

**Ethical Clearance:** The study was approved by the Committee of Institutional Scientific Review Board. T

**Funding:** None Self

**Conflict of Interest:** The author declared that there is no conflict of interest.

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Original Article

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# Effect of Partial Blood Flow Restriction Training in Improving Physical Functioning among Middle-Aged Subjects with Knee Osteoarthritis: A Pilot Study

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**Abstract**

**Background:** Blood Flow Restriction (BFR) training combines low-intensity exercise with blood flow occlusion to produce outcomes comparable to those of high-intensity training. BFR is as effective as high-intensity protocols known to enhance knee extensor muscle strength in subjects with knee osteoarthritis (OA). Therefore, the aim of this study is to find out the effect of Partial Blood Flow Restriction Training on pain and physical functioning among knee OA subjects.

**Purpose:** To assess the effectiveness of Partial Blood Flow Restriction Training in Improving Physical Functioning Among Middle-Aged Subjects with Knee Osteoarthritis.

**Materials and Methods:** This is the pilot study where twenty subjects with knee OA were divided randomly into two equal groups. Group "A" received BFR training combined with conventional exercise two times/week and Group "B" received conventional exercise two times/week. Numeric Pain Rating Scale (NPRS), Western Ontario and McMaster Universities Arthritis Index (WOMAC) were used to evaluate subjects at two intervals (Pre-Test and Post-Test).

**Results:** The difference between the Group A and Groups B was statistically significant ($p<=0.001$). Hence conventional exercise combined with blood flow restriction training shows significant improvement than conventional exercise among OA knee subjects.

**Conclusion:** This pilot study concluded that the conventional exercise combined with blood flow restriction training was effective in subjects with OA knee.

**Key Word:** Occlusion training, Kaatsu training, Degenerative joint disease, BFR training.

## Introduction

Knee osteoarthritis (KOA) is a common chronic joint disease accompanied by functional limitations and pain. The onset of knee OA is predisposed to advanced age, female sex, obesity, previous joint damage, weak knee flexor and extensor muscles, occupation and genetics. The male prevalence was lower (31.2%) than that of females (42.1%)[1].

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Knee symptoms vary depending on their underlying cause. Knee pain around the joint is the most common symptom of osteoarthritis (OA). Sharp, throbbing, dull, ongoing, or periodic pain is all possible. Studies indicate that enhancing the knee extensor muscles is the foremost step in the management of knee OA, with a widely recognized hypertrophy training protocol[2,3]. The traditional treatment goals include pain reduction and improved function. According to current guidelines, regardless of the severity of the disease, degree of pain, or functional status, physical activity is advised to treat knee OA[4].

In addition, the World Health Organization's recommendations for physical activity show that patients need to engage in at least 150 min of moderate-to-strenuous exercise per week, split into sessions of at least 10 min. Owing to time and other factors, only 23% of individuals with knee OA successfully achieved this goal. Unfortunately, high-intensity resistance exercise (HIRE) necessitates the use of heavy loads, which can exacerbate pain in patients with knee OA and lead to swelling and inflammation. Therefore, adherence to exercise decreases with the appearance of these symptoms appear[5].

Recent research has investigated new training modalities for enhancing muscle strength due to the low adherence of patients with knee OA to HIRE, including aquatic exercises, neuromuscular, high-speed, and blood flow restriction training (BFR)[6].

The training technique known as blood flow restriction (BFR) completely restricts venous outflow while only partially allowing arterial inflow in working muscles also known as Kaatsu training[7]. When performed with less resistance, partial blood flow restriction training has been demonstrated to have a significant positive impact on local skeletal muscles, including an increase in local muscle mass, strength, and endurance. Therefore, patients who cannot undergo conventional resistance training may benefit from this method. BFR has produced positive outcomes in musculoskeletal rehabilitation. Increases in muscle mass, quadriceps strength, and functional ability in patients with knee OA have been achieved through blood flow restriction training[8,9,10]. The goal of this Pilot study was to determine whether individuals with knee osteoarthritis can be effectively treated with traditional exercise and blood flow restriction training.

## Aim

The Aim of the study is to determine the effectiveness of Partial Blood Flow Restriction Training in Improving Physical Functioning Among Middle-Aged Subjects with Knee Osteoarthritis.

## Material and Method

This pilot study conducted on 20 subjects with OA knee, age between 40-60 years of both genders was taken from a private hospital in Chennai, during the period of July 2022 to August 2022. Convenient Sampling with random allocation method was used in the study.

**Inclusion criteria:**

- Age – 40 to 60 years, both gender
- Individuals experiencing unilateral knee pain.
- NPRS score of 3 or higher
- Subjects who meet the ACR clinical & Radiological Criteria for knee Osteoarthritis' primary OA criteria
- Kellgren & Lawrence radiographic changes of grade 1 or higher

**Exclusion criteria:**

- Subjects with a diagnosis of active synovitis, intense trauma, surgical procedures, other arthritis and a use of recent intra-articular corticosteroid injections on knee
- Foot deformities or lower extremity amputation
- Neurological dysfunction on the central or peripheral levels, including spinal stenosis, persistent lumbar pain, chronic peripheral vascular disease together with claudication, and peripheral nerve damage either with or without foot drop.
- Bilateral or unilateral TKA
- Thromboembolism
- Medically unstable, as evidenced by uncontrolled blood pressure, uncontrolled blood sugar, or unstable coronary artery disease

**Outcome measures:**

Assessment was performed at baseline (before starting of treatment) and after four weeks of study.

- NPRS - Numerical Pain Rating Scale
- WOMAC - Western Ontario and McMaster Universities Arthritis Index

## Procedure

Twenty samples were randomly chosen based on the inclusion and exclusion criteria, and subjects were selected for a pilot study design. Before beginning the procedure, all subjects provided written informed consent after being informed of the study. The NPRS and WOMAC were used to evaluate the pre-test and post-test. The study participants were randomly divided into two groups: Group A (n=10) and Group B (n=10), using the closed-envelope method. Blood flow restriction training combined with conventional exercise were performed in the Group A. Conventional exercise was performed in the Group B. Quadriceps muscles were mainly strengthened.

Each training session during the intervention began with a 10-minute general warm-up. To initiate any adjustments, the maximal load for each strengthening exercise (30% of one repetition maximum for the Group A and 30% of one repetition maximum for the Group B group) was examined during the initial rehabilitation session.

**Group B (Conventional exercise):** Patients in this group underwent lower limb muscle stretching and strengthening exercises, including quadriceps exercises (30% of one Repetition Maximum), over the course of 8 therapy sessions (two sessions each week) over a period of four weeks.

- SLR with weighted ankles - In a supine position, the patient was asked to raise the exercise limb with the knee in full extension, and then lower the limb back to the initial position; resistance (30% 1RM) was provided by ankle weights.
- Sitting Knee Extension with Weighted Ankles - Sitting with knee at $90^{o}$ flexion, the patient was asked to fully extend the knee. Resistance (30% 1RM) was provided by ankle weights.
- Hip Adduction and Abduction with Weighted Ankles - For Adduction: Lying sideways, the patient was asked to bend the hip and the knee of the upper leg and raise the lower leg, keeping it straight; extra resistance (30% 1 RM) was provided by ankle weights; For Abduction: Lying sideways, the patient was asked to bend the knee and hip of the lower leg and raise the upper leg, keeping it straight; extra resistance (30% 1RM) was provided ankle weights.
- Calf Raises - In a standing position, the patient was asked to rise up on toes and return.
- Stretching of the Hamstring Muscle - In a supine position, the patient was asked to raise the exercise limb with the hip and knee in 90 ° flexion then the patient was asked to extend the knee fully while holding the thigh (15 repetitions for 30s).

**Group A (BFR Training with Conventional exercise):** Participants in this group underwent the same protocol as Group B over 8 sessions of therapy (two sessions per week for four weeks) combined with BFR training. A lower limb-specific sphygmomanometer that can restrict blood flow to the thighs was used in the BFR. Exercises for the Group A were SLRs with BFR using weighted ankles, BFR with weighted ankle while seated extension of the knee, BFR using weighted ankles with adduction and abduction of the hip, calf raises, and stretching of the hamstring muscle with the same protocol as Group B.

**Blood flow restriction cuff placement:** Relatively small (5–6 cm wide) restrictive cuffs were used to restrict the blood flow. For the majority of people, restricting the cuff pressure for the lower body to between 160 and 240 mmHg is appropriate. A lower-limb-specific sphygmomanometer was used. Quadriceps exercises were performed while the pressure cuff was inflated to 190 mmHg. Using a measuring tape, the length from the inguinal crease to the upper part of the knee patella was determined, and an outline was created on the lower limb, 33% distal to the inguinal crease. To obtain a precise picture of the cuff location, thigh circumference was evaluated at this point. Blood gathered in the vessels far from the cuff as a result of the device.

**Treatment Protocol:**

- Duration of the session: 30-40 minutes
- Frequency: Single session per day/4 weeks
- Sets: 2 sets
- Repetitions: 15 repetitions
- Rest: 2-3 mins break between sets.

**Data Analysis**

Pre-test and post-test values of Numerical Pain Rating Scale and Western Ontario and Mcmaster Universities Arthritis Index scale are analysed using the paired t-test within the groups and unpaired t-test between groups.

## Result

The Pilot study was conducted on 20 subjects. Both the groups has 10 subjects each. All 20 subjects completed the study successfully, pre-test and post-test values of NPRS and WOMAC were presented in the following Figures: 1,2,3. The mean for NPRS was 2.47 for Group A and 4.20 for Group B, with p value =<0.0001 and t value was 7.2113 indicating that the results were extremely statistically significant. The mean for WOMAC was 47.60 for Group A and 57.13 for Group B, with p value =<0.0001 and t value was 13.3296 indicating that the results were extremely statistically significant.

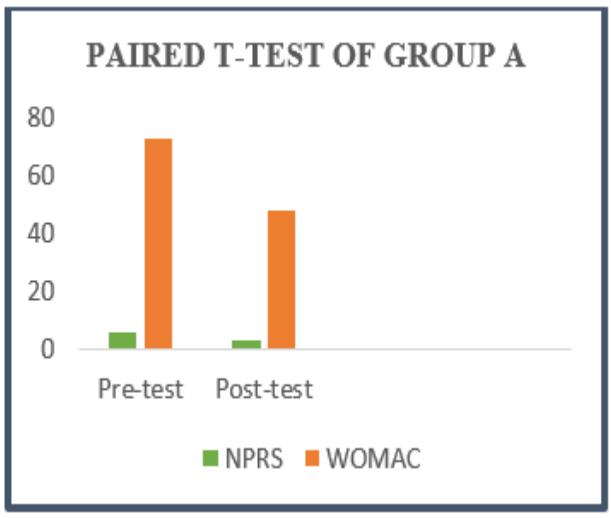



**Fig 1: Comparison of pre and post-test values of NPRS and WOMAC in GROUP A**

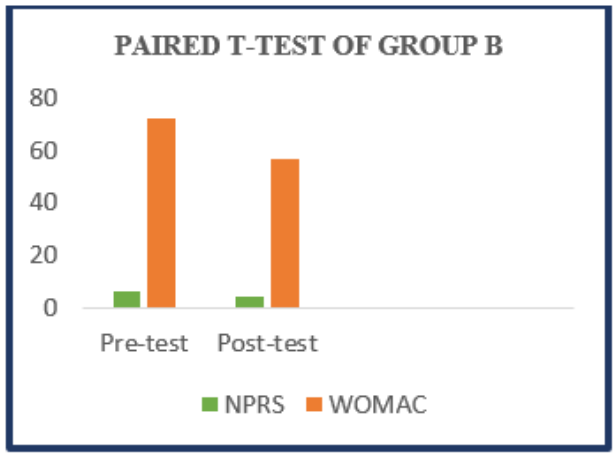



**Fig 2: Comparison of pre and post-test values of NPRS and WOMAC in GROUP B**

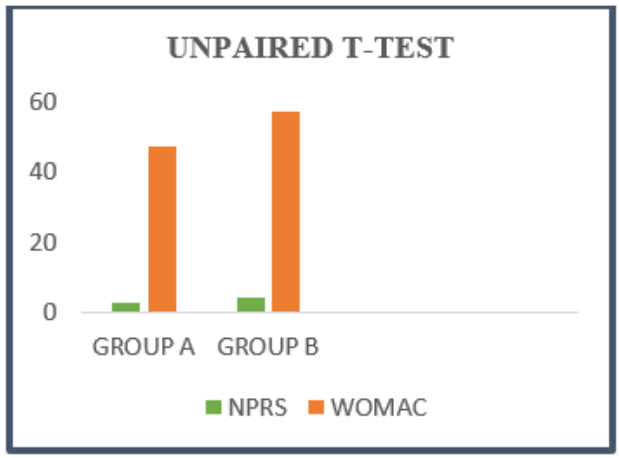



**Fig 3: Comparison of post-test values of NPRS and WOMAC in GROUP A and GROUP B.**

## Discussion

This Pilot study was done to see the effect of partial blood flow restriction training in improving physical functioning among middle-aged subjects with knee osteoarthritis. Study included 20 subjects in the age of 40 to 60 years. Groups were divided into half by random allocation of groups. Group A received partial blood flow restriction training combined with conventional exercise and Group B received only conventional exercise. The duration of the study was 4 weeks and exercises were given 2 days/week. There is no drop- out during the treatment.

Pre-test and Post-test analysis was done for Group A and Group B for which partial blood flow

restriction training combined with conventional exercise was given, data was analysed using paired t- test within the groups for NPRS and WOMAC showed statistical difference in all two outcome measures that is pain and physical functioning.

The Unpaired t test was used to examine significant changes in post- test values between the Group A and B in both cases. The beneficial effects were significantly greater in Group A than Group B.

According to preliminary research, BFRT can increase muscle strength in individuals with risk factors for knee OA. This study has implications for OA management [11,12]. Preliminary research suggests that individuals with risk factors associated with knee OA may benefit from BFRT by strengthening their muscles. Although adequate research is currently lacking, it is probable that lower joint stress and less pain will have different impacts on long-term adherence to physical activity in patients with knee OA[13,14,15].

An arterial blood pressure monitor was also used to check the readings before and after each training session, and no clinically significant changes were found [15, 16]. Similar to how resting blood pressure was unaffected by the 6-week intervention, BFRT's safety case for this population was strengthened. In fact, BFRT has been found to be safe in a number of populations in the past, with a low incidence of unfavourable events; however, these populations did require professional assistance and proper control of training variables[17].

To determine the impact of a twelve-week HIR training program on pain, function, and strength in patients with OA knee, Bryk[18] conducted a clinical trial on 14 patients. The Knee Injury and Osteoarthritis Outcome Score (KOOS) and Arthritis Self-Efficacy Scale (ASES) both experienced a statistically significant increase in the function subscale.

The impact of isolated resistance training on arthritis symptoms and physical performance in patients with knee OA was examined by Angela K. Lange[19] in a systematic review of 18 RCTs involving 2832 patients. They found that patients with knee OA benefited from resistance training in terms of physical function.

Yokokawa[20] examined the effects of dynamic balance training versus LLR training with BFR in elderly individuals at a risk of developing knee OA. One of the two groups was randomly chosen from 51 participants 65 years. Prior to and following the eight-week program, performance in both groups was evaluated. Blood samples from participants (n=11) were also collected, and growth hormone and lactate levels were measured. Performance and balance after the program showed overall improvement, but there were no group differences. The functional mobility test (TUG) was used to measure it.

The results of this pilot study showed promising outcomes in the intervention group, suggesting that BFR training with conventional exercise has a positive impact on pain and physical function among individuals with OA knee which was clinically significant. Despite the promising results, there are some constraints in this pilot study that should be taken into account. The generalizability of the results is restricted by the small sample size. Additionally, the short duration of the intervention does not allow for long-term assessment of its effects. Future research with larger, randomized controlled trials and longer follow-up periods would be necessary to validate these findings.

## Conclusion

When performed properly, BFRT has the potential to help subjects with osteoarthritis of the knee by preventing muscle atrophy and improving muscle strength. In subjects with knee OA, adding BFR to LLR exercise produced functional mobility gains comparable to those of high-load conventional exercise programs; this type of exercise is advantageous to patients who felt they had a reduced tolerance for the high-load programs. As a result, it might be a beneficial form of exercise for improving physical function and effectively strengthening the quadriceps muscles while reducing discomfort and harmful joint loading in persons with knee OA. If additional research confirms the results of this study, BFRT should be applied more frequently in patients with osteoarthritis.

**Ethical clearance:** The study was approved by the committee of institutional scientific review board. All study participants were informed about the

study objectives, and those who agreed to Participate signed informed consent forms.

**Funding:** This study was a self- funded study.

**Conflicts of interest:** The authors declare that they have no conflicts of interest.

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Original Article

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# Effectiveness of Balance Training on Quality of Life among Osteoarthritis Knee

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**Abstract**

**Background of the Study:** Osteoarthritis of knee is defined as a degenerative disorder of muscular and skeletal region that causes pain, stiffness and increasing loss of function cause decreased Balance and Quality of Life (QoL). Studies has also found that an increased chances of fall risk in patients with OA knee. Balance training impacts the improvement of functional ability and the quality of life in patients with osteoarthritis knee.

**Purpose:** The main purpose of this study was to evaluate how well balance training affected the quality of life in OA knees.

**Methods:** 30 participants with knee osteoarthritis (OA) who matched certain inclusion requirements participated in the study. These subjects were randomly selected from two groups: Group A and B. Group A participated in conventional exercises, while Group B received a combination of conventional exercises and balance training. To assess the impact of the interventions, the Time Up and Go (TUG) test was used to gauge balance, and the subjects' Quality of Life (QoL) was measured using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). These measurements were taken before and after the eight-week intervention period. During the study, each treatment regimen was administered three times a week for a total of eight weeks. The purpose of this research was likely to evaluate the effects of conventional exercises and balance training on balance and quality of life in individuals with knee osteoarthritis.

**Result:** At the completion of the intervention session, subjects who had Balance training had statistically better improvement of Balance and Quality of Life (QoL) , group B, WOMAC (mean=61.13, SD= 1.59) and p value=0.0001) & TUG (mean=15.20, SD=2.41 and p value=0.0001).

**Conclusion:** The study concluded that the combination of conventional exercise with Balance training shows better outcomes in improving quality of life among patients with knee OA.

**Keywords:** Osteoarthritis, Balance, WOMAC, TUG, Quality of Life.

## Introduction

Knee osteoarthritis is the most frequent kind of arthritis and one of the most prominent diagnoses in general practice. OA is the most frequent etiology for lower extremity impairment in older persons due to its propensity for lower extremity joints including

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the knee and hip. According to the WHO Scientific Group on Rheumatic Diseases, 10% of global adults 60 and older have serious clinical conditions that may be associated to OA. Among those 60 years of age or older, 10% of men and 13% of females have symptomatic knee OA, according to statistics[1].

Osteoarthritis (OA) is a condition characterized by isolated synovial joint areas of articular cartilage deterioration, as well as bone hypertrophied bone, bone spurs (osteophytes), increase in the density of the bone matrix (subchondral bone sclerosis), and swollen capsule[2]. For epidemiologic study, osteoarthritis OA could be defined in many ways like pathological studies, radiological imaging tests, or clinical evaluation. Among these radio-graphical study has acknowledged as most valued confirmation of OA[3]. About 3.3 to 3.6% of people worldwide suffer with OA. Only 8.9% of adult population had clinically severe osteoarthritis in the knee, hand, or hip, according to a research. Only around 15% of people has radiologically confirmed knee osteoarthritis report knee discomfort4. Additionally, over the past 20 years, the incidence of symptomatic knee OA has raised by 4.1% and 6%, respectively, in men and women[5].

According to an analysis, the long-term chance of having manifesting knee OA was 47% for women and 40% for men, with higher risks associated with obesity[6]. Based on current suggestions, in adults over the age of 40 has wear and tear knee pain, morning stiffness, limitation function, and examination findings like crepitus, limited motion, enlargement of bone, and a certain evaluation of knee OA can be made with a radiographic study[7]. There are both internal and external risk factors for osteoarthritis, according to epidemiological studies. Undoubtedly genetic variables are involved[8]. Systemic risk factors for OA include gender, age and hormonal substances, racial or congenital/developmental disorders, and food. Local risk factors include being overweight, injury/ surgery, work, daily activity/sports, mechanical problems, and instability[9].

Physical function loss and diminished muscle strength are common deficits in people with OA knee. Additionally, people with KOA typically lose their sense of balance, possibly as a result of damaged articular cartilage and defective mechanoreceptors[10]. When compared to their healthy contemporaries, people with knee OA experience lower quality of life and reduced activities of daily living, such as a reduced capacity to walk and a higher risk of falling[11]. A thorough review found that OA significantly affects quality of life (QoL) in OA knee[12].

Treatment aims to reduce disease symptoms and signs and, if at all feasible, slow the disease's course. From basic measures, physiotherapy, musculoskeletal devices, or orthotic aids, medication such intra-articular injection, and eventually surgery and rehabilitation, the therapeutic spectrum includes. "Prevention is the optimal treatment for knee osteoarthritis"[13].

## Aim

The aim of the present research compares the Effectiveness Of Balance Training with conventional exercise On Quality Of Life Among Osteoarthritis Knee.

## Materials and Methodology

A total number of thirty individual were selected by simple random sampling method. Samples were selected from the outpatient department of Saveetha Medical College Hospital, Thandalam, Chennai according to inclusion and exclusion criteria. The selected individual was split into two groups which is named as Group A and B. The total duration of the study was eight weeks which is from June 2022 to August 2022. In this study balance is evaluated through Time Up and Go Test while Quality of Life is analyzed via WOMAC which is stands for Western Ontario McMaster Universities OA Index (WOMAC) Questionnaire.

**Inclusion criteria:**

- Age group 55 to 70 years.
- Both gender "Male" and "female "
- Chronic knee pain ≥3 months
- WOMAC scale - 70-80
- TUG Test– 20sec. to 30sec.
- Difficulty to maintain the general body balance

**Exclusion criteria:**

- Previous history of knee joint surgery/lesion
- Lower limb nerve pain
- Balance-related vision, inner-ear vestibular problems, proprioceptive nerve injury, or lesion within the previous six months.
- High severity knee OA that made it difficult for them to stand
- Atypical neurological conditions
- Failure of cardiopulmonary system or stroke history or History of vertigo
- Recent trauma to the affected knee joint.
- Recent wound injuries around knee
- Skin inflammation, infection

## Outcome Measures

The Time Up and Go (TUG) Test and WOMAC which stands for Western Ontario McMaster Universities OA Index (WOMAC) Questionnaire was the two outcome measures of the study.

### Procedure

With simple random approach, collectively 30 patients were chosen based on the requirement for being included and excluded. Before beginning of the study's process, each participant provided written informed consent after being told about the study. Patients in both groups received information regarding osteoarthritis of the knee as well as protective suggestions (ergonomic advices) for the knee. The pre- test was assessed by WOMAC index and TUG test, and the post test will be assessed at the sixth week's end. The subjects received the treatment for eight weeks of three sessions per week. Through random selection method of two distinct groups of those participating in the study were formed. The subjects in group A termed as conventional group, received the conventional exercises; The subjects in Group B termed as Experimental group, received the Balance training along with conventional exercises, eight weeks of three exercise sessions per week, and the participants were reassessed after eight weeks with WOMAC questionnaire and TUG test.

**GROUP A**

Subjects in Group A was directed to be in supine position to do the conventional exercise.

***I. Conventional Exercise Program***

1. Quadriceps exercises that are static
2. Hamstring and -quadriceps muscle exercises that involve active stretching and range of motion.
3. Isometric workouts for the hamstrings.
4. Ankle pump - Active
5. Knee exercises for short arc terminal extension. Exercises using isometric contractions for 10s and 2s of rest were used. 10 repetitions of isotonic exercises were performed.

**GROUP B**

Subjects in Group B was directed to do the Balance training along with the conventional exercises.

***II. Balance Exercise Program***

1. Up and down on a standard four-step staircase
2. placing your feet at shoulder-width apart while standing, stretch your hands just front of your shoulder. Try to maintain the position for 10s while lifting both heels off the ground.
3. Hold the arm in a similar position as indicated in the earlier exercises while standing with your feet shoulder-width apart. Try to maintain the stance for 10s by placing one foot inside the other's ankle.
4. Hold a one-legged standing with one foot lifted behind you and the other leg bent 90 degrees. Try to hold that position for at least three seconds.
5. Stand with your feet slightly wider than your shoulders and your hands behind your back. Try to maintain the position for 10s while lifting both heels off the ground.
6. Repeat the previous exercise while lifting one foot in front with the non-weight-bearing knee flexed and raised to the height of the hip.
7. Along a line drawn on a typical floor, step from heel to toe.

8. Unsupported one (relatively small) leg lifts to the front and back are performed with the knee straight but not hyper-extended. Front and back continued to alternate.

Participants were also told to stand in six various positions for static exercises (examples: 1, 2, 3, 5, 6, & 8 as shown):

1. On the floor with open eyes, neutral head position and the same with closed eyes.

2. On the floor with open eyes, head slightly tilted back and the same with the closed eyes

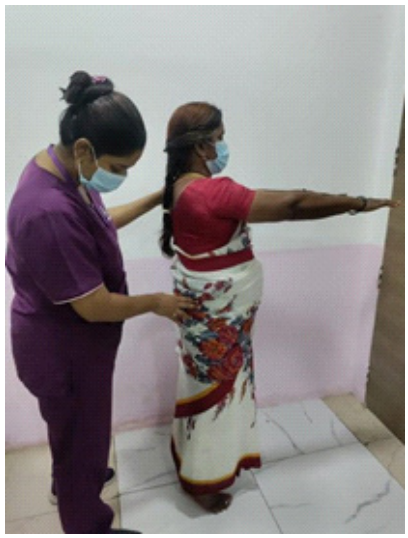


**FIGURE - 1**

Placing the feet at shoulder-width apart while standing, stretching hands just front of the shoulder



**FIGURE - 2he**

Unsupported one leg lifts to the front and back are performed with the knee straight but not hyper-extended. Front and back continued to alternate.

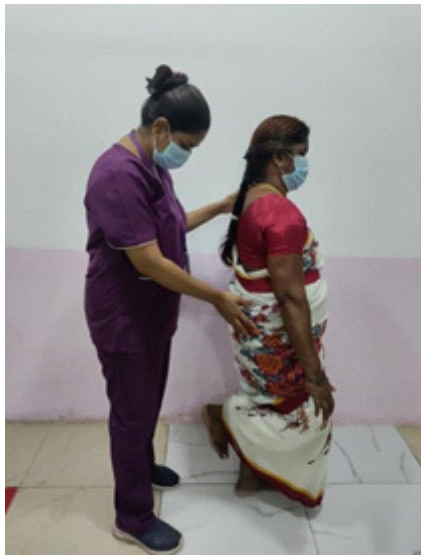


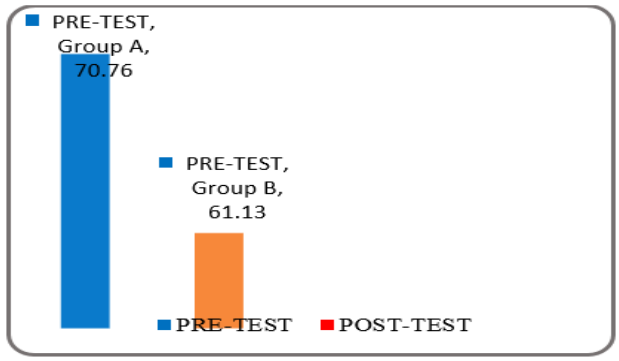
**FIGURE - 3**

Hold a one-legged standing with one foot lifted behind and the other leg bent at 90 degrees

## DATA ANALYSIS

In this study, Statistical Package for the Social Sciences SPSS 27.0 version was used for statistical analysis. The normality was assessed using Shapio-Wilk test. The Western Ontario Mc Master Scale and Time Up and Go values was found to be normally distributed. For the statistical evaluation, both the independent and paired t tests were carried out. The significant results were confirmed if $p<0.05$.

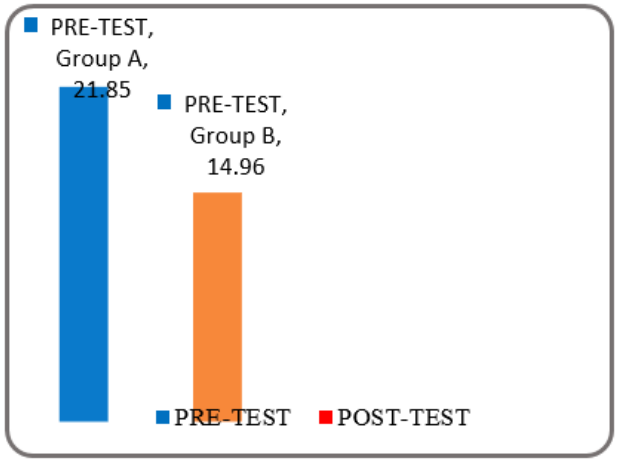
INTRA-GROUP PAIRED T-TEST




INTERPRETATION: Graph 1 shows that the values are extremely statistically significant.

GRAPH 1 shows the comparison of intra-group analysis of Western Ontario Mc Master Scale values for Group A and Group B. The standard deviation and mean of post-test values of WOMAC for Group A (70.76 ± 2.32) which was increased to post-test values of Group B (61.13 ± 1.59) using Shapio-Wilk test. As a result, the findings are statistically noteworthy with a p value of less than 0.0001.

INTRA-GROUP PAIRED T-TEST




INTERPRETATION: Graph 2 shows that the values are extremely statistically significant.

GRAPH 2 shows the comparison of intra-group analysis of Time Up and Go test values for Group A and Group B. The standard deviation and mean of post-test values of TUG for Group A (21.85 ± 2.41) which was increased to post-test values of Group B (14.96 ± 2.34) using Shapio-Wilk test. Hence the results are statistically significant with a p value of < 0. 0001.

## Results

Total 30 people from all participants were selected and screened for osteoarthritis knee with reduced balance. They were grouped into two, each group has 15 individuals, Group B received treatment in addition to traditional exercises, while Group A received treatment only with traditional exercises. At the end of the treatment session, subjects who had Balance training had statistically better improvement of Balance and Quality of Life (QoL) , group B, WOMAC (mean=61.13, SD= 1.59) and p value=0.0001) & TUG (mean=14.96, SD=2.41 and p value=0.0001). This study reveals that the balance training along with conventional exercises reported a significant improvement in improving QoL and Balance that is been associated with the significant value of <0.0001.

## Discussion

The purpose of the research was to determine how adding balance exercises to traditional exercises affected the quality of life (QoL) of OA knee patients. The total numbers of subjects were 30, 15 subjects in each group, allocation was done by Random Sampling method. In Group A there were 3 males and 17 females, where as in Group B had 16 female and 4 males. Group A received conventional exercises and Group B received Balance training along with conventional exercises in patients with OA knee on improving Quality of Life (QoL). Group shows significant improvement and there were no dropouts.

Lee et al.'s 2022 study highlighted the importance of balance control in daily activities. People constantly adjust their postures and centre of gravity to maintain balance on a stable foundation. Balance control involves both static steadiness and dynamic stability during complex movements, which are crucial for activities of daily living[14].

In their 2015 study, Harshneet et al. investigated the effects of combining traditional treatments with balance exercises to improve the functional capacities of patients with knee osteoarthritis (OA). The research study aimed to conclude whether the addition of balance exercises to conventional treatments could enhance the functional abilities of OA knee patients compared to conventional exercises alone[15].

Judith et al. in 2017, conducted randomized controlled trial of a single-blind method and tailored a balance training program's effects on dynamic balancing and self stated bodily activity in people with medial tibiofemoral osteoarthritis were the focus of this investigation[16].

Raposo et al. in 2021 has done a literature review on Exercise's impact on osteoarthritis in the knee. The literature review aimed to explore the impact of exercise on functional and physical results in individuals with knee osteoarthritis, and to deliver current and excellent advice for treatment[17]

Bobic et al. in 2018 evaluated that the balance confidence influences various Age-related activities of daily life (ADL) with osteoarthritis knee. And the author focused on understanding the relationship between balance confidence and the physical challenges faced by these individuals in their daily lives. The findings clears that older people with knee OA who had lower confidence in their ability to carry out physical activities experienced more difficulties in performing ADL[18].

## Conclusion

The study's final conclusion indicates that Group B, consisting of patients with knee osteoarthritis, experienced greater benefits from a combination of balance exercises and traditional exercises compared to traditional exercise alone. This conclusion is supported by the observed increase in scores in the TUG test, indicating improved balance, and a decrease in the overall WOMAC score, indicating reduced knee osteoarthritis-related disability, following the treatment program.

**Ethical clearance:** Approved by Institutional Scientific review board

**Funding:** self

**Conflict of interest:** Nil

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Original Article

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# Comparing High-Load Strength Training with Plantar-Specific Stretch and Manual Therapy for Plantar Fasciitis Pain

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**Abstract**

**Background:** The plantar fascia, a substantial band of tissue running along the bottom of the foot from the heel bone to the toes, is involved in the inflammation and irritation of the condition. One in ten people will experience plantar fasciitis at some point in their lives, making it a prevalent condition.

**Purpose:** To compare the effectiveness of High-load strength training with plantar stretch and manual therapy on pain and functional recovery in subjects with plantar fasciitis.

**Materials and Methods:** Thirty participants were randomly assigned to experimental (High-load strength training with plantar stretch) and conventional (manual therapy) groups. The numerical pain rating scale (NPRS), and foot and ankle ability measure (FAAM) were used to evaluate the pre-test. The same test was used to determine post-treatment values after six weeks of treatment.

**Results:** A significant difference was observed between the experimental and control groups (P = <0.0001). High-load strength training and plantar stretching play an important role in patients with plantar fasciitis.

**Conclusion:** The combination of specific plantar stretches and high-load strength-training activities produce significant functional benefits and rapid reduction of pain.

**Key Words:** Plantar fasciitis, cross-friction massage, mobilization, high-load strength training exercise, plantar stretch.

## Introduction

Many people frequently experience heel discomfort owing to plantar fasciitis. It affects approximately 10% of the population[1]. The word "fasciitis" refers to inflammation; however, the fundamental phase of this disorder is degenerative, with no inflammatory cells. It can be identified by soreness at the calcaneal origin of the plantar fascia and thicker plantar fascia, regardless of whether the condition is known as plantar heel discomfort or plantar fasciitis. Risk factors include a restricted range of ankle dorsiflexion, elevated BMI, and prolonged duration of painful or uncomfortable standing[2].

The human foot complex is composed of a solid mechanical structure comprising 26 bones, 33 joints, 19 muscles, and 107 ligaments. Heel pain, frequently

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characterized as a stabbing sensation felt in the arch and heel regions of the foot, is one of the most typical symptoms of plantar fasciitis [3]. Being overweight or obese, being over 40, having high arches or flat feet, and all increase the risk of developing a condition called plantar fasciitis. It can have a considerable impact on our everyday lives given the complexity and crucial function of the foot plays in sustaining our body weight and enabling movement [4].

Although studies suggest degenerative changes in the plantar fascia, including collagen fibre breakdown, increased production of ground substance protein, concentrated fibroblast proliferation sites, and enhanced vascularity, the histology of plantar fasciitis is unknown [5]

The main issue with PF is heel pain when performing weight-bearing movements, particularly walking, which is the most crucial daily activity. Patients with walking issues may experience limitations in function, employment, social engagement, and quality of life (QoL). Patients with PF who experience painful episodes in the heel frequently avoid putting weight on the foot that is exhibiting symptoms and run the risk of developing antalgic gait.[6]

Combined with Achilles tendon loading, the windlass device applied controlled high-load tensile forces to the plantar fascia. When the metatarsophalangeal joints are flexed to the dorsal position, the windlass mechanism promotes the plantar fascia to tighten [7]. Furthermore, it is possible that a sizable amount of Achilles tendon loading is transferred to the plantar fascia given the close anatomical connections between the Achilles tendon, para-tendon, and plantar fascia. This could imply that considerable tensile strains across the plantar fascia are brought on by the windlass mechanism being activated and strong loading of the Achilles tendon [8].

This study aimed to determine whether the high-load strength training with plantar stretch and manual therapy were effective in treating plantar fasciitis.

## Aim

To compare the effectiveness of High-load strength training with plantar stretch and manual therapy on pain and functional recovery in subjects with plantar fasciitis.

## Material and Method

It was an experimental study conducted on 30 subjects with plantar fascitiis, age between 18-35 yrs was taken from Saveetha Medical College and Hospital, Chennai. Convenient sampling Technique using closed- envelope method. The total study duration was 6 weeks from July 2022 to August 2022

**Inclusion Criteria:**

- Both genders were represented, and the plantar fascia thickness is 4.0 mm or more.
- Pain when the proximal plantar fascia or medial calcaneal tubercle was palpated.
- A minimum of three months prior to enrollment, a history of inferior heel pain.
- Present with heel pain, which is noted as being higher in the morning and reducing while walking continues.

**Exclusion Criteria:**

- History of systemic diseases.
- Injection of steroids for plantar fasciitis within the last six months.
- Pregnant women (because of changes in weight and potential pedal edema which may result in heel pain).
- People below the age of 18
- The participant's medical history form, including any concerns about their health (cancer, tumor, fracture).

**Outcome Measure:**

Assessment was performed at baseline (before starting of treatment) and after six weeks of study.

- NPRS - Numerical Pain Rating Scale.
- FAAM- Foot and Ankle Ability Measure.

## Procedure

Thirty respondents were chosen using a convenient sampling technique, based on the inclusion and exclusion criteria. All individuals provided written informed consent before beginning the study. patients were visiting the physiotherapy OPD for treatment protocol. Assessment of all the included participants was done according to the assessment form. A numerical pain rating scale, and foot and ankle ability measure were used to evaluate

the pre-test and post-test. Using the closed-envelope method, participants were randomly assigned to one of two groups.

**Group A: (High-Load Strength Training with Plantar Stretch)**

**High-load strength training:**

The activity was performed in a stairwell or similar area. To ensure that the patient's toes were fully dorsally flexed at the peak of heel rise, the towel was customized. The clients who finished every heel rise include a 2-second isometric stop at the end of a 3-second concentric phase (moving up) and a 3-second eccentric phase (moving down). They started with three sets of 12 maximum repetitions (RM). 12RM is defined as the maximum weight a patient can lift 12 times while using the proper technique and a full range of motion. After two weeks, they decreased the number of repetitions to 10 RM and increased the load by carrying books in a rucksack. Increasing the number of sets to four simultaneously.

**Plantar-specific stretch:**

**Gastrocnemius Muscle stretch:**

The individual was advised to lean against a wall with both hands shoulder-width apart. The healthy limb was moved forward, while the injured leg was moved backward. The front leg's knee was flexed, but the back leg's knee remained extended. Throughout the stretch, the heels of both feet remained on the ground. The participant then leaned forward until a maximum stretch in the calf area was felt. The protocol for each participant was a 30-second stretch three times per day for three weeks.

**Soleus Muscle stretch:**

The individual was told to lean against a wall, hands shoulder-width apart. The healthy limb was moved forward, while the injured leg was moved rearward. Both legs' knees were slightly flexed. Throughout the stretch, the heels of both feet were held on the ground. The participant then leaned forward until a maximum stretch in the calf area was felt. The procedure for each participant was a 30-second stretch three times a day for three weeks.

**Group B: (Manual therapy)**

**Manipulation technique:**

Mortise shear: Participants receive only the eccentric exercise for a single session per day in the total of 5 weeks. The participants used dumbbells as resistance to eccentric exercise (weight 10 RM).

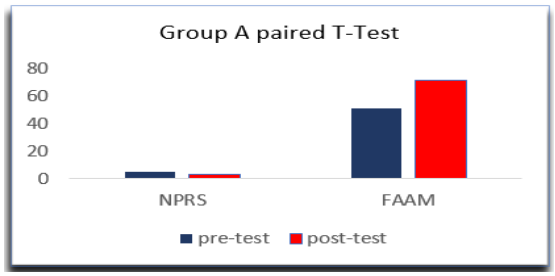
Figure eight foot: The participant was supine, with one hand on the lateral portion of the ankle and calcaneus, held from underneath. The other hand of therapist was put on the midfoot medial aspect, with the thumb on the sole and the fingers on the dorsum. The ankle was kept steady while the forefoot and midfoot were manipulated using a mixture of inversion, abduction, and eversion. The motion is oriented medial to lateral (figure of eight).

Metatarsal shear: The individual was supine at the time of the metatarsal shear. Then the therapist grasped on either side with the thumbs placed on the metatarsal head on the sole of foot. Each affected foot's metatarsal head was translated back and forth.

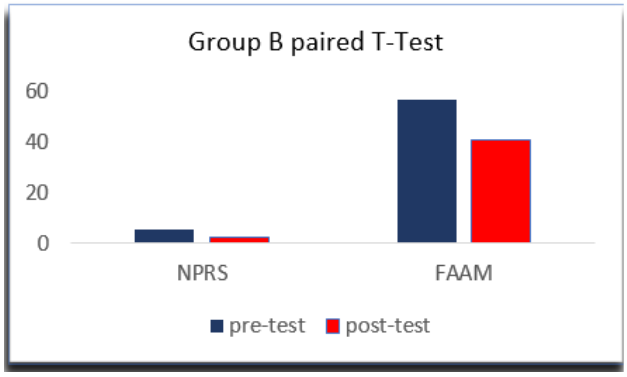
**Mobilization techniques:**

Hallux mobilization technique: The participant was supine, and the researcher was at the foot of the table, one hand stabilising the foot and the other grasping the patient's hallux, moving it in all directions with a medial shove.

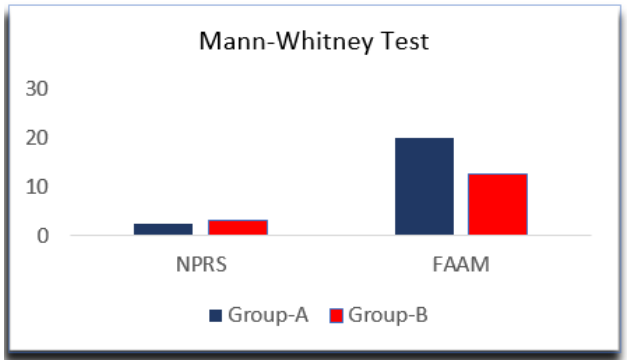
Cross Frictional Massage: For this intervention, participants were positioned supine. Because no lubricant was used, the finger (typically one, but sometimes two) doing the massage did not slide across the skin, but rather took the skin with it, allowing the force to be conveyed straight to the deep tissue being treated. The most painful point of the plantar fascia insertion was identified, and the foot was dorsiflexed to allow the plantar fascia to stretch. A strengthened index finger was then used to perform deep friction massage at the insertion of the plantar fascia. Back and forth 'across the grain' of the tissue, the motion was restricted to about an inch.




INTERPRETATION: Fig.1 shows that the values are extremely statistically significant.




INTERPRETATION: Fig.2 shows that the values are extremely statistically significant.




INTERPRETATION: Fig.3 shows that the values are extremely statistically significant.

## Result

- The study was conducted on 30 subjects. Both the groups had 15 subjects each.
- The mean for NPRS of experimental group was 2.3 and for conventional group was 3.1, with p value is <0.0001 and indicating that the results were extremely statistically significant.
- The mean for FAAM of the experimental group was 20.05 and for the conventional group was 12.49, with p value =<0.0001 and indicating that the results were extremely statistically significant.

## Discussion

The purpose of this study was to compare the effectiveness of high-load strength training with plantar-specific stretch and manual therapy on pain and functional recovery in patients with plantar fasciitis. The study involved 30 people aged 18 to 35. Patients with dominant sides were impacted more than patients with non-dominant sides. Random group allocation separated the groupings in half. The experimental group did high-load strength training with plantar-specific stretch, while the control group did manual therapy. The trial lasted 6 weeks. During the treatment, there is no drop-out.

When data from the experimental group, which received high-load strength training with plantar-specific stretch, were analysed using paired t-tests within the study population for NPRS, and FAAM, there was a statistical difference in all two measures of outcome, namely pain, and function. Activating the windlass mechanism in the plantar fascia gives proximal stability and helps to minimize tension at the heel, limiting pain stimulation of receptors and reducing pain by neurotransmitters in affected tissue. Decreased pain aids in the improvement of performance and the reduction of impairment. The fair distribution of kinetic energy in the kinetic chain also aids in performance [9].

When data was analysed using paired t-testing within the group for NPRS, and FAAM for conventional groups that only received manual therapy, there was a statistical difference in all two outcome measures, which are pain, function. As shown in the study by Jarde, enhanced collagen production may assist restore tendon structure and improve patient outcomes in individuals with plantar fasciitis who have degenerative alterations at the plantar fascia. However, the thickness of the plantar fascia was significantly reduced in both groups. However, the majority of patients still demonstrated significant plantar fascial thickening compared to the amount of around 2.2-4.0 mm reported in pain-free individuals [10].

In all situations, the Maan- Whitney test was employed to look for significant differences in post-test results between the control and experimental groups. The experimental and control groups have a considerable difference. As a result, the mean values of the experimental and usual groups diverge substantially. This difference is statistically significant, according to convenient criteria. The positive benefits were clearly greater in the experimental group than in the control group.

According to Yelverton in 2019, the stretching procedure included a dorsiflexion stretch to treat

potential stiffness in the gastrocnemius and soleus muscles. By altering the muscle-tendon unit, passive stretching has been proven to increase ankle ROM. As a result, higher ROM in the direction of passive stretch would be expected. In terms of the overall effect, the combination of stretching and cross-friction appears to be the most beneficial to the patient [10, 11].

According to Ashley Aisle's research, traumatic hyperaemia increases blood supply to the location, which reduces pain by boosting the rate of Lewis P substance breakdown. Lewis P substance is a neuropeptide that works as a pain transmission mediator in the CNS. As a result, its destruction may have resulted in a reduction in pain, and the following reduction in pain intensity may have aided in the improvement of function. The therapies provided in the reviewed research differ significantly in their approaches to treating plantar fasciitis and enhancing intrinsic foot musculature strength [(12, 13)].

Dean Huffer and Wayne Hing in 2016.The objective was to critically assess the research on strength training methods for the management of plantar fasciitis and strengthening of the intrinsic foot musculature. Seven articles met the requirements for inclusion. All of the articles displayed a moderate to high level of quality, although their external validity was poor. Comparing the therapy reveals significant differences in the strength training regimens used to treat plantar fasciitis and improve intrinsic strength. The strength of the intrinsic foot muscles and the symptoms of plantar fasciitis should be evaluated in future studies using standardized outcome measures [(14)]. Taping has a benefit of reducing tension and the symptoms of plantar fascia [(15)].

All outcome indicators in both groups showed significant improvement. There was a slight improvement in pain score, and functional recovery in the experimental group, which was statistically significant. This study concluded that the high-load strength training with plantar-specific stretch significantly improved the function, and pain reduction in patients with plantar fasciitis [(16)]. After four weeks, high-load strength training was associated with better short-term benefits. This could be attributed to adherence to the intervention. We expect that patients will eventually reduce performing their workouts when they reach a pain threshold they find acceptable. This question was answered by using valid data on long-term compliance.

## Conclusion

The study concludes that high-load strength training along with plantar-specific stretch has significant effects in reducing pain and improving function in subjects with plantar fasciitis.

**Ethical clearance:** The study was approved by the committee of institutional scientific review board. All study participants were informed about the study objectives, and those who agreed to Participate signed informed consent forms.

**Funding:** This study was a self- funded study.

**Conflicts of interest:** The authors declare that they have no conflicts of interest.

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Original Article

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# The Effectiveness of IASTM Versus Static Stretching in Improving Hamstring Flexibility Along with Quadriceps Strengthening Exercises, Tens in Patients with Osteoarthritis Knee

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**Abstract**

**Background:** Osteoarthritis (OA) of the knee is prevalent in the elderly and causes pain, stiffness, and functional limitations. Hamstring inflexibility and weakened quadriceps worsen OA progression. Hence, Therapeutic interventions like IASTM and Static Stretching show potential in addressing musculoskeletal issues.

**Objective:** This study aimed to investigate and compare the effectiveness of IASTM versus Static Stretching, along with quadriceps strengthening exercises and TENS, in improving hamstring flexibility, and quadriceps strength, and reducing pain in patients with knee OA.

**Methodology:** A randomized controlled trial with 30 knee OA patients: Group A (n=15) received IASTM, quadriceps strengthening exercises, and TENS; Group B (n=15) underwent Static Stretching, quadriceps exercises, and TENS. Both groups underwent a six-week intervention program, with pre-and post-assessments using NPRS, AKE Test, and WOMAC questionnaire.

**Results:** Significant differences were observed between Group A and Group B in NPRS, AKE Test, and WOMAC scores ($p < 0.0001$). Group A exhibited lower values in NPRS, AKE Test, and WOMAC, indicating reduced pain, improved knee function, and decreased discomfort compared to Group B. The combination of interventions in Group A appeared to offer better outcomes for knee OA patients.

**Conclusion:** The study suggests that the combination of IASTM, quadriceps strengthening exercises, and TENS (Group A) yields better outcomes in improving knee OA patients' hamstring flexibility, quadriceps strength, and pain reduction compared to Group B.

**Keywords:** Knee Osteoarthritis, IASTM, Hamstring flexibility

## Introduction

Osteoarthritis (OA) is a prevalent joint condition characterized by bone growth around joints and cartilage degeneration, leading to pain, stiffness, and reduced mobility[1]. It affects both primary and secondary knee classifications, with women being more susceptible, particularly among older individuals in rural and urban areas. The incidence of OA increases after age 50, making knee OA a common manifestation in the elderly population[2]. Biomechanical factors, joint mal alignment, and meniscal rupture are recognized as contributing

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factors in the progression of OA, especially after knee injuries[3].

In the conservative management of knee OA, various therapeutic approaches have been explored to improve patient outcomes and quality of life. One such technique is Instrument-Assisted Soft Tissue Mobilization (IASTM), which utilizes tools to treat musculoskeletal issues, promote soft tissue healing, and relieve muscular stiffness[4]. IASTM involves repetitive mechanical stimulation to alter mechanoreceptor responses in targeted muscles, leading to increased joint range of motion and flexibility. By reducing joint and muscle stiffness and modifying stretch tolerance, IASTM can significantly improve physical function and control musculoskeletal disorders[5].

IASTM employs devices to treat soft tissue injuries by eliminating scar tissue and promoting new protein synthesis, aiding healing. It restores soft tissue function, reduces discomfort, and improves range of motion, especially in sports injuries. Recommended frequency: one to two sessions per week for 4-5 weeks, based on injury severity and rehab program. Crucial in sports-related injury care due to its effectiveness and popularity[6].

Stretching exercises play a pivotal role in enhancing muscular flexibility and joint range of motion. Regular stretching decreases the risk of imbalances and injuries during physical activity and aids in injury prevention and improved performance[7]. Research on stretching and flexibility may be limited, but adhering to a well-rounded stretching practice is crucial for optimizing flexibility gains. Recommended stretching includes at least 3-4 sets, each lasting 30 seconds, performed 5 or more times per week for optimal results[8].

Another essential aspect of knee OA management is strength training, which has gained approval from the American College of Rheumatology[9]. Strength training offers multiple therapeutic benefits, including pain modulation, improved knee biomechanics, and weight loss. Studies have consistently shown that strength training can reduce pain, increase activity levels, and enhance overall well-being in knee OA patients. Furthermore, its positive psychological effects on knee joint functionality help protect articular cartilage from excessive forces and potential injury[10].

Transcutaneous Electrical Nerve Stimulation (TENS) has emerged as an effective pain management technique for knee OA[11]. TENS enhances quadriceps muscle activation and reduces knee discomfort, benefiting individuals with milder disease more than those with more severe radiographic disease. It may improve stair climbing capacity and quadriceps strength, making it a valuable tool in knee OA management[12].

The WOMAC assesses hip or knee osteoarthritis progression or treatment response. It has 24 items with Likert scale responses ranging from "none" (0) to "extreme." VAS and numerical rating scale variants are also available[13].

The AKE test, involving knee joint movement, is generally considered safe as the patient determines the endpoint. Therefore, a simpler and more effective method for assessing hamstring flexibility while ensuring pelvic and leg stability is needed[14].

The Numerical Pain Rating Scale (NPRS) is a simple and widely used tool to assess pain severity. It uses a 10-centimeter line, with "0" representing no pain and "10" the worst possible pain. Individuals mark their pain level on the line and measure the distance to assign a numerical value to pain severity[15].

This study compares IASTM and stretching effects on hamstring flexibility in knee OA patients with hamstring shortening. The IASTM combined with quadriceps strengthening will yield better results. Outcome measures like WOMAC, AKE, and NPRS will guide treatment regimens for knee OA, improving management strategies

## Aim

The aim of this study is to compare the effectiveness of Instrument-Assisted Soft Tissue Mobilization (IASTM) versus static stretching in improving hamstring flexibility, in conjunction with quadriceps strengthening exercises and Transcutaneous Electrical Nerve Stimulation (TENS), among patients with knee osteoarthritis (OA). The study will assess the immediate mechanical effects of these interventions on hamstring flexibility in

individuals with knee OA and hamstring shortening, with the goal of determining which approach yields better outcomes for improving joint mobility and overall function in this patient population.

## Materials and Methodology

The study was conducted at Saveetha Medical College and Hospital, Chennai, in the outpatient department. It was an experimental study with a duration of 6 weeks that was conducted from June 2022 to August 2022 with 30 eligible subjects divided into Group A and Group B. Pre-test and post-test measurements were taken using the WOMAC Questionnaire, NPRS, and AKE Test. Over six weeks, both groups received different treatments three times a week. Group A received IASTM, quadriceps strengthening exercises, and TENS, while Group B received static hamstring stretching, quadriceps strengthening exercises, and TENS. Participants provided informed consent, with assurances of data privacy and use for research purposes.

**Inclusion criteria:**

- Age group 50 to 60 years
- Grade 0 or 1 OA knee
- Hamstring tightness (<65° by AKE Test).
- Hamstring soft tissue restriction.
- Stair difficulty
- Both male and female

**Exclusion criteria:**

Prior knee surgery

Recent knee trauma

Wound injuries near the knee

Knee skin inflammation/infection

Previous knee physical therapy

**Outcome Measures**

The study used WOMAC, AKE test, and NPRS as outcome measures. WOMAC assesses pain, stiffness, and function in hip or knee osteoarthritis. AKE test evaluates hamstring flexibility, and NPRS measures pain severity. These measures guide treatment regimens for knee osteoarthritis.

## Procedure

This study is a comparative intervention trial with groups comprising 30 knee osteoarthritis (OA) subjects: Group A and Group B. Convenient Sampling was used to divide the participants into groups. Both groups underwent six weeks of treatment, with three sessions per week. Group A received IASTM, quadriceps strengthening, and TENS treatments, while Group B received static hamstring stretching, quadriceps strengthening, and TENS.

The IASTM technique involves the use of specialized instruments to promote healing in soft tissues. It triggers a localized inflammatory response, enhancing collagen synthesis and realignment in the extracellular matrix. The protocol includes cream application to reduce friction, positioning the participants to face down, and using scraping movements on the back of the thigh, targeting the hamstring muscle complex fibres. Sessions are conducted three days a week, lasting between 40 to 120 seconds on average.



**Fig. 1: Quadriceps Strengthening**

Group A also followed a comprehensive Quadriceps Strengthening Exercise Protocol, using ankle weights and elastic bands for resistance. The exercises included knee extension in the inner range, knee extension with knee flexed at 90 degrees, seated knee extension, supine straight leg raise, and elastic band exercises. Participants gradually increased resistance and sets over time, with initial sessions lasting 30-40 minutes, three days a week.



**Fig. 2: IASTM for Hamstring**

For Group B, the intervention involved manual static stretching of the hamstring muscles. Participants were positioned supine, and the therapist manually stretched the hamstring muscles three times per session, holding each stretch for 30 seconds. A 30-second rest interval was provided between stretches to prevent overstretching. The therapist guided the participants into a mild to moderate stretch, ensuring no pain during the process. Passive knee extension was applied to promote muscle adaptation and flexibility.



**Fig. 3: Hamstring Stretching**

Both groups also received Transcutaneous Electrical Nerve Stimulation (TENS) to reduce discomfort in knee OA patients. TENS involved placing four self-adhesive electrodes around the affected knee joint, delivering electrical stimulation for 20 minutes. The stimulation parameters were adjusted based on the patient's response and tolerance.

Pre- and post-test measurements were conducted to assess knee pain, functional ability, and hamstring flexibility. Through these interventions, the study aimed to improve hamstring flexibility and overall knee function in knee OA patients. The success of the intervention relied on participants' gradual progression and adherence to the exercise protocols.

In conclusion, this comparative intervention trial focused on two groups of knee OA subjects, implementing IASTM, quadriceps strengthening, and TENS for Group A, and static hamstring stretching, quadriceps strengthening, and TENS for Group B. The study aimed to enhance hamstring flexibility and knee function in knee OA patients through these targeted interventions. The techniques used, such as IASTM, quadriceps strengthening, manual static stretching, and TENS, were chosen based on their potential to promote healing, reduce discomfort, and improve musculoskeletal function in knee OA patients.

## Data Analysis

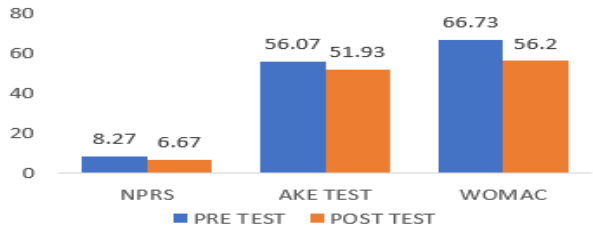



**Fig 4: Group A paired T-Test**

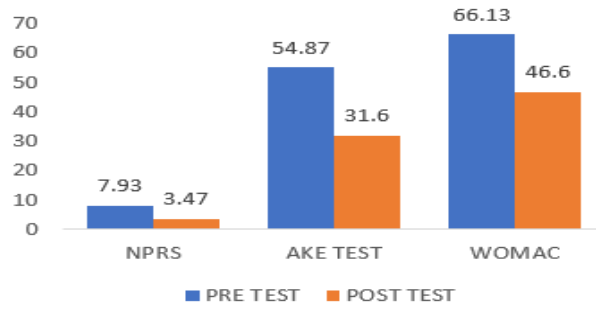



**Fig 5: Group B paired T-Test**

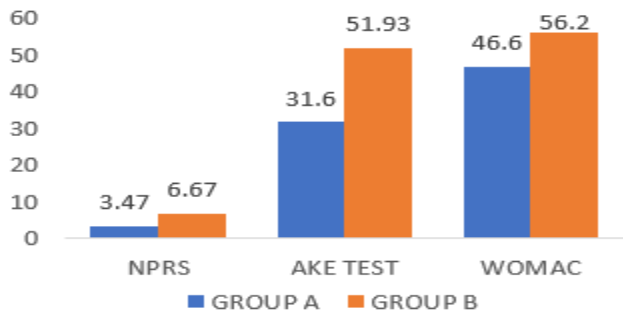



**Fig 6: Unpaired T-Test**

## Result

The results revealed significant differences between Group A and Group B in NPRS, AKE Test, and WOMAC scores ($p < 0.0001$). Group A displayed lower values in NPRS, AKE Test, and WOMAC, suggesting reduced pain, improved knee function, and decreased discomfort compared to Group B. The combined interventions in Group A seemed to yield more favourable outcomes for knee osteoarthritis patients. These findings imply that the implemented protocol, which involved IASTM, quadriceps strengthening exercises, and manual static stretching, had a notable impact on alleviating pain and enhancing knee function in individuals with knee osteoarthritis.

## Discussion

The study investigated the effects of IASTM and static stretching, along with quadriceps strengthening and TENS, on knee ROM and flexibility in subjects with OA knees and hamstring tightness. 30 subjects were divided into two groups, with Group A receiving IASTM and Group B receiving static stretching.

Marshall PW et al. found that the IASTM approach was more effective than other methods in increasing peak quadriceps strength, the related balance ratio, passive knee joint stiffness, and pain threshold. These positive outcomes suggest that IASTM could be a promising intervention for individuals with knee issues, providing potential benefits in strength, balance, joint flexibility, and pain management.[16].

According to Markovic et al., IASTM utilizes devices to treat soft tissue injuries, aiding healing by eliminating scar tissue and promoting new protein synthesis. It improves function, reduces discomfort, and is crucial in sports-related injury care. The recommended frequency is one to two sessions per week for 4-5 weeks, tailored to the injury severity and rehab program. [17].

Stitt LW validated WOMAC as a meaningful health measure for hip or knee osteoarthritis patients on antirheumatic medication. WOMAC, a unique self-administered test, assesses pain, stiffness, and physical function. It passed validity, reliability, and responsiveness tests, ensuring dependable results in tracking patient-relevant outcomes over time. WOMAC's accuracy in measuring disease features highlights its value as a tool for assessing health status in osteoarthritis patients[18].

In a study by Park J et al., research aimed to determine the optimal duration for hamstring muscle stretching to maximize flexibility. The findings revealed that both 30-second and 60-second hamstring stretches significantly improved flexibility compared to no stretching or 15-second stretches. Interestingly, there was no statistically significant difference between 30-second and 60-second stretches, indicating that either duration was equally effective in enhancing flexibility[19].

Olesen et al.'s research highlights that weakened quadriceps in individuals with OA knee may be a secondary response to pain and altered joint mechanics. While quadriceps strengthening is crucial for function and pain reduction, hip strengthening exercises may target the root cause of improper joint loading. Combining both types of exercises could offer a more effective approach for managing individuals with OA knee[20].

The study compared IASTM with quadriceps strengthening and static stretching with quadriceps strengthening for improving hamstring flexibility, knee active range of motion (ROM), and pain reduction. Both therapies improved knee ROM significantly, but only the IASTM group showed reduced pain in the hip and knee areas. This suggests IASTM may be equally effective in improving knee ROM and offer additional pain relief benefits.

## Conclusion

In conclusion, the study indicates that the comprehensive intervention involving IASTM, quadriceps strengthening exercises, and TENS (Group A) leads to superior outcomes in enhancing hamstring flexibility, quadriceps strength, and pain reduction for knee osteoarthritis patients, compared to Group B. These findings emphasize the effectiveness of the combined approach in managing knee osteoarthritis symptoms and support the importance of tailored treatment protocols for optimizing patient outcomes. Further research and clinical application of these interventions may offer valuable insights for healthcare professionals seeking to improve the well-being of individuals with knee osteoarthritis.

**Conflicts Of Interest**: All authors declare no conflicts of interest.

**Ethical Clearance**: The study gained approval from the institutional review board. Participants were fully informed about the study's purpose, and willing to participate. Participants provided consent by signing informed consent forms.

**Funding**: Self

**Authors' contributions**: All authors contributed equally to the manuscript and read and approved the final version of the manuscript.

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Original Article

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# The Effectiveness of Kinesio-Taping and Muscle Energy Technique Versus Knee Strengthening Exercises on Pain and Function in Subjects with Osteoarthritis of the Knee

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**Abstract**

**Background:** An approach known as Kinesio-taping will be used to support the knee joint and muscle. MET is a sort of manual therapy that uses moderate isometric contractions to relax the muscles and reduces discomfort, stress and strain. It also prevents knee instability by enhancing quadriceps and hamstring muscle strength and function in patients with OA knees.

**Objective:** The purpose of the study was to investigate the effectiveness of Kinesio-taping and muscle energy techniques for pain and function in terms of NPRS and KOOS in subjects with OA knee.

**Methodology**: Forty osteoarthritis patients were randomly assigned to one of two groups (A or B). Group A (n=20) will receive Kinesio-taping and (MET) post-isometric relaxation for the hamstring, quadriceps, and gastrocnemius muscles along with interferential therapy. Group B (n=20) will receive knee strengthening exercises for both hamstring and quadriceps and interferential therapy for a period of thrice a week for 6 weeks. The NPRS (numerical pain rating scale) and KOOS (knee injury and osteoarthritis outcome score) were used to assess pain and functional improvement before and after the tests.

**Results**: Group A showed a significant mean difference (P = >0.001) between the NPRS and KOOS. Hence Group-A Kinesio-taping and muscle energy technique along with IFT are significant in treating individuals with pain and function in Osteoarthritis of the knee.

**Conclusion:** This study concluded that the Kinesio-taping and MET (post isometric relaxation) with IFT (Group A) shows effectiveness in improving the pain and function in the OA knee.

**Keywords:** Knee Osteoarthritis, Kinesio-taping, Muscle energy technique, KOOS, NPRS.

## Introduction

Osteoarthritis (OA) is a prevalent degenerative joint condition primarily affecting seniors, causing knee pain, swelling, stiffness, and loss of joint function due to cartilage wear and tear[1]. OA's prevalence in older adults ranges from 30% to 45%, with females being more affected than males[2].

Knee joints are commonly affected due to weight bearing and repetitive motion. The condition's progression and severity vary among individuals but

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often lead to disability over time. The exact cause and underlying mechanisms of OA remain unknown[3]. Current therapies include surgical, nonsurgical, pharmacological, and non-pharmacological approaches to alleviate symptoms and improve the quality of life[4].

MET and Kinesio-taping have grown in popularity recently among non-pharmacological modalities. Kinesio taping is a non-invasive and drug-free approach to therapy that in recent years has grown in popularity[5]. Kinesio taping is an elastic and stretchable adhesive tape that is utilized for patients with musculoskeletal ailments to reduce pain and discomfort and improve muscle strength and functional activity in knee osteoarthritis[6].

It stabilizes the injured location and permits the connective tissue surrounding the injured muscle or tendon to move with the body[7]. Kinesio taping has excellent adhesion and can be placed directly on the skin and left there for several days. The technique has a low risk of skin irritation making it patient-friendly and generally simple to apply in daily life[8].

MET is an active manual therapy based on autogenic and reciprocal inhibition. PIR and PFS are two of the most common MET techniques used to treat hamstring and quadriceps muscles[9]. PIR relaxes tight muscles without triggering a stretch response, increasing musculoskeletal function by mobilizing joints and reducing pain[10].

PIR consists of a brief period of submaximal isometric contraction followed by muscle relaxation while being stretched, acting as a preventive mechanism to prevent injury, muscle spasms, increasing range of motion, and enhancing circulation and lymphatic drainage[11]. MET is useful for treating muscle-related conditions and improving overall muscle function[12].

Interferential Therapy (IFT) is low-frequency electrotherapy for muscle function, treating musculoskeletal pain. It increases blood flow, activates muscles, and reduces pain. Some data suggests it may decrease nociceptive stimulus through large-diameter afferent fibers[13]. The KOOS and NPRS are commonly used outcome measures for knee osteoarthritis (OA) assessment, providing valuable data on pain, functionality, and other aspects of how OA affects the knee joint[14]. The self-administered KOOS questionnaire has five subscales, while the NPRS is a simple pain assessment tool using a 0-10 scale[15].

To our knowledge, however, no research has compared Kinesio-taping combined with the muscle energy technique for knee osteoarthritis. The aim of the study is to assess Kinesio taping and muscle energy technique versus knee strengthening exercises along with IFT on pain and function in subjects with OA knee using NPRS AND KOOS scores.

## Aim

The aim of the study was to investigate the effects of Kinesio-taping and Muscle energy technique on pain and function in subjects with OA knee.

## Material and Method

The study included 40 subjects with knee osteoarthritis selected using convenient sampling from Saveetha Medical College Hospital, Thandalam, Chennai, outpatient department. It was an experimental study with a duration of 6 weeks that were conducted from June 2022 to August 2022

**Inclusion criteria:**

- Age group 45-65 years
- Both gender male and female
- Knee joint muscle tightness
- NPRS score above 5 will be included.
- Diagnosed with OA knee from grade 1 to 2

**Exclusion criteria:**

- Recent trauma on the affected side
- Skin allergy and infection
- Open wounds around the affected knee joint
- Congenital deformity of lower limb
- Osteoporosis

## Outcome Measure

The Numerical Pain Rating Scale (NPRS) is a widely used scale to assess pain intensity. It ranges from 0 (no pain) to 10 (most painful imaginable), with patients indicating their pain level by choosing or circling a number. The Knee Injury and Osteoarthritis

Outcomes Score (KOOS) is a self-administered questionnaire designed to assess the immediate and long-term outcomes for individuals with knee injuries. It evaluates five key aspects: knee-related quality of life, pain, activities of daily living, and sports and recreational function. Scoring is based on a Likert scale with responses ranging from 0 (no problem) to 4 (extremely problematic). Scores are scaled from 0 to 100, with zero indicating severe knee issues and 100 suggesting no knee problems. It serves as an effective tool to evaluate knee injury progression and treatment outcomes.

## Procedure

A total of 40 participants were divided into two groups (A and B) using a random number method. Both groups received treatments for 6 weeks, four sessions per week. Group A was treated with Kinesio-taping, muscle energy techniques, and interferential therapy, while Group B received knee-strengthening exercises and interferential therapy. Pre and post-test results were measured using KOOS and NPRS scales. Informed consent was obtained from the patients before the study.

**Kinesio taping for Group A:**

The functional corrective tape application method is divided into two components: In Part 1, the tape length is measured from above the patella to the tibial tuberosity, and a Y-tape tail is formed. The base is connected over the upper edge of the patella, and the rest is applied later when winding the tail tapes around the patella. The tape ends overlap on the tibial tuberosity and join together. In Part 2, measurements for the medial and lateral collateral ligaments are taken, and the tape is applied with 40% maximum tension. The knee is flexed to secure the tape ends without stress. The entire process takes 5-10 minutes.



**Figure 1: Kinesio taping for Osteoarthritis knee**

**Muscle Energy Technique for Group A:**

Post-isometric relaxation (PIR), which is the result of a reduction in the muscular tone of a single muscle or group of muscles, occurs after a brief time of submaximal isometric contraction of the same muscle. Self-inhibition is an overall concept in PIR.

The Post- isometric relaxation technique performs like: The therapist looks for limitations, imbalances, and tightness in the quadriceps and hamstrings. Positioning the patient correctly focuses on specific muscle groups. The patient pushes against resistance for 5-10 seconds during isometric contractions. Following relaxation, passive stretching is used to gently lengthen the muscles. A reassessment is performed to monitor improvement. Each session lasts approximately 10-15 minutes, and treatment is done in 4 sessions / 5 weeks. This systematic method aids with the patient's overall physical functional rehabilitation by improving the range of motion, addressing muscular imbalances, and relieving stress.

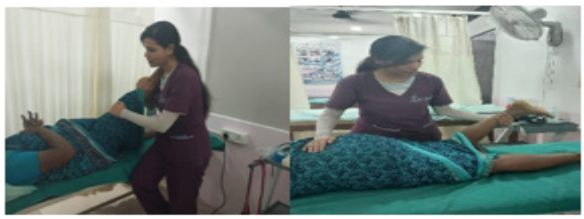


**Figure 2: PIR Technique for Hamstring and Quadriceps muscles**

**Knee Strengthening Exercises for Group B:**

Group B participants receive knee muscle strengthening exercises that includes a number of activities that target the hamstring and quadriceps muscles. Seated knee extension, terminal knee extension with a resistance band, short arc quads with a foam roller, standing calf raise, straight leg raise with weight cuffs, hamstring curls with ankle weight resistance and prone straight leg raise with ankle weight resistance are the exercises included. The Group B treatment was performed every exercise in three sets, three times a day, with 15 repetitions per set. Each repetition is held for 5 seconds, with a 2-second break in between. This strengthening exercise aims to improve the strength and stability of the knee muscles in Group B participants.

**Interferential Therapy for both groups:**

Interferential Therapy (IFT) was applied to the patient in a relaxed position using a quadripolar technique. The IFT machine's frequency ranged from 80 to 120 Hz with mild current intensity to create an interference effect in the tissues. The treatment protocol included 10-minute sessions, 4 times/ 2 weeks, based on the patient's pain threshold.

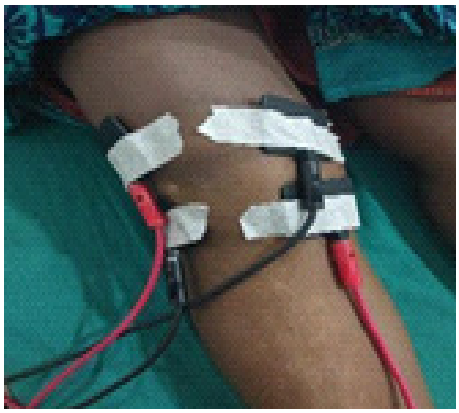
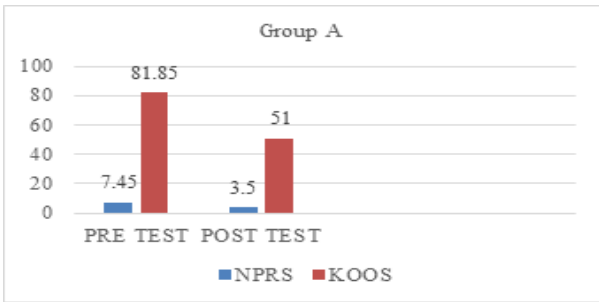


**Figure 3: Interferential therapy for OA knee**

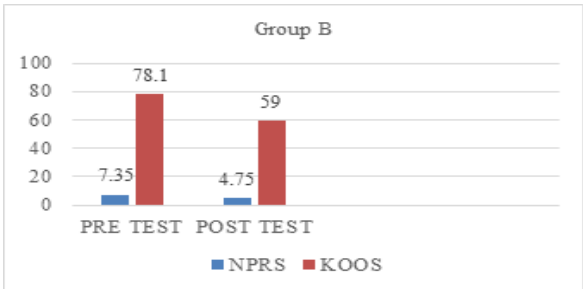
## Data analysis

**Group A Paired T- TEST**



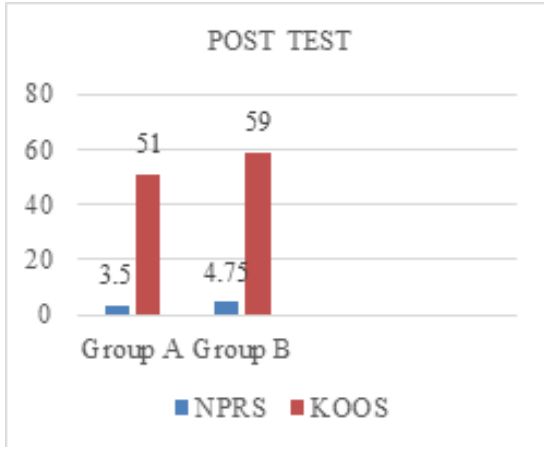

**Interpretation: Fig 4 -Group A** shows that the values are extremely statistically significant.

**Group B Paired T-TEST**




**Interpretation: Fig 5 -Group B** shows that the values are statistically significant.

**Group A & B Unpaired T-TEST**




**Interpretation: Fig 6 -Group A & B** shows that the values are extremely statistically significant.

## Results

The study was conducted on 40 subjects. Both the groups have 20 subjects each. On the parameter of NPRS AND KOOS Group A scored the mean value of 7.45 and 81.85 respectively. Group B scored a mean value of 7.35 on NPRS, and 78.10 on KOOS are the pre-test values of both groups. On the other hand, the post-test values of Group A on NPRS and KOOS are 3.50 and 51.00 respectively. Group B has post-test values of 4.75 on NPRS, and 59.00 on KOOS accordingly. Group A showed a significant mean difference between the NPRS and KOOS. Hence Group-A Kinesio-taping and muscle energy technique along with IFT are significant in treating individuals with pain and functional restrictions in Osteoarthritis of the knee.

## Discussion

The study compared Kinesio taping and the muscle energy technique (MET) versus knee strengthening exercises along with IFT for knee osteoarthritis. The 40 participants were divided into two groups of 20 each. Group A received Kinesio taping and MET with IFT, while Group B received knee strengthening exercises with IFT. KOOS and NPRS were used to conduct evaluations before and after six weeks. Both groups improved significantly in pain and function, and there were no dropouts.

MET (Muscle Energy Technique) showed significant improvement in knee joint and muscle

pain and function. Kinesio-tape enhances circulation and stimulates cutaneous mechanoreceptors. Improved function after MET may be due to altered mechanoreceptor-proprioception interactions, involving neuronal, viscoelastic, and thixotropic characteristics, and the Golgi tendon reflex during isometric muscle contraction.

Yeh-Hyun Kang et al., conducted a systematic review on Muscle Energy Technique (MET) for hamstring flexibility. The study included 19 RCTs with 949 patients, showing MET was more effective than stretching and control groups for sit-and-reach assessments, but not significantly better than other interventions for active knee extension tests. Further high-quality research is needed to fully evaluate MET's efficacy due to clinical heterogeneity and limited trials[16].

Cho et al., studied the effects of Kinesio taping (KT) on knee osteoarthritis. KT application to the quadriceps reduced pain levels, improved active range of motion (AROM), and enhanced proprioception in older patients. KT may be a suitable strategy for osteoarthritis management[17].

Ahmed M Elshinnawy et al., investigated the effects of Kinesio taping and Muscle Energy Techniques (MET) on chronic low back pain. Combining these with conventional therapy showed potential in reducing discomfort and enhancing trunk mobility. Further research in larger and diverse patient populations is recommended[18].

Manisha Sarkar et al., evaluated the effectiveness of Kinesio-taping and the Muscle Energy Technique in treating mechanical sacroiliac joint dysfunction. Both treatments, along with conventional physiotherapy, improved pain and quality of life in patients[19].

Tadar Anam et al., evaluated Kinesio taping, conventional therapy, and muscle-energy techniques for knee osteoarthritis patients. Both groups experienced reduced knee pain, but there was no statistically significant difference. Group A had improved pain alleviation, hamstring flexibility, and knee extension range of motion[20].

But here we are combining Kinesio-taping and MET. These are more effective than muscle strengthening, and it improves the pain and functional limitation of the subjects in the short duration and the intensity of the pain is decreased a little faster and more noticeable when compared to the knee strengthening exercises. The main end measures of the study were positively impacted by each intervention, according to our findings. In a brief amount of time, both therapies were having a beneficial impact. Therefore, it would be interesting to investigate the long-term impact of both interventions on subjects with knee osteoarthritis.

## Conclusion

According to the findings of this study, which involved comparing Group A with Group B has been concluded that Group A (Kinesio-taping and muscle energy technique along with IFT) was found to be effective than treating Group B (Knee strengthening exercises and IFT) on improving pain and function among subjects with OA knee.

**Ethical clearance:** The research received approval from the institutional scientific review board. All participants were adequately informed about the study's purpose, and those who agreed to take part provided their consent by signing informed consent forms.

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**Conflicts of interest:** The authors declare that they have no conflicts of interest.

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Original Article

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# A Study to Analyse the Effectiveness of Capacitive Resistive Diathermy on Patellofemoral Pain Syndrome Among Adult Population

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**Abstract**

**Background:** Many factors might lead to the development of patellofemoral pain syndrome (PFPS), a prevalent cause of anterior knee discomfort. Overuse from intense athletics or training, as well as issues with the alignment of the kneecap, are frequently important contributors.

**Purpose:** The purpose of this article is to analyse the effectiveness of capacitive resistive diathermy on patellofemoral pain syndrome among the adult population.

**Methodology:** Fifty subjects were based on inclusion and exclusion standards. The study's safety measures, risk considerations, and methodology were disclosed to the participants. The participants were all chosen using a practical sampling approach. The subjects were tested with Clarke's grind test and Vastus medialis coordination test and the treatment given to the patient is TECAR therapy for the duration of 15 minutes each day regularly for a period of 10 days under RET mode with the intensity of temperature according to patients sensitivity and tolerance.

**Results:** The subjects who received TECAR therapy were significantly improved, the pain was much more reduced with the p value of <0.001

**Conclusion:** This study concluded that TECAR therapy was effective in subjects with patellofemoral pain syndrome.

**Keywords:** Capacitive-Resistive diathermy, KUJALA patellofemoral scale, vastus medialis coordination test, Clarke's patellar grind test.

## Introduction

The knee complex is composed of femur, tibia, fibula and patella and it is a hinge joint. Knee joint surface is composed of two articulations within a single capsule: tibiofemoral joint and patellofemoral joint. Patellofemoral pain arising from the patellofemoral joint itself, or adjacent soft tissues, typically refers to anterior knee pain during activity such as running, climbing stairs, squatting. However, this is false because the popliteal fossa and the rest of the knee may both feel pain. It is also known as runner's knee or jumper's knee, and it frequently affects athletes who play basketball, running, and other sports. Patellofemoral syndrome, however, can also afflict persons who are not athletes and is often observed

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in teenagers, young adults, manual labourers, and elderly adults. Symptoms may appear suddenly or steadily worsen over time. Patients affected with this condition can persist for multiple years up to 60% of the time. The differential diagnosis of PFPS includes patellar tendinopathy and chondromalacia patellae. Despite patients complaining of comparable symptoms, neither condition is thought to fall within the broad definition of PFPS. Because it is believed that the pathophysiology is distinct, there are several treatments available[1].

The patellar orientation varies from patient to patient and may differ from the left to right knee in the same person due to anatomical misalignments, abnormal patellofemoral joint alignment and morphology of the cochlea. The loading of the patellofemoral joints during weight bearing activities on a flexed knee is thought to be altered due to various reasons leading to pain. Consequently, the patella can track smoothly up and down which over time can cause irritation of the joint surfaces and trigger nociception, a little patellar deviation can result in biomechanical anomalies, muscle imbalances, and even PFPS. On the other hand, a patellar deviation can result from muscle imbalances or biomechanical abnormalities, which can potentially lead to PFPS. For instance: When the Vastus Medialis Obliquus isn't strong enough, the Vastus Lateralis can apply a greater strain, causing a lateral glide, lateral tilt, or lateral rotation of the patella. This can lead to an overuse of the lateral side of the facies patellar is and produce pain or discomfort. Although it's unlikely, a medial glide, tilt, or rotation is feasible. The lateral retinaculum is another component that may contribute to patellar deviation. Secondly muscle weakness of the quadriceps and gluteus is a potential risk factor associated with PFPS. This is because poor strength and function in the quadriceps will influence how the patella tracks in the cochlea and how load is distributed across the patellofemoral joint. Gluteus on other hand can alter the lag axis if the femur adapts a more internally rotated position with regards to the tibia again impairing smooth movement of the patella within the femoral cochlea. Additionally, tibial torsion, genu valgum or varus, elevated Q-angle, tightness in the iliotibial band, hamstrings, or gastrocnemius can all contribute to PFPS[2].

Even while knee pain and discomfort are occasionally concentrated there, other times, something else is to blame. PFPS can be brought on by pes planus (pronation) or pes cavus (supination). Foot pronation, which is more prevalent in PFPS, results in an internal rotation of the tibia or femur as a means of compensation, which throws off the patellofemoral mechanism. Supination of the foot puts additional strain on the patellofemoral system because there is less cushioning for the leg as it touches the ground. Additionally, the hip's kinematics might affect the knee and cause PFPS. TECAR Therapy also known as capacitive and resistive energy transfer) is a safe, non-invasive, radio frequency current of 0.3MHz – 1MHz. It induces an increase in intra and extra cell exchanges and has a diathermic effect on living tissues[3].

TECAR therapy is a physical therapy technique used for pain management and rehabilitation. It utilizes the application of radiofrequency electromagnetic energy to promote tissue healing and relieve pain. The therapy is based on the principles of diathermy, which involves the generation of heat within tissues using high-frequency electromagnetic waves[4].

TECAR therapy can be performed using two different modes: capacitive and resistive. In the capacitive mode, a non-invasive electrode is placed on the skin surface, and an electric field is generated between the electrode and the underlying tissues. This mode primarily targets superficial tissues, such as skin and subcutaneous layers, and is useful for promoting local blood circulation and tissue metabolism[5].

On the other hand, in the resistive mode, a conductive electrode is placed on the patient's body, and a circuit is completed by using a manual or passive electrode. The electric current flows through the tissues, generating heat primarily in the deeper tissues, such as muscles and joints. This mode is beneficial for treating deep-seated pain, muscle spasms, and joint conditions[6].

TECAR Therapy is a form of endogenous thermotherapy it heals by creating heat inside and it eliminates pain and inflammation by affecting the internal and external structures like muscles,

tendons, ligaments and joints. TECAR therapy is useful in treating acute and chronic conditions particularly more effectively in treating traumatology, rheumatology, pain, phlebology and in sports injuries. Soft tissues and muscles are affected by the capacitive mode, which has a larger electrolytic content, whereas joints, bones, and tendons are affected by the resistive mode, which has a higher resistance. Its primary applications in physiotherapy are in the treatment of musculoskeletal and pain diseases, as well as in the recovery from injury in sports[7].

Capacitive Mode: In this mode, the therapist applies a capacitive electrode, which acts as a conductor, to the skin. The electrode does not make direct contact with the body. The electrical energy flows through the electrode and into the tissues, creating an oscillating electrical field. This mode primarily targets superficial tissues and is effective for conditions such as edema, inflammation, and muscle spasms. Resistive Mode: In the resistive mode, the therapist applies a resistive electrode, which does make direct contact with the skin. The electrical energy is delivered through the electrode and into the tissues, generating heat. This mode targets deeper tissues, such as muscles and tendons, and is commonly used for conditions like chronic pain, muscle strains, and joint stiffness[8].

This method delivers immediate therapeutic results from the very first treatment session and significantly decreases the rehabilitation time compared to equipment of older generations. It acts on biological tissues through electrostatic attraction and friction, aiming to increase blood circulation, provide rich oxygenated blood in the area of injured tissues and through the lymphatic system it aims to reduce edema, inflammation, and pain[9].

In addition, by providing energy to the tissues, it stimulates the healing mechanisms and acts by accelerating the physiological processes of tissue metabolism, resulting in an accelerated process of healing of the injured tissues. Using CAP and RES electrodes, as needed, the thermal induction stimulated by the ionic charges present in the body's soft tissues, produces biostimulation, through which tissue stimulation occurs at the cellular level. This interaction causes an exchange of charges, creating an increase in temperature and promoting physiological effects like vasodilation, improved blood flow, and increased oxygen supply to the tissues. It also enhances the transport of ions and nutrients, as well as the removal of metabolic waste. For anodized aluminium applicators with insulated electrodes, the capacitive system CAP (Capacitive) produces surface heating, given the low conduction capacity of the applicators. Therefore, the method is indicated for tissues with low resistance to current, offering treatment linked to the lymphatic, circulatory system, muscles, connective tissue and skin. RES (Resistive System) uses stainless steel applicators with good electrical charge conduction, so they have deeper heating. Hence its application in tissues with greater resistance to electric current and treatment linked to cartilage, ligaments, joints, deep muscle tissues and tendons[10].

The main purpose of the radiofrequency device is to increase local tissue temperature. The electrically induced heat is historically known as diathermy. Diathermy is purported to trigger a chain reaction in the body, which is responsible for many therapeutic effects, one of them is stimulating the body's natural repair processes. It's important to note that Tecar therapy should be administered by a qualified professional, as they will determine the appropriate parameters and treatment plan based on the individual's specific needs.

## Aim

The study's goal is to investigate the efficacy of TECAR therapy in the treatment of patellofemoral discomfort.

## Materials and Methodology

This is a pilot study carried out in a private medical hospital in Chennai during the period of August 2022 to November 2022. 50 patients who had PFPS were screened, and a convenience sampling technique was used to include 50 PFPS patients according to the inclusion and exclusion criteria with the patients willingness and prior informed consent was taken from the patients.

**Inclusion criteria:**

- Age – 20 to 49 years of both gender
- Knee pain for more than 3 months.

- NPRS score of 3 or higher
- Diagnosis of patellofemoral pain syndrome.
- Knee pain during physical activity or exercise.

**Exclusion criteria:**

- Open wounds or skin lesions
- Infections.
- Metal implants.
- Neurological disorders.
- Malignancy.
- Recent trauma or fracture.
- Hypersensitive skin type.
- Difficulty to resist heat.

**Outcome Measures**

Assessment was performed at baseline (before starting of treatment) and after four weeks of study.

- NPRS - Numerical Pain Rating Scale.
- KUJALA Patellofemoral Scale

## Procedure

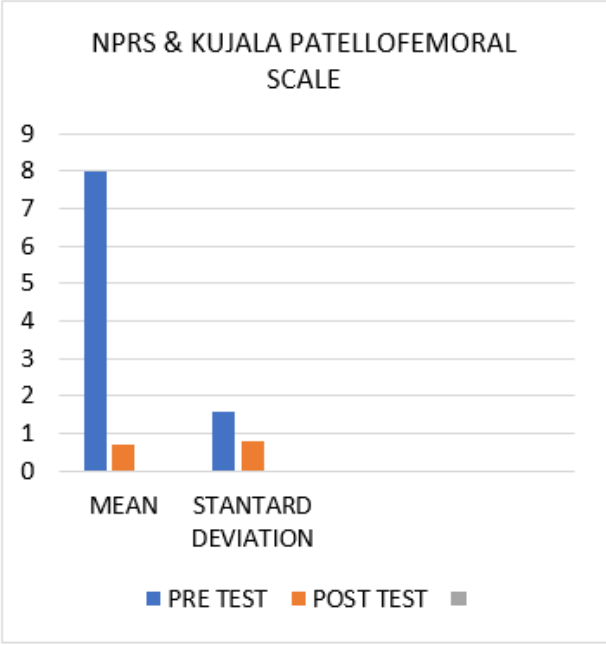
**Study procedure:** The essential piece of equipment for TECAR therapy is the TECAR machine. It produces electromagnetic energy with a high frequency that is administered to the subject's body. To transmit the electromagnetic waves produced by the TECAR machine, electrodes, conductive pads or plates are applied to the patient's skin. Capacitive and resistive electrodes are only two of the many types of electrodes that may be utilized for various applications and therapeutic methods. Electrode cables: By connecting the electrodes to the TECAR device, these cables allow electromagnetic waves to be sent. Gel or cream: Prior to applying the electrodes, a conductive gel or cream is often put to the patient's skin. This allows greater contact between the electrodes and the patient's body and aids in the conduction of the electromagnetic waves. Towels or disposable sheets are used to cover the treatment area during therapy and keep it clean.

**Safety measures**: It's critical to have safety precautions in place, including correctly grounding the equipment, ensuring the patient's comfort and safety throughout the therapy session, and adhering to any special instructions supplied by the Tecar machine's manufacturer.

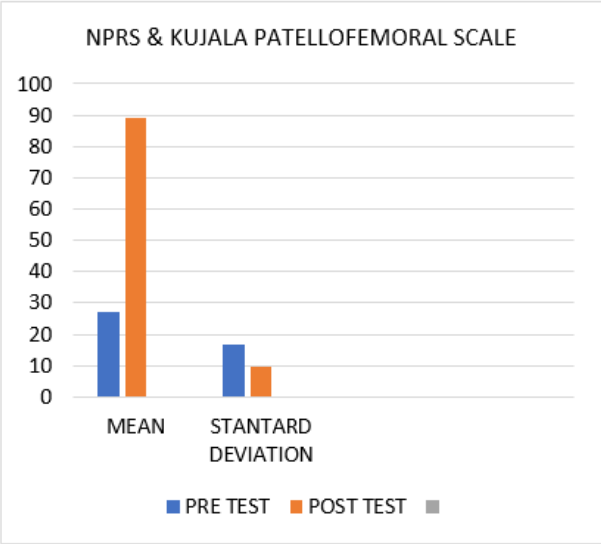
**Treatment procedure:** The subjects tested with a positive test of Clarke's patellar grind test and vastus medialis coordination test and were treated with TECAR therapy. In TECAR therapy the subjects were positioned in supine lying. Return plate which is a passive immovable electrode was placed in contact to the patient's body surface and the active electrode which is movable resistive-energy transmission (RET) handpiece of 40mm size for 8 minutes and capacitive-energy transmission (CET) handpiece of 60mm size for 7 minutes is used to treat over the patellofemoral region within the parameters for each day regularly for a period of 10 days under RET & CET mode with the intensity of temperature according to the subjects sensitivity and tolerance level.

Fifty samples were selected based on the inclusion and exclusion criteria, and subjects were selected for a Quasi experimental study design. Before beginning the procedure, all subjects provided written informed consent after being informed of the study. The NPRS and KUJALA Patellofemoral Scale were used to evaluate the pre-test and post-test.

## Data Analysis




**INTERPRETATION: Fig 1 shows that the values are extremely statistically significant.**




**INTERPRETATION: Fig 2 shows that the values are extremely statistically significant.**

## Result

TECAR treatment has been demonstrated to be more successful than other therapies in treating PFPS, as well as MSD and other physical ailments. A complete review is difficult to offer without precise data regarding the research that support the assertion that TECAR treatment is more successful. However, it is worth noting that a p-value of 0.001 indicates a high level of statistical significance. Nonetheless, the clinical importance and generalizability of these findings should be evaluated in addition to the statistical significance. The patients who underwent TECAR treatment were statistically substantially better, with a p value of 0.0001.

## Discussion

This study's objective was to confirm the TECAR therapy-based physiotherapeutic intervention's efficacy. Numerous restrictions and methodologically sound research on the eventual efficacy of this therapy were demonstrated throughout this study. The results of the tests demonstrated the effectiveness of this therapy, particularly in terms of pain, where a noticeable decrease occurred quickly[11].

The biological consequences of the treatment given to the disease itself might be taken into account when interpreting these improvements. For instance, the production of endorphins that regulate neuropathic and nociceptive pain, anti-edema and anti-inflammatory effects, muscular relaxation effects, and ultimately, the increase in cellular metabolism that contrasts with degenerative processes. The authors come to the conclusion that the results should be approved due to the device's properties, which permit heat transfer treatment without heat from the first day following surgery with a likely favourable impact on arterial microcirculation and lymphatic diseases that may be the cause of the successful results. For individuals having surgery on their locomotor system, this treatment adds value. It can also be seen that TECAR therapy is suggested as a helpful tool in the management of stroke following traumatic episodes based on clinical findings, and it maintains that the third post-injury day is a sufficiently safe starting point given the deep endothermic effect that TECAR therapy is capable of producing[12].

When comparing the outcomes between patients who underwent TECAR therapy and those who underwent combined therapies, it was found that TECAR therapy combined with a functional re-education programme enabled the acute inflammatory process to resolve quickly, the active and passive joints to recover early, and the muscle strength to recover quickly[13].

Therefore, it can be inferred that the TECAR therapy's method resulted in a quicker resolution of pain symptoms, a quicker return to normal function, and a higher quality of life. In the treatment of osteoarticular pain in geriatric patients, TECAR therapy is an effective adjunctive strategy that doesn't conflict with the use of other therapeutic modalities. It is also an invaluable tool for physiotherapists and can boost their job satisfaction in the geriatric sector[14].

TECAR treatment effectively reduced knee discomfort and increased physical stamina. According to the study's findings, capacitive and resistive electrical transfer treatment can help the knee's discomfort, stiffness, and functional limitations[15].

## Conclusion

The body's natural regeneration processes, particularly cellular repairs, can be speed up with TECAR treatment. It provides energy to the tissues, it stimulates the healing mechanisms and acts by

accelerating the physiological processes of tissue metabolism, resulting in an accelerated process of healing of the injured tissues Additionally, it can lessen pain, which has the benefit of hastening the recovery from injury or the issue associated with pain that has impacted the body. After treatment with TECAR therapy there is a decrease in pain. Thus, we conclude that TECAR therapy is effective in treating patellofemoral pain syndrome.

**ISRB approval**: Ethical clearance certificate was obtained from the Institutional scientific review board for the purpose of this study. ISRB NO: 01/007/2022/PGSR/SCPT.

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**Conflicts Of Interest**: No conflict of interest involved during this research.

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Original Article

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# Efficacy of Scapular Strengthening Exercise and Eccentric Forearm Exercise on Functional Recovery in Subjects with Lateral Epicondylitis

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**Abstract**

**Background:** Inflammation of the extensor Carpi Radialis Brevis tendon causes lateral epicondyle discomfort. Patients on the dominant side were more affected than those on the nondominant side. And also proximal muscle weakness or instability places an additional load on the distal joint, leading to distal conditions, such as lateral epicondylitis.

**Purpose:** To evaluate the effectiveness of scapular strengthening exercise and forearm eccentric exercise on functional recovery in subjects with lateral epicondylitis.

**Materials and Methods:** Thirty participants were randomly assigned to experimental (scapular strengthening with eccentric exercise) and conventional (eccentric exercise) groups. Pain-rated tennis elbow evaluation (PRTEE), the numerical pain rating scale (NPRS), and grip strength measurement using a hand dynamometer were used to evaluate the pre-test. The same test was used to determine post-treatment values after five weeks of treatment.

**Results:** A substantial difference was seen between the experimental and control groups (P = 0.0001). Scapular strengthening and eccentric exercises were effective in patients with lateral epicondylitis.

**Conclusion:** Scapular muscle strengthening and eccentric forearm training are effective in individuals with lateral epicondylitis.

**Key Word:** Scapular muscle strengthening, Eccentric exercise, Tennis elbow, Grip strength, Hand dynamometer.

## Introduction

One of the most prevalent arm lesions is the tennis elbow. Lateral epicondyle pain is an inflammatory condition that affects the common attachment of the tendons of the extensor forearm muscles, predominantly the tendon of the extensor carpi radialis brevis[1]. This generally occurs when people perform tasks that require repeated wrist extensions. The relevant risk factors include age, poor circulation, muscular deterioration or imbalance, overuse, repeated motions, improper training, misalignment, flexibility issues, and mental concerns[1, 2]. It is among the most prevalent injuries affecting both those who are employed and those who are not[3].

Lateral epicondyle predominance peaks were observed between the ages of 30 and 60. It is predicted

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that 3–7% of the population will be affected[4]. Repetitive task workers are more vulnerable, accounting for 35–64% of all incidents. Patients experience numerous functional challenges due to pain and decreased grip strength, including trouble wringing clothes, using a firm grip, unlocking locks, and opening a jar[5, 6].

Strong indications for diagnosis include substantial pain during forced wrist extension, and tenderness when pressure is applied to the radio-humeral gap. Tennis elbow should not be diagnosed until specific findings are present[7].

Functional impairments can be caused by many different events such as discomfort, diminished grip strength, and decreased strength and endurance of the scapular muscles in lateral epicondylitis. They are not solely caused by wrist extensors. Kinetic chain theory states that every distal joint requires kinetic power generated by the proximal muscles. Proximal muscle weakening or instability puts extra strain on the distal joint and can result in distal pathologies, such as lateral epicondylitis. Subjects with lateral epicondylitis performed worse than healthy patients and showed considerable middle, lower, and upper trapezius, serratus anterior weakness, and decreased scapular endurance of the muscle. Exercises that strengthen the scapular muscles aid in improving grip strength and also minimise pain[8, 9].

Eccentric exercise lengthens the muscle-tendon unit as weight is applied, which encourages tendon healing and modifies the way the tendon is injured. However the purpose of eccentric exercise training is to stop or slow down muscle elongation. This presents a challenge to the muscle, as it increases its strength and accelerates healing and metabolism. By changing the characteristics and performance of their muscles, eccentric workouts are thought to be helpful in the rehabilitation of athletes, senior citizens, and patients[10, 11].

This study aimed to determine whether scapular strengthening and eccentric forearm exercises were effective in treating lateral epicondylitis.

## Aim

To evaluate the effectiveness of scapular strengthening exercise and forearm eccentric exercise on functional recovery in subjects with lateral epicondylitis.

## Material and Method

It was an experimental study conducted on 30 subjects with lateral epicondylitis, ages between 25-45 years. Samples were selected from the outpatient department of Saveetha Medical College and Hospital, Thandalam, Chennai. Using the closed-envelope method, participants were randomly assigned to one of two groups. The total duration of the study was 5 weeks, which is from July 2022 to August 2022.

**Inclusion Criteria:**

- An adult between the ages of 25 and 45, both genders, who has been experiencing pain in the lateral epicondyle region for the past two weeks.
- NPRS score of 3 or higher
- Presented with minimum one of the cozen`s, maudsley`s or milli`s procedure results that are positive.
- While gripping, there is discomfort at the lateral epicondyle.

**Exclusion Criteria:**

- Upper extremity neurological symptoms, musculoskeletal issues, neck pain, joint deformities, neurological illness, and cervical radiculopathy were all present.
- History of deformity in the affected extremity due to recent injury.
- The participant's medical history form, which includes any health concerns such as cancer, tumor or non-healing fractures.
- Injections of corticosteroids in the previous six months.

**Outcome Measure:**

Assessment was performed at baseline (before starting of treatment) and after five weeks of study.

- NPRS - Numerical Pain Rating Scale.
- PRTEE – Pain-Rated Tennis Elbow Evaluation.
- Grip strength measures using a Hand Held Dynamometer.

## Procedure

Thirty respondents were chosen using a convenient sampling technique, based on the

inclusion and exclusion criteria. All individuals provided written informed consent before beginning the study. Assessment of all the included participants was done according to the assessment form. Pain-rated tennis elbow evaluation, a numerical pain rating scale, and grip strength measurements using a hand dynamometer were used to evaluate before and after treatment. Using the closed-envelope method, participants were randomly assigned to one of two groups.

**Group A: (Scapular Strengthening and Eccentric Forearm Exercise)**

Participants receive the scapular strengthening with eccentric exercise for a single session per day in the total of 5 weeks also in the scapular strengthening mainly focused on serratus anterior, upper, lower and middle trapezius muscles. The participants used dumbbells as resistance to scapular strengthening and eccentric exercise (weight 10 RM).

- Scapular plane lateral raise - For the serratus anterior, while standing, the participants were asked to raise their arms and lower their heads in the plane of the scapula.
- Dumbbell shrug - For the upper trapezius, an individual is taught to stand, shrug their shoulders, and raise their shoulders towards their ears.
- Prone single arm dumbbell - For the middle trapezius, the participants were positioned on their back, shoulders near the table's edge, shoulder 90 degree abduction, elbows bent at a straight angle, and heads turned on either side for comfort. They were then instructed to raise their elbows towards the sky.
- Prone bench Y raise - For the lower trapezius, the participants were asked to lie face-down on the floor. Squeeze your shoulder blades together, raise your arm at a 45-degree angle above your head, point your thumb to the ceiling, keep your elbow straight, and slowly raise your arms as much as possible.
- Eccentric forearm exercise-Participants wrists were fully extended, forearms were pronated, and elbows were fully extended when the participants sat. The patient's wrists were gradually lowered to flexion, and the other hand was slowly lifted back to full extension. Supination and pronation were achieved by gradually turning the palm up and then down, respectively.

**Group B: (Eccentric forearm exercise)**

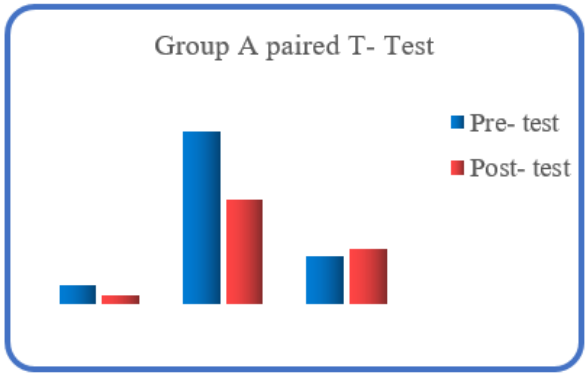
Participants receive only the eccentric exercise for a single session per day in the total of 5 weeks. The participants used dumbbells as resistance to eccentric exercise (weight 10 RM).

- Eccentric forearm exercise- Treatment application instructions were identical to those provided to the experimental group. As post- test values, the same test was performed after five weeks of treatment.

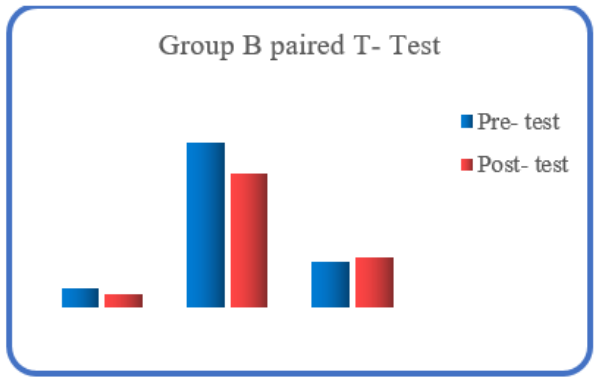
**Treatment protocol:**

- Duration of the session: 30- 40 minutes
- Frequency : Single session per day / 5 weeks
- Sets : 2 sets
- Repetitions: 10 repetitions
- Rest : 2-3 mins break between sets

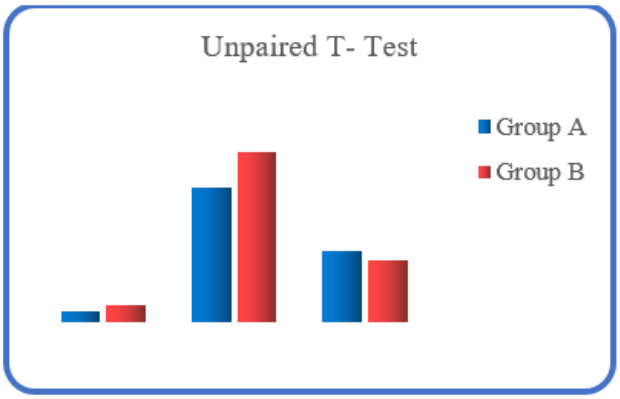
**Data analysis**




**INTERPRETATION: Fig1 shows that the values are extremely statistically significant.**




**INTERPRETATION: Fig 2 shows that the values are extremely statistically significant.**




**INTERPRETATION: Fig 3 shows that the values are extremely statistically significant.**

## Result

- The study was conducted on 30 subjects. Both the groups have 15 subjects each.
- The mean for NPRS was 2.67 for Group A and 4.07 for Group B, with p value is <0.0001 and t value was 5.3572 indicating that the results were extremely statistically significant.
- The mean for PRTEE was 32.3300 for Group A and 41.00 for Group B, with p value =<0.0001 and t value was 5.8231 indicating that the results were extremely statistically significant.
- The mean for Grip Strength was 17.127 for Group A and 15.127 for Group B, with p value =<0.0001 and t value was 5.1793 indicating that the results were extremely statistically significant.

## Discussion

The goal of this research was to assess the effectiveness of scapular training activity and eccentric forearm exercise on functional recovery in patients with lateral epicondylitis. The study involved 30 people aged 25 to 45. Participants with dominant sides were impacted more than patients with less dominant sides. Random group allocation separated the groupings in half. The experimental group did scapular strengthening exercises as well as eccentric forearm exercises, while the control group did only eccentric exercises. The trial lasted 5 weeks, and workouts were given 5 days each week. During the treatment, there is no drop-out.

When data from the experimental group, which received scapular muscle strengthening and eccentric forearm exercise, were analysed using paired t-tests within the study population for PRTEE, NPRS, and grip strength, there was a statistical difference in all three measures of outcome, namely discomfort, performance, and grasping power. Strengthening the scapular musculature gives proximal stability and helps to minimize tension at the musculotendinous junction, limiting pain stimulation of receptors and reducing pain by decreasing neurotransmitters in affected tissue. Decreased pain aids in the improvement of performance and the reduction of impairment. The fair distribution of kinetic energy in the kinetic chain also aids in performance. Eccentric exercise may have improved grip capacity by putting tensile strain on the muscle[12, 13].

When data was analysed using paired t-testing within the group for PRTEE, NPRS, and grasping power for conventional groups that only received eccentric exercise, there was a statistical difference in all three end measures, which are pain, performance, and grasping power. As shown in the article by Pufe T, Peterson et al. strengthening the eccentrically has helped to alleviate discomfort caused by neovascularization since exercise stops the formation of blood vessels in tendons. On the mechanical element influencing endostatin expression. It also stimulates collagen synthesis and tendon repair[14, 15.]

In all situations, the unpaired t test was employed to look for significant differences in after treatment results between both the control and experimental groups. The experimental and conventional groups have a considerable difference. As a result, the mean values of the experimental and usual groups diverge substantially. This difference is statistically significant, according to convenient criteria. The positive benefits were clearly greater in the experimental group than in the control group.

Bhide et al. investigated the effects of dynamic scapular muscle training on grip endurance in young people in order to debate the effectiveness of proximal stability on distal performance and a 4 weeks intervention consisting of dynamic scapular musculature strengthening exercises that targeted the musculature of scapular stabilizers. The findings of paired t-tests comparing grip strength before and after the intervention were highly significant, and it was concluded that grip strength in young adults increased significantly[16].

When group analysis was conducted, there was considerable variation in grip strength according to the study. This was supported by the findings of Bhargava et al. perform a case-control study that evaluates the hand endurance of players with LE in two separate wrist positions, as well as comparing athletes' and non-athletes' involved and not involved sides. This finding demonstrates that hand endurance decreases in patients with CLE. Statistical analysis revealed higher grip strength. Additionally, athletes' improved muscle strength, coordination, and neural adaptability may have had a certain influence on their outcomes[17].

There has been an increase in interest in the utilization of scapular muscle strengthening exercises and eccentric forearm exercises as prospective treatments for lateral epicondylitis in recent years. The scapular muscles help to stabilize the shoulder girdle during upper limb motions, and their failure can lead to altered biomechanics and greater load on the forearm extensor muscles. Eccentric forearm workouts, on the other hand, have been demonstrated to aid tendon repair and improve muscular strength and function. While some evidence supports the individual efficacy of scapular strengthening exercises and eccentric forearm exercises in lateral epicondylitis, little study has been conducted to investigate the combined benefits of these therapies on functional recovery in affected patients. As a result, the purpose of this research is to look into the potential synergistic efficacy of combining scapular strengthening exercise and eccentric forearm exercise into therapeutic programs for people with lateral epicondylitis, which could lead to better treatment outcomes and overall patient outcomes.

## Conclusion

All outcome indicators in both groups showed significant improvement. There was a slight improvement in pain score, total pain-rated tennis elbow scale score, and grip strength in the experimental group, which was statistically significant. This study concluded that scapular muscle strengthening and eccentric forearm exercises significantly improved the function, grasping endurance, and pain reduction in patients with lateral epicondylitis. A further recommendation for this study was to conduct prospective studies to ascertain whether scapular muscle weakness existed before the onset of lateral epicondylitis and whether it might be a risk factor for the condition.

**Ethical clearance:** The study was approved by the committee of institutional scientific review board. The study objectives were explained to all participants in the study, and those who decided to participate signed informed consent forms.

**Funding:** This study is a self- funded study.

**Conflicts of interest:** The authors declare that they have no conflicts of interest.

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Original Article

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# Effect of Mulligan Techniques on Pain Reduction and Improving Functional Activity of Shoulder Among Periarthritis Shoulder Individuals

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**Abstract**

**Background:** The background of the study is the incidence of Movement restriction among Periarthritis subjects which affects the Pressure pain threshold and Functional activity of the shoulder.

**Purpose:** To compare the effectiveness of shoulder strengthening exercises in patients with Periarthritis Shoulder. To evaluate the effect of pain and functional activity by pressure algometer and SPADI.

**Materials and methods:** The two groups; Group-A (Mulligan Mobilisation with Movement) and Group-B (Shoulder strengthening exercises) were randomly assigned. The pre-test assesses Pressure Pain Threshold by utilising a pressure algometer and Shoulder Pain and Disability Index (SPADI) Questionnaires to assess Shoulder Functional Activity among periarthritis shoulder in both the groups. The Group-A(MWM) has received Mulligan Mobilisation with Movement for a period of 4 weeks. In contrast to Group-B,which has received shoulder strengthening exercises for periarthritis shoulder.The same tests were measured after 4 weeks of treatment as post-test values.

**Results:** The pretest and post test values significant difference ($p<0.0001$)between groups A(MWM) and B(Shoulder strengthening exercises).The study showed that MWM has a major impact on recovery of PPT and Functional activity affected in Periarthritis shoulder participants**.**

**Conclusion:** The Mulligan mobilisation with movement was effective on improving the Functional activity and reduction in pressure pain threshold.

**Keyword:** Periarthritis shoulder,Movement with Mobilisation, Pressure pain threshold(PPT),Pressure Algometer, Shoulder Pain and Disability Index(SPADI).

## Introduction

Periarthritis of the shoulder is an inflammatory condition that affects the soft tissues around the shoulder joint, capsule, and joint itself. It frequently happens and causes a great deal of discomfort, impairment, and time away from work[1].In Bangladesh, the prevalence of shoulder discomfort and disability is at 7.3%[2]. Numerous entities with comparable clinical symptoms are included in the differential diagnosis. The most frequent lesions are rotator cuff tendinitis and tears, biceps tendinitis, and subacromial- subdeltoid bursitis[3]. Numerous disorders, including chronic shoulder strain, trauma, and regular exposure to cold or wet conditions are acknowledged as potential causes for PA despite

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the fact that its aetiology is unclear.[4] A more or less continuous clinical syndrome is periarthritis shoulder can be easily identified by pain in the shoulder area that radiates down the arm in patients between the ages of 50 and 60, gradual movement limits, and frequently co-occurring anxiety or depression[5]. From the posture in which the limb is resting mostly in abduction and external rotation[6], the motions are restricted in all directions. Effective treatment options for shoulder periarthritis continue to be elusive. The treatment provided should be such that the shoulder joint is more mobile and has a greater range of motion[7,8,9]. Mulligan mobilisation, also known as Mulligan techniques or mobilisation with movement, is a manual therapy approach used by physiotherapists to treat pain and improve joint movement. The main principle behind Mulligan techniques is the concept of mobilisation with movement (MWM), which aims to improve joint mechanics, reduce pain, and enhance function through pain-free and immediate improvements in range of motion.The Mulligan mobilisation technique often involves combining active movements from the patient with passive assistance from the therapist. This approach is believed to stimulate specific joint receptors, which can contribute to improved proprioception (awareness of joint position) and pain reduction. By optimising joint movement and reducing soft tissue tension, the Mulligan mobilisation technique may help alleviate pain related to joint dysfunction. The combination of joint receptor activation and decreased soft tissue tension may contribute to pain relief in some individuals.

Due to the modification of the articular surfaces and reconditioning of the shoulder kinematics, the Mulligan technique outperforms the Maitland treatment in terms of results for range of motion (ROM). Additionally, it has been claimed that the Mulligan approach relaxes surrounding soft tissues, such as ligaments and capsules, and lessens pain by activating joint receptors[11].

Three articles that all contained level I evidence of Mulligan mobilisation were discovered. In comparison to Maitland mobilisation and guided shoulder exercises, all three studies supported Mulligan mobilisation and demonstrated significant improvements in discomfort, range of motion, and function in individuals with frozen shoulders[12]. Theraband exercises, also known as resistance band exercises, have gained popularity as an effective and versatile method for shoulder strengthening. In this essay, we will explore the benefits and effectiveness of Theraband exercises for shoulder strengthening and their role in promoting optimal shoulder health. Benefits of shoulder strengthening exercises are 1) Progressive Resistance: A variety of resistance levels, from light to heavy, are offered in therabands. As an outcome, individuals can gradually increase resistance as their shoulder muscles receive stronger, starting with lower resistance. Theraband exercises are suitable for people of all fitness levels and ages because of their adaptability. 2) Targeted Muscle Activation: Theraband exercises can isolate specific shoulder muscles, such as the rotator cuff muscles (supraspinatus, infraspinatus, teres minor, and subscapularis), deltoids, and trapezius. This targeted muscle activation helps address muscle imbalances and weaknesses, which are common contributors to shoulder injuries and pain.3)Safe and Low-Impact: Theraband exercises are generally low-impact and safe on the joints, making them suitable for individuals with shoulder issues or those in the early stages of rehabilitation. The elastic nature of Therabands also provides a controlled resistance, reducing the risk of overloading the muscles during exercises.4) Versatility: Therabands can be used in a variety of exercises, including shoulder external and internal rotations, shoulder abduction, scapular retractions, and shoulder flexion. Their versatility allows for a comprehensive shoulder strengthening routine that targets different muscle groups and movement patterns. 5) Rehabilitation and Injury Prevention: Theraband exercises are widely used in shoulder rehabilitation programs to restore muscle strength and function after injuries or surgeries. Theraband exercises are a valuable and accessible tool for shoulder strengthening. Their progressive resistance, targeted muscle activation, safety, and versatility make them effective in addressing shoulder muscle imbalances, preventing injuries, and promoting overall shoulder health. Whether used in rehabilitation or as part of a regular exercise routine, Theraband exercises offer numerous benefits that contribute to stronger, more stable, and pain-free shoulders. Embracing Theraband

exercises for shoulder strengthening can empower individuals to take charge of their shoulder health, improve performance, and enhance their overall quality of life.

## Aim

To determine the effectiveness of mulligan technique versus shoulder strengthening exercises in patients with Periarthritis Shoulder.

## Material and Method

In this experimental study, the effectiveness of movement with mobilization (MWM) and shoulder strengthening exercises (SSE) among periarthritis shoulders were analyzed. Total of Thirty samples were selected from Saveetha medical college and hospital, Thandalam.The duration of the entire study was around 4 months i.e., from July to October 2022 including the sample collections procedures and treatment period. This study was performed in the line with the principles of Helsinki.Approval was granted approval by the ethical committee of Saveetha College of Physiotherapy, Tamil Nadu, India(ISRB NO:01/009/2022/ISRB/PGSR/SCPT.

**Inclusion Criteria:**

- Participants with periarthritis shoulder Both Male and female
- Participants were aged between 40 to 60 years
- Participants with painful stiffness shoulder for at least 3 months
- Participants with limited range of motion and difficulty in shoulder functional activity.

**Exclusion Criteria:**

- Traumatic injury patients
- Neurological conditions
- Other musculoskeletal disorders
- Fractures and post-surgery patients
- Patients with corticosteroid injections.

## Procedure

Participants of 30 with Periarthritis Shoulder were chosen based on the criteria, and informed consent was obtained before treatment was initiated. Participants were randomly allocated to either: Movement with mobilisation or Shoulder Strengthening Exercises based on concealed envelope method; they were explained about the procedure and intervention of the study. All the participants underwent pre-test and post-test measurement with pressure algometer and Shoulder Pain and Disability Questionnaire. Both the groups underwent a treatment session thrice a week for 4 weeks. Each sitting glide is performed about 10-15 repetitions.

**Group A: Movement with Mobilization**

In MWM, the therapist applies a gentle, oscillatory glide or pressure to the affected joint in the direction that is restricted. The patient is then asked to perform a pain-free movement that complements the mobilisation force. MWM may involve applying a lateral glide to the humeral head while the patient actively raises their arm overhead. The therapist instructs the patient to perform pain-free active movements while applying the mobilisation force to the joint. During shoulder abduction, apply a gentle glide or distraction force to the humeral head while the patient raises their arm. Likewise glide is performed in all the directions in periarthritis shoulder patients during the treatment session. The treatment session takes place thrice a week for 4 weeks.

**Group B: Shoulder strengthening exercises (SSE)**

Shoulder strengthening exercises - The patient stood comfortably on the surface of the ground via both feet set firmly on the TheraBand. The patient is directed to apply pressure gradually and asked to hold over the end of the TheraBand. From the starting position, abduction, external rotation, and shoulder flexion have been encouraged. After retaining the position, turn to it without bouncing. Each of the subjects initially received strengthening using yellow bands for 2 weeks, followed by progression provided by using red TheraBand's for the following 2 weeks. The treatment protocol is structured so that exercises using the red TheraBand are carried out five times and those using the yellow band at the beginning of treatment. Hold for 25 seconds, three times per week for three weeks on alternate days.

**Materials required**

Pressure pain threshold Algometer, SPADI Scale.

## Outcome measures

Pain Threshold pressure algometer

The pressure pain threshold (PPT) is the point at which a pressure stimulus changes from being painless to being painful.it is suggested to use pressure algometry(PA)to objectively measure this PPT. Applying a mechanical stimulation to track when the pressure-induced sensation of the stimulus first transforms into pain allows us to determine PPT. While sufficient pressure is applied to the pre-selected points at a 90 degree angle, the Pressure Algometer, a valid and reliable tool for measuring pain intensity, is used to measure it. A force gauge with a rubber disc of 1 kg/cm2/s perpendicular to the skin operates as the pressure threshold meter. It had been displayed that this instrument can be useful in clinical practice for determining deep muscle tenderness[19]. Deltoid muscles and subscapularis muscles were assessed for the pain pressure threshold for the trigger point's pain intensity. The validity and reliability were 0.9. In addition, there was only 1 reading taken.

Shoulder Pain And Disability Index

The SPADI scale, a measurement of shoulder pain and disability, was used to evaluate it. The shoulder pain and disability index was created to quantify the pain and limitation caused due to shoulder pathology. The thirteen items on this self-administered index have been divided down into two subscales, namely pain and disability. It takes about 10 to 15 minutes to complete the task. This scale has a 0.89 reliability and validity scores. The outcome is represented as a percentage[20]

## Data analysis

All parameters were subjected to the mean and standard deviation (SD).For analyzing pre and post-test measurements. Within the group, paired t test was performed.

The unpaired t test was used to compare the group's pre and post-test measurements between the group. The P value of <0.0001 was deemed statistically significant.

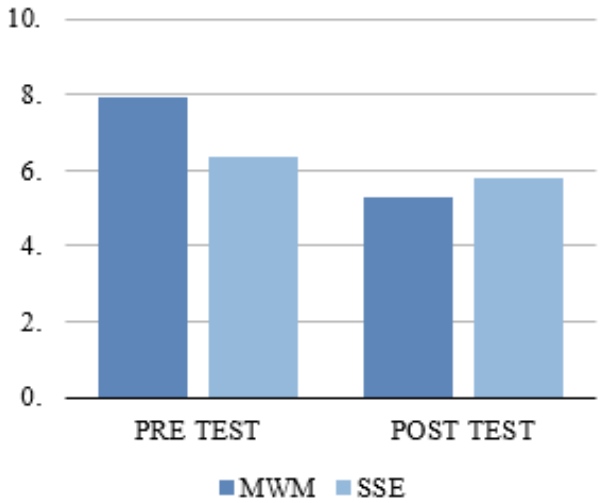
## Results

The Mean and standard deviation of the data were determined. The before and after values for both the groups were evaluated using the Shapiro-Wilk test for the normalcy. A p- value of 0.0001 or less was considered significant.

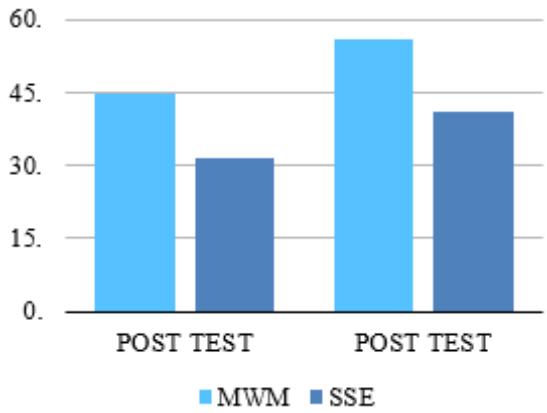
The mean value of MWM in pretest and posttest is 7.94 and 5.27 also the mean value of SSE in pretest and posttest is 6.34 and 5.80 which was measured using pressure algometer.

The mean value of MWM in pretest and posttest is 44.88 and 56.07 also the mean value of SSE in pretest and posttest is 31.6 and 40.93 which was measured using SPADI.

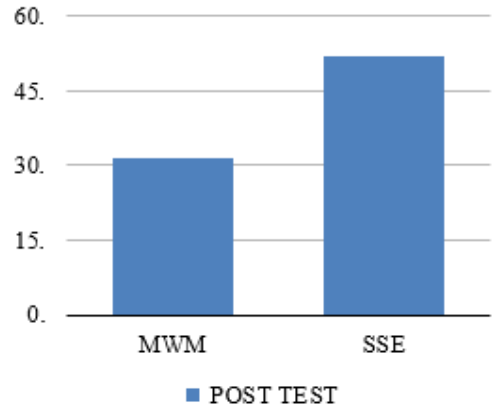
The mean value of MWM in posttest is 31.6 and also the mean value of SSE in posttest is 51.93 which was measured using pressure algometer.The mean value of MWM in posttest is 55.6 and also the mean value of SSE in posttest is 53.8 which was measured using SPADI



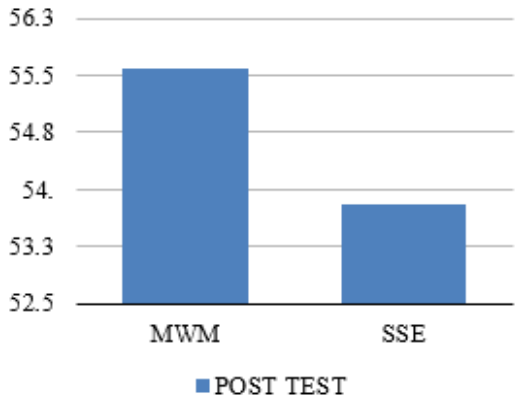

**INTERPRETATION: Graph 1 shows the Pretest and Posttest Mean and Standard deviation (SD) values of Movement with mobilisation and Shoulder Strengthening exercises within the group using Pressure Algometer.**




**INTERPRETATION: Graph 2 shows the Pretest and Posttest Mean and standard deviation (SD) values of Movement with mobilization and Shoulder Strengthening exercises within the group using SPADI Questionnaire.**




**INTERPRETATION: Graph 3 shows the Pretest and Posttest Mean and Standard deviation (SD) values of Movement with mobilisation and Shoulder. Strengthening exercises between the groups using Pressure Algometer.**




**INTERPREATATION: Graph 4 shows the Pretest and Posttest Mean and standard deviation (SD) values of Movement with mobilisation and Shoulder Strengthening exercises between the group using SPADI Questionnaire.**

On comparing both the groups, movement with mobilisation showed an improvement than shoulder strengthening exercise.

## Discussion

This comparative study was the first to investigate the outcome of MWM and SSE among periarthritis shoulders. The study included 15 individuals who were separated into two groups: MWM group and SSE group. The study investigated and analysed the effect of Mulligan Technique in improving Functional ability and Pain threshold in subjects with periarthritis shoulder.

Group A had 10 males and 5 Females where Group B had 8 females and 7 females. Group A received the Mulligan technique (MWM) in improving Functional ability and decrease in pressure pain threshold whereas Group B received Shoulder strengthening exercises with TheraBand among Periarthritis Shoulder individuals. Aliaa rehab Youssef, Ahmed moors et.al.,A significant contribution to the field of shoulder rehabilitation is the comparison of the Maitland technique and the Mulligan mobilisation in the treatment of diabetic frozen shoulder. The results indicate that for this particular condition, Mulligan mobilisation is superior to Maitland technique. The results may have major implications for physicians and physical therapists who treat diabetic patients who have frozen shoulder because they point to a potentially more beneficial strategy for treating this difficult condition.

Y.V. Raghava Neelapala et al. Conducted study provided a valuable evidence supporting the efficacy of the Mulligan's posterolateral glide technique in improving shoulder rotator strength and scapular upward rotation in individuals with shoulder pain. The results suggest that this intervention could be a promising addition to the repertoire of physiotherapy techniques for managing shoulder pain and improving shoulder function. Khyathi et.al study adds to the evidence supporting the use of physiotherapy techniques in managing frozen shoulder. The research highlights the effectiveness of both the Spencer technique and the Mulligans technique in providing pain relief, increasing shoulder range of motion, and improving functional abilities in patients with frozen shoulder. These

findings encourage physiotherapists to consider these techniques as viable options for treating individuals with adhesive capsulitis. Nonetheless, further research with larger sample sizes and longer follow-up periods would be valuable to validate and strengthen the results of this study. The prevalence of periarthritis shoulder in people over 40 is very high, and in our study, group A's mean age was 62 and group B's mean age was 59. Pressure Pain Threshold and SPADI Score were the end measures in the current study, and they were both analysed every other day for seven days. Pre and post analyses were conducted on days 1 and 7. The study found that the Mulligan technique (MWM) considerably improved functional ratings, but that Group A(MWM) alone had a significant decrease in pressure pain threshold. This might suggest that the Mulligan technique has a positive impact on raising functional ability and lowering pain threshold under pressure.

Improvements in MWM may be a result of its biomechanical and neurophysiological mechanisms. According to biomechanics, mulligan's mobilisation with movement (MWM) may address joint partner bone alignment, for example, when shoulder biomechanics are altered, the head of the humerus is pulled towards the glenoid fossa, changing the glenohumeral mechanism and causing positional faults that can be corrected through movement. In MWM, the patient simultaneously experiences input from painless joint movements, increasing activity level. MWM aids in extending and relaxing the muscles and capsule surrounding the shoulder joint, which may have improved motor function and set the patient up for long-term benefits.[18,19]

Jeyakumar S et al., states that maitland and mulligan techniques shows a good improvement in increasing the range of motion and reducing the pain in adhesive capsulitis of shoulde.[21]

Jeyakumar S et al., states that both, Maitland mobilization and myofascial trigger point release are proven to be effective in treatment of adhesive capsulitis.

The findings of this study also demonstrated that each intervention had a comparable favourable effect on the study's primary outcome measures. The Mulligan technique (MWM) had produced favourable results quickly.

Examining the long-term effects of Movement with Mobilisation in people with Periarthritis Shoulder would therefore be interesting.

## Conclusion

In accordance with the study, Movement with mobilisation opposed to Shoulder strengthening exercises, has a larger favourable impact on pain threshold and functional activity among periarthritis shoulder. Although the results of the pain pressure algometer and SPADI Questionnaire for both groups showed a significant improvement after treatment, movement with mobilisation had a greater increase in functional activity and decrease in pressure pain threshold than the SSE group.

**Ethical Clearance:** The study was approved by the Committee of Institutional Scientific Review Board.

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**Conflict of interest:** None

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Original Article

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# Effectiveness of Mckenzie Exercises Versus Neural Flossing Technique in Patients with Lumbar Radiculopathy

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**Abstract**

**Background:** Lumbar radiculopathy is a term used to describe a range of symptoms that includes pain, tingling, numbness, and weakness that spreads along the pathway of the sciatic nerve. This condition can arise when any of the five sciatic spinal nerve roots become compressed or irritated, affecting one or both lower limbs.

**Purpose:** The study is to compare the effectiveness of McKenzie exercises and the neural flossing technique in managing lumbar radiculopathy in patients.

**Methodology:** The study recruited 40 participants with lumbar radiculopathy, randomly allocating them to Group A (McKenzie exercises along with laser therapy) and Group B (neural flossing with low-level laser therapy). The modified Oswestry Disability Index and Numeric Pain Rating Scale were used to assess outcomes.

**Results:** The results showed that the neural flossing technique (Group B) demonstrated statistically significant improvements in reducing pain and improving function compared to the McKenzie exercises (Group A) post-treatment. Group B had significantly lower NPRS scores ($p < 0.0001$) and a higher improvement in MODI scores compared to Group A.

**Conclusion:** In this study, the neural flossing technique (Group B) showed superior outcomes in managing lumbar radiculopathy compared to McKenzie exercises (Group A). Group B exhibited significantly lower pain levels and greater improvement in functional disability. These findings suggest that the neural flossing technique may be a more effective treatment option for patients with lumbar radiculopathy.

**Keywords:** McKenzie technique, Nerve flossing technique, Laser therapy, radiculopathy, low back pain.

## Introduction

Lumbar radiculopathy, a condition characterized by radiating pain, numbness, and weakness in the lower back and legs, affects a significant proportion of the population and poses a considerable burden on individuals' quality of life. It is a prevalent and debilitating condition that affects a substantial portion of the global population. More than 70% of individuals in developed countries have reported experiencing low back pain at least once in their life[1,2].

Lumbar radiculopathy may cause irritation in one or both legs because of an issue with any

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(or all) of the five sciatic spinal nerve roots. Nerve root entrapment is another way of saying lumbar radiculopathy along with other similar terms like sciatica and nerve root pain. The most typical condition affecting both sexes and most age groups is lower back discomfort. Approximately 85% of the population is affected by this. An extensive treatment program for lumbar radiculopathy may also include spinal extension exercise, mainly McKenzie exercise, Neural flossing exercises, chiropractic care, pain management methods, and anti-inflammatory drugs. To relieve the compression on the afflicted nerves in extreme situations where conservative therapies are ineffective, surgical surgery may be considered[3,4.]

The McKenzie Method focuses on self-assessment and self-treatment, empowering patients to take an active role in their recovery. The key principle behind McKenzie exercises is centralization, which refers to the process of moving the pain from the legs back to the lower back. This is considered a positive sign as it indicates that the pressure on the irritated nerve is reducing. By centralizing the pain, the exercises aim to promote the body's natural healing process and alleviate discomfort caused by nerve impingement[5,6.] During the assessment phase, the therapist identifies specific movements that either centralized or peripheralized the pain. Peripheralization is when the pain spreads further down the leg, which is usually an indicator that a particular movement is aggravating the condition. Once the centralizing movements are identified, the patient is prescribed exercises tailored to their specific condition[7,8.]

These exercises may include repeated movements, such as standing or lying extensions, and sustained positions, like lying on the stomach or back. The goal is to encourage proper disc alignment and reduce irritation on the affected nerve root. Patients are encouraged to perform the prescribed exercises regularly at home. Over time, the exercises are adjusted and progressed based on the individual's response to treatment. McKenzie exercises are often incorporated into a comprehensive treatment plan for lumbar radiculopathy[9,10.]

Nerve flossing, a technique (NFT) pioneered by Michael Shacklock, is an active procedure that provides mechanical and physiological advantages as a conservative treatment option. For many compressive neuropathic diseases, the flossing technique is a safe, feasible, and conventional therapy option. Neural flossing, also known as neural gliding or neurodynamic mobilization, is a method that can both reduce pain and improve range of motion. The neural flossing method gently mobilizes the damaged nerves by gently stretching them through a series of controlled movements. Variations of the specialized neural flossing exercises for lumbar radiculopathy may include the slump floss, slump with a lateral glide, and straight leg lift floss[11,12.]

MODI Modified Oswestry Disability Index (MODI) is a validated questionnaire used to assess functional disability in patients with lower back pain or lumbar radiculopathy. [(13)]

The Numerical Pain Rating Scale (NPRS) is a simple and widely used tool to assess pain severity. It uses a 10-centimeter line, with "0" representing no pain and "10" the worst possible pain. Individuals mark their pain level on the line and measure the distance to assign a numerical value to pain severity[14.]

## Aim

The aim of the study is to evaluate the effectiveness of McKenzie exercises versus neural flossing technique in patients with Lumbar radiculopathy.

## Materials and Methodology

It was an Experimental study conducted at Saveetha medical college and hospital, Chennai**.** The duration of the entire study was around 5 months i.e., from June to October 2022 including the sample collections procedures and treatment period.40 participants with lumbar radiculopathy were chosen based on specific inclusion and exclusion criteria. Subsequently, they were allocated randomly to either of the two groups. Group A underwent McKenzie exercises (ME) along with low level laser therapy, while Group B received the neural flossing technique (NFT) in combination with low-level laser therapy, and this treatment regimen lasted for a duration of 6 weeks. To evaluate the results, the researchers used a modified Oswestry disability index (MODI) and the Numeric Pain Rating Scale (NPRS).

**Inclusion criteria**:

- Both male and female
- Above 30 years old
- Subject diagnosed with IVDP confirmed by MRI.
- Sharp, shooting, and radiating leg pain
- Positive passive straight leg raise test [30 – 70 degrees]

## Exclusion criteria:

- Infection of the spine
- Recent surgery
- History of vertebral fracture
- Spinal deformity
- Osteoporosis
- Sacroiliac joint pain
- Spondylolisthesis
- Vascular disorders
- cauda equina syndrome
- spinal deformity

**Outcome Measures**

The study used MODI, and NPRS as outcome measures. MODI assesses pain, stiffness, and function in the spine. NPRS measures pain severity. These measures guide treatment regimens for lumbar radiculopathy.

## Procedure

This study is a comparative intervention trial involving 40 subjects with lumbar radiculopathy, divided into two groups: Group A and Group B. Eligible participants were selected based on inclusion and exclusion criteria. After explaining the study and intervention, subjects were separated into the McKenzie group and neural flossing group, with their consent obtained. Baseline demographic data, along with MODI and NPRS scores, were recorded before treatment and after the 6-week intervention. Both Group A and Group B received low-level laser therapy treatment for 3 sessions per week for 4 weeks, followed by continuing exercises at home for the remaining 2 weeks. The study aims to compare the effectiveness of the two interventions in managing lumbar radiculopathy.

The participants in Group A received McKenzie exercises followed by low level laser therapy for 3 sessions a week continuously for 4 weeks. After 4 weeks of treatment, instructions were given to the participants to do exercises alone for two weeks. Subjects were reassessed by a physiotherapist after 2 weeks of follow up. The MODI and NPRS were used to measure function and pain respectively.

The participants in Group B receive neural flossing technique followed by low level laser therapy for 3 sessions per week continuously for 4 weeks. After 4 weeks of treatment, instructions were given to the participants to do exercises alone for two weeks. Subjects were reassessed by a physiotherapist after 2 weeks of follow up. The MODI and NPRS were used to measure function and pain respectively.

**Group A: McKenzie exercise**:

1. LYING IN PRONE: This simple exercise can prove highly effective for individuals who are in pain-sensitive or acute condition. Patients turn their head to one side while lying on their stomach. The lumbar spine's natural inward curve, or lordosis, is induced by this position. For at least three minutes, the patient holds this position while attentively evaluating how their symptoms change. In more severe circumstances, adopting this position might be enough to lessen symptoms, allowing the patient to advance to prolonged or repetitive motions with less pain or discomfort. This activity is an important first step in evaluating the patient's condition and choosing the best course of treatment for them.

2. LYING - PRONE EXTENSION (prone on elbow) To perform the McKenzie prone on elbow exercise, lie face down, support your upper body on your elbows, and keep your forearms flat on the ground. Raise your upper body by slightly arching your back. Maintain this position for a brief period, and then gently lower yourself back down. This exercise helps improve spine extension and can be beneficial for some lower back conditions.

3. EXTENSION IN LYING (prone on hand): In prone position, assume a press-up stance with hands under shoulders. Push upper body up, straightening elbows, and relax hips, pelvis, and legs while maintaining regular breathing. Hold for 10 seconds, then return to the initial position. Perform 2 sets of 10 reps, ten times each session, spread across six to eight sessions. Focus on smooth, rhythmic movements.

4. EXTENSION IN STANDING: To perform this exercise, stand with feet shoulder-width apart, hands on the lower back, and gently arch the lower back backward. Hold for 5-10 seconds, then return to an upright position. Repeat 8-10 times.

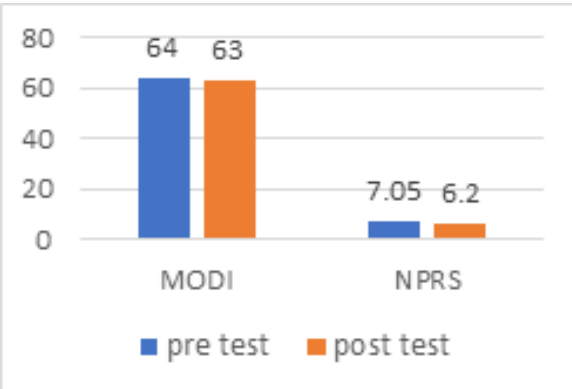
**Group B Neural flossing technique:**

The neural flossing technique was actively carried out while seated on a chair or couch. The participant lowered their head while simultaneously bending their knee backward under the chair, holding the position for five seconds. The subject then stretched his neck while straightening the leg on the side of his body that was experiencing sciatica. Until he felt discomfort, the participant lifted his leg forward and out in front and stopped there. He sustained the position for five seconds while extending his foot higher towards his shin to boost the stretching effect as the nerve's sensitivity decreased. The nerve-flossing technique was performed 15 times. After each set of 15 repetitions, the patient underwent an additional evaluation. The above were administered in five sets, with a two-hour break between each set while the investigator was present.

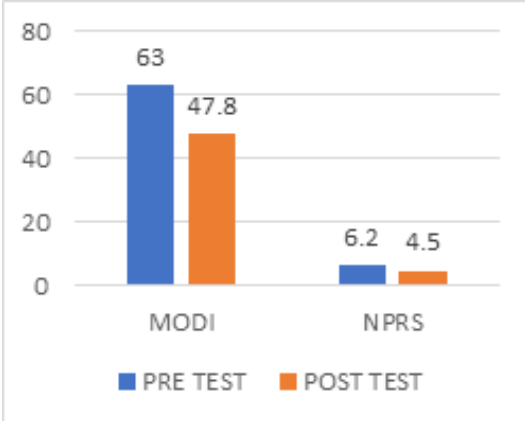
**LOW LEVEL LASER THERAPY**

Once, the participants completed an exercise using a McKenzie and neural flossing approach. Then Participants from both the groups were given LLLT with 830 nm laser with a power density of 0.67 W/cm2 or 300 mW/cm2. The stationary laser probe was positioned with the utmost attention to skin hygiene by placing it near either L4, L5, or S1 spinal process associated nerves targeted to treat a single distal level segment. A period of 30 to 60 sec was used to apply the laser at each point. The procedure was performed 3 days every week for 4 weeks.

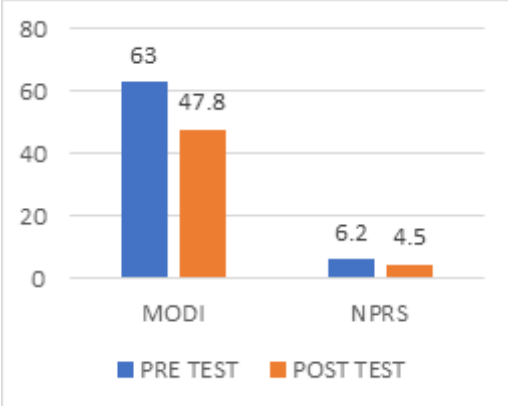
## DATA ANALYSIS




**Graph 1: Group A paired t test**




**Graph 2: Group B paired t test**




**Graph 3: unpaired t test**

## Result

The study compared Neural Flossing Group and McKenzie Group with MODI and NPRS values. In the Neural Flossing Group, post-test MODI was 47.8 (SD = 18.53), NPRS was 4.55 (SD = 1.10). McKenzie Group had MODI 63.30 (SD = 20.74) and NPRS 6.20 (SD = 1.36). MODI, NPRS showed highly significant differences ($p < 0.0001$). the neural flossing technique (Group B) showed superior outcomes in managing lumbar radiculopathy compared to McKenzie exercises (Group A). Group B exhibited significantly lower pain levels and greater improvement in functional disability. These findings suggest that the neural flossing technique may be a more effective treatment option for patients with lumbar radiculopathy.

## Discussion

According to the present study, individuals with lumbar radiculopathy have less pain and

disability while using the nerve flossing technique with low- level laser therapy (LLLT). In this study, we compare the outcome parameter of MODI and NPRS in improving the lumbar mobility and lumbar functional activity by giving neural flossing technique and McKenzie exercise.

McCracking et al. conducted a study on low back pain (LBP) with radiculopathy and reported similar results in Favor of neurodynamic treatment techniques. Neurodynamic treatments aim to address nerve-related issues and have shown promising outcomes for individuals with LBP and radiculopathy[15].

Kranthi Pallipamula et al.'s 2012 case study explored the efficacy of nerve flossing for sciatica caused by an extruded disc. While limited by its single-case design, the study suggests the potential effectiveness of the technique in treating such cases[16].

In 2022, Afzal et al. reported that neural flossing technique (NFT) shows promise in alleviating sciatica symptoms and improving patient outcomes. The approach, when combined with traditional physical therapy, demonstrated favourable effects, suggesting its potential as an effective treatment for sciatica[17].

In Ishaq Ahmed et al.'s study (2022), the findings indicate that low-level laser therapy (LLLT) is a successful supplementary treatment for discogenic lumbar radiculopathy when used in combination with traditional physical therapy. This suggests its potential as an effective approach in managing this condition[18].

The study conducted by Anikwe EE et al. in 2015 examined the impact of the Nerve Flossing Technique on acute sciatica symptoms and hip range of motion. The results demonstrated that incorporating Nerve Flossing with conventional physical therapy significantly reduced acute sciatica symptoms and improved hip mobility. These findings suggest that Nerve Flossing could be a valuable treatment option for patients with acute sciatica[19].

In chronic back pain, exercise is helpful in return to activities of daily living. Niraj Kumar's 2020 study compared McKenzie Techniques (MT) with isometric strengthening exercises (ISE) in patients with cervical radiculopathy. After four weeks of treatment, the study found that the McKenzie protocol was more effective in managing cervical radiculopathy compared to isometric strengthening exercises[19,20].

## Conclusion

The study compared the effectiveness of McKenzie exercises (Group A) and neural flossing technique (Group B) in lumbar radiculopathy patients. Group A showed higher post-test disability (MODI) and pain (NPRS) scores compared to Group B, which received neural flossing. Thus, the findings suggest that the neural flossing technique be more effective in managing lumbar radiculopathy than McKenzie exercises, as Group B demonstrated lower post-test disability and pain scores.

**Ethical Clearance:** The study was approved by the Committee of Institutional Scientific Review Board.

**Conflicts of interest**: All authors declare no conflict of interest.

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Original Article

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# Analysing the Relationship between Gluteus Maximus Muscle Activity and Hamstring Muscle Length and its Influence on Sit to Stand Activity in Persons with Sacroiliac Joint Dysfunction

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**Abstract**

**Background:** The sacroiliac (SI) joint has been found to be a source of discomfort for 25 to 35% of people suffering from persistent low back pain. Though the Gluteus Maximus and Hamstring muscles play a vital role in sit-to-stand activity in normal people, its role in individuals with sacroiliac joint dysfunction is yet to be studied.

**Purpose:** To assess the association between Gluteus Maximus activity and Hamstring muscle length and determine the efficacy of Gluteus Maximus activation exercise and Hamstring muscle eccentric training on improving sit-to-stand activity in people with SI Joint dysfunction.

**Materials and Methods:** In the first phase of the study, Hamstring muscle length, Gluteus maximus muscle activity, Pain during sit-to-stand activity was recorded. All thirty participants in the second phase of the study underwent six weeks of Hamstring muscle eccentric exercise and Gluteus Maximus muscle activation exercise.

**Results:** A Pearson correlation test shows a positive correlation ($r = 0.208$) but the weaker relationship between the variables. Paired t test analysis shows a significant improvement after the treatment in terms of Gluteus Maximus muscle activity, Hamstring muscle length and pain reduction with a P value $< 0.001$.

**Conclusion:** This study concluded that Gluteus Maximus activation exercise and Hamstring muscle eccentric training will significantly improve sit to stand activity and reduce pain.

**Key Words:** Sacroiliac joint dysfunction, Gluteus Maximus, EMG activity, Hamstring muscle length, Active knee extension test

## Introduction

Sacroiliac joint dysfunction acts as an important contributor in individuals with persistent and functionally limiting low back pain with symptoms that vary from person to person, making it challenging to diagnose. Common symptoms include lower back pain, sciatica-like pain radiating down the hips or legs, pain during or after prolonged sitting or standing, tenderness around the joint, and a reduced range of motion in the hips and lower back[1].

Sacroiliac joint dysfunction can arise from various factors, including injury, pregnancy,

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repetitive motion, and degenerative changes. Trauma or sudden impact to the joint, such as a fall or car accident, can lead to ligamentous sprains or even fractures. Pregnancy, on the other hand, can cause hormonal changes that result in increased laxity of the ligaments surrounding the joint, leading to instability and dysfunction. Repetitive motions, such as heavy lifting or bending, can strain the joint and eventually lead to dysfunction. Additionally, degenerative changes due to aging can contribute to the deterioration of cartilage and the development of osteoarthritis, further exacerbating the dysfunction[2].

The Gluteus Maximus and Hamstrings, particularly the Biceps Femoris muscles, have attachments over the "sacrotuberous ligament" and "long dorsal ligament" of the sacroiliac joint. Contraction or tension created in this muscle can produce compressive force on the sacroiliac joint, which creates a force closure mechanism at the sacroiliac joint[3].

Since the sacroiliac joint serves as an axis for load transmission, individuals with sacroiliac joint dysfunction have improper weight transfer across the pelvis. Ligament tension, muscle contraction, and joint proprioception should work in harmony to produce normal force transfer. In this part, the sacroiliac joint is stabilised by muscle activity acting as a self-bracing mechanism[4].

Sit-to-stand activity is a fundamental movement pattern involved in daily activities, from rising from a chair to initiating gait. The execution of this seemingly simple movement relies on the coordinated functioning of various muscle groups, particularly the "Gluteus maximus and the Hamstring muscle". These muscles play a crucial role in stabilizing the pelvis and lower limb during the transition from a seated to a standing position. The efficient execution of sit-to-stand is crucial for functional independence and plays a significant role in activities ranging from getting out of a chair to initiating walking or climbing stairs[5].

The biomechanics of sit-to-stand can be understood as a series of sequential events involving several key phases. Initially, the individual shifts their weight forward, activating the lower extremity muscles to generate the necessary force for pushing the body upward. Subsequently, the hips and knees extend, and the individual rises to a standing position, finally achieving an upright posture[6].

## Aim

The goal of this research was to study the association between Gluteus Maximus activity and Hamstring muscle length and determine the efficacy of Gluteus Maximus activation exercise and hamstring muscle eccentric training on improving sit-to-stand activity in people with (SI) joint dysfunction.

## Materials and Methodology

Subjects with SI Joint dysfunction was screened based on the selection criteria and informed consent was obtained. Out of which thirty subjects were recruited for the phase I. In the first phase of the research the Hamstring muscle length and Gluteus Maximus muscular activity were assessed using active knee extension test and surface EMG (peak to peak amplitude) respectively. Pain during sit-to-stand activity was recorded using the NPRS scale. All thirty subjects in the second phase of the study underwent six weeks of Hamstring muscle eccentric exercise and Gluteus Maximus activation exercise. This study was conducted from June 2022 to November 2022.

**Inclusion criteria:**

- Between the ages of 18 and 40
- Both male and female
- Had at least three positive results on the SI joint provocation test
- Positive Froment sign

**Exclusion criteria:**

- Pregnancy
- History of recent pelvic, hip, or lower spine fractures
- Positive neurological evaluation related to LBA
- Spinal infectious diseases

**Outcome Measures:**

- EMG (Peak to Peak amplitude)
- Active Knee Extension Test (AKE)
- Numerical Pain Rating Scale.

## Procedure

Based on the inclusion criteria subjects underwent sacroiliac joint provocation tests, namely "Pelvic Compression Test", "Pelvic Distraction Test", "Sacral Thrust Test", "Thigh thrust test", "Gaenslen's Test". Patients who exhibit a minimum of three positive provocation tests were selected for the study. The study was divided into two phases.

**PHASE I:**

In this phase, EMG activity of Gluteus Maximus and Hamstring muscle length were measured to find out the relation between Gluteus Maximus activity and length of the Hamstring muscles.

Recording Gluteus Maximus (GM) muscle activity: Surface EMG was used to find out the GM muscle activity. The active electrodes were placed over the lower inner quadrant of the buttock (GM Muscle) while the reference electrode was placed 3cm away from the active electrode and a ground electrode in between the recording electrodes. The subjects were instructed to perform sit to stand activity in a chair without arm support to trail the activity. The peak-to-peak amplitude of GM activity was recorded. The subjects underwent a total of three sets of sit-to-stand tasks in order to measure the muscle activity.

An AKE test was performed to determine the length of the Hamstring muscle. The subjects were lying supine, with the untested knee extended and the ankle in neutral position. To minimise compensatory pelvic tilt, a pelvic strap was secured around the ASIS. The patients were instructed to position the testing leg vertically with a 90-degree bent knee. Patients were instructed to grasp their thighs with their hands in order to prevent trick movement of the hip. They were now told to extend their knees as far as they could. Now a Goniometer was used to measure the angle of extension. Anything less than 60 degrees is considered hamstring tightness. Pain during sit-to-stand activity was recorded using the NPRS scale.

**PHASE II**

In phase two study exercises to activate the Gluteus Maximus and Hamstring eccentric training were given to all thirty subjects. The exercises were given for 5 days per week for the period of 6 weeks.10-12 repetition × 2 sets. Each exercise consists of 10 seconds hold and 10 seconds rest period on every five repetitions.

**Intervention Protocol:**

**Exercises to activate the Gluteus Maximus**

- Quadruped hip abduction,
- Forward and Retro step up,
- Unilateral and Bilateral pelvic bridge



**Fig 1: Quadruped Hip Abduction**



**Fig 2: Forward Step Up**



**Fig 3: Bilateral Pelvic Bridge**

**Eccentric exercises for hamstring muscles**

- Prone Hamstring Curl
- Seated Thera-band Hamstring Curl

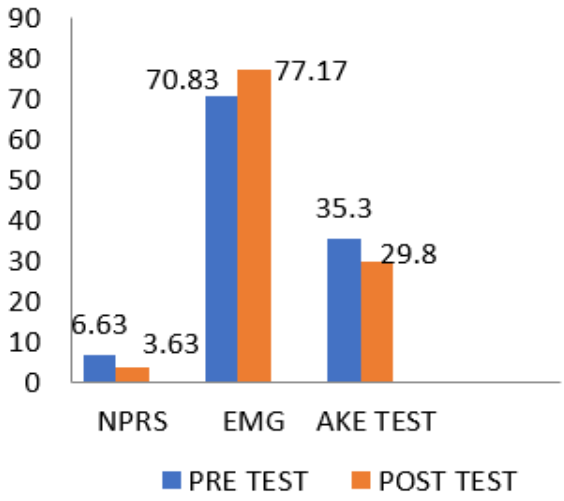


**Fig 4: Seated Thera-band Hamstring Curls**



**Fig 5: Prone Hamstring Curlsm**

**Data analysis**




**Graph No: 1**

**INTERPRETATION: Graph No.1 shows statistically significant improvement in Pre and Post intervention mean values**

## Result

A Pearson Correlation test was used to find the relationship between Gluteus maximus muscle activity and Hamstring muscle length, it shows a positive correlation (r = 0.208) but the weaker relationship between these variables.

The mean value of NPRS before treatment (Pre NPRS) was 6.63 ± 1.10. The mean value of NPRS after treatment (Post NPRS) was 3.63 ± 1.03. The t-value for the comparison between Pre NPRS and Post NPRS was 17.35. The p-value for this comparison is stated as < 0.001, indicating that the difference in NPRS before and after treatment is statistically significant. The mean value of EMG for gluteus maximus before treatment (Pre EMG glut.max) was 70.83 ± 4.50. The mean value of EMG for gluteus maximus after treatment (Post EMG glut.max) was 77.17 ± 4.88. The t-value for the comparison between Pre EMG glut.max and Post EMG glut.max was 14.8. The p-value for this comparison is stated as < 0.001, indicating that the difference in EMG activity of gluteus maximus before and after treatment is statistically significant. The mean value of AKE Test before treatment (Pre AKE test) was 35.30 ± 4.42. The mean value of AKE Test after treatment (Post AKE test) was 29.80 ± 4.57. The t-value for the comparison between Pre AKE test and Post AKE test was 15.94. The p-value for this comparison is stated as < 0.001, indicating that the difference in AKE Test results before and after treatment is statistically significant. From the results presented, it can be inferred that the treatment had a significant positive effect on reducing pain (NPRS scores) and increasing the muscle activity of Gluteus Maximus (EMG) as well as improving the AKE Test performance.

## Discussion

In our study we found that there is a reduced Gluteus Maximus activity, which has a positive but a weaker relationship with hamstring muscle length. With a reduction in the Gluteus Maximus muscle activity, a considerable reduction in the Hamstring Muscle length can be seen. These results were supported by a number of studies as follows.

A study conducted by Added MA et al. (2018)

found that patients with sacroiliac joint dysfunction had a significantly weaker Gluteus Maximus muscle and concluded that strengthening could improve sacroiliac joint dysfunction and provide relief from pain[7].

Several studies have investigated the role of the Gluteus Maximus in the sit-to-stand activity. One such study by Dimple et al. (2018) found that decreased activation of the Gluteus Maximus in the elderly was associated with increased difficulty in performing sit-to-stand activity[6].

A study, conducted by Chen et al. (2015), investigated the influence of Hamstring flexibility on sit-to-stand performance in healthy individuals. The study found that individuals with limited Hamstring flexibility exhibited reduced sit-to-stand performance, indicating that Hamstring flexibility is essential for sit-to-stand activity[8.]

Research studies have demonstrated the effectiveness of the AKE test in assessing Hamstring flexibility. A study conducted by Yildirim et al. (2015) compared the active knee extension test to other commonly used methods and concluded that it was a valid and reliable test for assessing hamstring flexibility[9].

## Conclusion

The conclusion of this study is that the subjects with sacroiliac joint dysfunction have decreased Hamstring muscle length and Gluteus maximus activity, both of which are crucial for executing sit-to-stand activity. The sit-to-stand activity was significantly improved by activating the Gluteus Maximus and eccentrically training the Hamstring muscles.

**Ethical clearance:** Approved by Institutional Scientific Review Board

**Funding:** Self

**Conflict of Interest:** Nil

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# Efficacy of Dry Needling Therapy Versus IASTM on Myofascial Trigger Point in Patient with Neck Pain

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**Abstract**

**Background**: The background of the study is soft tissue mobilization and dry needling among neck pain subjects, which indirectly affect functional activity and pressure threshold for pain over the neck area.

**Purpose**: To evaluate the effects of IASTM and dry needling therapy on myofascial trigger points in individuals with neck pain. And assess the effect of pain and functional outcomes by pressure algometer and NDI.

**Methods**: Thirty participants were randomly assigned to the two groups the dry needling therapy (DNT) Group and Instrument assisted soft tissue mobilization (IASTM) Group. The pretest measures of pressure pain threshold and functional activity of the neck were assessed by the pressure algometer and the neck disability index, respectively. The intervention DNT Group received dry-needling therapy, whereas the intervention IASTM Group received IASTM for a duration of 4 weeks. The same tests were measured after 4 weeks of treatment as post-test values.

**Result**: A substantial difference between the NDT group and the IASTM group was also discovered ($p = 0.001$). The study showed that dry needling significantly impacts pressure pain threshold and functional activity in neck pain participants. Conclusion: The dry needling therapy effectively improved functional activity and reduced pressure and pain thresholds.

**Conclusion**: Dry needling therapy has emerged as an effective therapeutic option for treating trigger points in the neck and relieving pain associated with them.

**Keywords**: Neck pain, Trigger point, Dry needling therapy, IASTM, Pressure Algometer, NDI

## Introduction

Neck pain is a common musculoskeletal health problem that poses a huge socioeconomic burden. The most prevalent issue overall, affecting two-thirds of the population who are active, is non-specific neck pain[1]. At some point in their lives, they will experience it, with lifetime prevalence ranging from 14.2% to 71% and prevalence rates of 6% to 22% among the senior population[2]. The precise source of pain is unknown, and there are no known underlying disorders that cause it. However, a few studies have suggested that poor posture and postural insufficiency caused by mechanical factors may be the cause of pain, although

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this is still under investigation[3]. Neck pain is most likely caused by a variety of different factors. Being a somewhat flexible structure, the neck can move in many different planes. Considering how mobile the neck is, it might be susceptible to harm and ailments that cause pain and restrict motion[4,5]. An awkward movement, bad posture, overuse, or other causes are commonly to blame for non-specific neck discomfort, which frequently radiates in a non-segmental manner up the arm, into the head, over the shoulder, or across the scapulae. Paraesthesia or hyperesthesia may also accompany it, although there isn't any objective loss of sensation or muscle strength[6].

NSAIDs, spinal injections such as (epidural steroid injections, trigger point injections, facet injections), braces, postural correction, ergonomic advice, etc. are among the other conservative treatments available. However, non-specific neck pain episodes occasionally resolve on their own after a period of rest[7,8]. Ice, heat, interferential treatment, ultrasound, warm-up exercises, light stretching, and strengthening exercises are some examples of physical therapy techniques[9]. The effectiveness of ergonomic therapies in minimizing mechanical neck discomfort has been established. These interventions include posture correction and changes to the workstation[10]. Conservative treatments for excruciating musculoskeletal diseases typically involve a variety of manual techniques to mobilize soft tissues and restore joint mechanics with supervised active exercises, education, and home programs including self-treatment. These methods might help with short pain relief by reducing discomfort and muscular spasm[11,14] Although the issue may recur, manual therapy, which also includes massage, fascial manipulation, passive mobilization through physiological and auxiliary movements, and stretching techniques for the superficial cervical muscles, offers short-term relief.[15,18]

Salaheddine DS et al., stated that active release technique helps in reducing pain and improve the range of motion in trapezius trigger point[19].

Recent research on female participants with persistent neck discomfort revealed that muscle chain stretching and conventional static stretching were equally helpful in reducing pain and enhancing range of motion and quality of life[19,20].Musculoskeletal weakness in the neck and trunk is linked to mechanical low back pain. Recently, there has been a lot of interest in instrument-assisted soft tissue mobilization (IASTM). To cure musculoskeletal pathology-related deficits, promote soft tissue healing, and lessen muscular stiffness, IASTM uses tools[21].

## Aim

To find out the efficacy of Dry needling therapy versus IASTM on Myofascial trigger points in patients with neck pain

## Materials and Methodology

It was an experimental study conducted on 30 subjects with neck pain carried out in a private hospital in Chennai during the period of July to October 2022. Samples were selected from the outpatient department of Saveetha Medical College Hospital, Thandalam, Chennai, according to the inclusion and exclusion criteria.

**Inclusion Criteria:**

- Age between 20 – 35
- Patient with neck pain
- Presence of active trigger point
- Both male and female Subjects are included

**Exclusion Criteria:**

- Previous whiplash injury
- Previous head, neck, cervical spine, or shoulder surgery
- Previous cervical radiculopathy
- Contraindication for dry needling and IASTM technique

## Study Procedure

Following the determination of their eligibility based on the inclusion and exclusion criteria, subjects were invited to participate in the study. The subjects who consented to participate were divided into two groups, the Dry needling therapy (DNT) group, and Instrumental assisted soft tissue mobilization (IASTM), and their signed consent was obtained after a brief explanation of the study and the intervention.

The total numbers of subjects were 30, with 15 subjects in each group, allocation was done by

Convenient Sampling, a randomized allocation method, the NDT Group had 10 males and 5 Females whereas the IASTM Group had 8 females and 7 females.

The Neck Disability Index Scale, a pressure algometer, and pretest measures were performed on each person. The post-test will be given at the end of the sixth week. For four weeks, the subject will undergo treatment in three sessions per week.

NDT Group patients undergo DRY NEEDLING therapy for four weeks in three sessions each week. After four weeks, a physiotherapist reviewed the subjects to measure the pressure algometer and NDI.

For four weeks, the participants in the IASTM Group get IASTM for three sessions each week. After four weeks, the subjects underwent another evaluation by a physiotherapist to measure the pressure algorithm and NDI.

**Dry Needling Therapy Group (DNT):**

Solid filiform needles (50. 3 mm) are created as key needles for MTrPs. For DN procedure was started by making the participant lie on their back on a couch. The top layer of the skin was cleaned with alcohol. The solid filiform needle was initially placed in its plastic guide tube. MTrPs were palpated and a needle inserting space was made by placing the thumb and index finger on both sides. DN was then placed over the MTrP of the taut band of the muscle between the thumb and index finger. MTrPs were tapped before the needle was inserted. The needle was then moved to the muscle around the bundle, advanced and retracted to the tissue, and then advanced again to produce a transient muscle twitch called LTR. Once LTR was produced, needling was stopped. If no twitch was noticed needling was stopped after two or three stellate.

**Instrumental Assisted Soft Tissue Mobilization (IASTM):**

The myo-release instrument was used to massage the muscle tissue for IASTM for 5 minutes. The stainless steel myo-release was the instrument utilized in this surgery. The massage therapist gave the muscle three passive stretches for 30 seconds right away after the session. For four weeks, the therapy was administered three times each week. (12 sessions total)

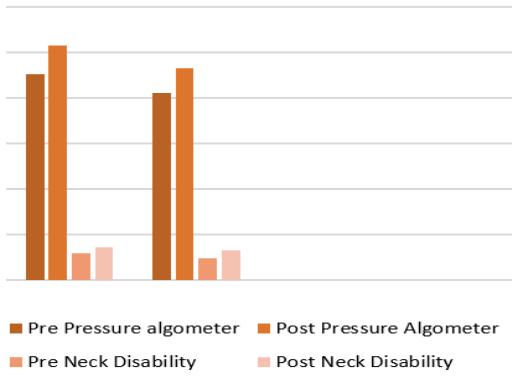
To apply cream and prevent friction between the participant's skin and the handlebar of the IASTM instruments, the participant in group A was told to lie down in a prone posture. The handlebar was then attached to the back of the neck using the scraping process. The neck muscle complex's fibers' direction and form were used to determine the IASTM application's direction.

To mobilize the whole surface of the neck muscle complex with continuous pressure, a "scraping" approach was used, moving from distal to proximal and lateral to medial.

- Session length: 40–120 seconds
- Weekly frequency: three days each week

## Data Analysis

Statistics, both descriptive and inferential, were used to tabulate and analyze the gathered data. Mean, median, and standard deviation (SD) were applied to all parameters. Parametric statistics are used to statistically analyze pressure algometer data. The significant differences between pre-test and post-test measurements were examined using a paired t-test. The significance level of (p0.05) was utilized to analyze significant differences between the two groups using an unpaired t-test. Non-parametric statistics are used to statistically analyze NDI questionnaire data. The statistically significant differences between pre-test and post-test values were examined using the Wilcoxon signed rank test. Mann–Whitney the significance level (p0.05) employed in the U test to analyze significant differences between two groups were deemed statistically significant.




**Graph No.1**

**INTERPRETATION: Shows the pretest and post-test of the Pressure Algometer and Neck Disability Index. NDT is more effective than IASTM Group**

## Results

Thirty people in all were chosen, and 30 of them underwent screening for neck pain. They were divided into two groups, each with 15 people. NDT Group patients with neck discomfort received dry needling therapy for trigger points. Individuals in the IASTM Group received treatment using the IASTM for neck discomfort.

NDT Group achieved the mean value on the parameters of the pressure meter and neck disability index, respectively. On the NDI and Pressure Algometer, IASTM Group received a mean value.

The NDT Group pre-test value of the pressure algometer is 225.4 and the IASTM Group pre-test value of the pressure algometer is 205.5 and has a mean difference of 19.9 and the post-test value of the NDT Group for NDI is 29.07 and post-test value of IASTM Group for NDI is 23.47 have the mean difference of 5.6.

Both dry needling and IASTM treatments showed equivalent benefits in lowering pain sensitivity, as seen by the same mean difference in pressure algometer values for both groups. Additionally, there was a constant mean difference in NDI scores between the two groups, indicating that both treatments had a similar effect on functional limits brought on by persistent neck discomfort.

These discoveries have significant effects on how persistent neck discomfort is treated. The use of dry needling and IASTM treatments seems to be an effective way to increase patients' pain sensitivity and functional ability. To properly address the intricacies of chronic neck pain, healthcare professionals and patients may consider these therapies as a part of an all-encompassing therapy approach.

The study employing the pressure algometer and NDI parameters to compare the results of IASTM therapy and dry needling on individuals with persistent neck pain produced positive findings. Following therapy, both groups showed considerable improvements in their pain sensitivity and functional limitations.

## Discussion

The study investigated and compared the effect of dry needling therapy and IASTM to improve the functional outcomes of the neck and reduction of values in the pressure algometer.

NDT Group received dry needling therapy whereas the IASTM Group was given instrument-assisted soft tissue mobilization [IASTM] for the intervention of 4 weeks and 3 sessions per week.

Common neck pain is extremely prevalent among individuals over the age of 20 to 35, similarly in our study the mean age of the NDT Group was 28 and IASTM Group B was 26. In the present study, the outcome measures were Pressure algometer and NDI which were analyzed on alternative days for 7 days. Pre and Post analysis was done on 1st day and 7th day.

The study showed that both interventions significantly improved neck functional outcomes but compared to dry needling therapy and IASTM, the dry needling therapy showed more improvement in increased neck functional outcomes and reduction in the values of the Pressure algometer than the IASTM Group.

Our results also showed that each intervention had a positive impact on the study's main outcome measures. But dry needling therapy showed better results than IASTM.

Neck trigger points can be effectively treated with dry needling. The afflicted region experiences discomfort, stiffness, and limited movement as a result of the trigger point, which is a tiny, constrictive band of muscle. The therapist can relax the tension and lessen the discomfort by putting a tiny, sterilized needle into the trigger point.

It is significant to note that a full treatment program for neck pain and myofascial trigger points, which may also involve exercise, stretching, heat or cold therapy, and other modalities, often involves both dry needling and IASTM.

## Conclusion

The study revealed that the Dry Needling group is considerably superior for myofascial trigger points in neck pain for treating patients in lowering pain and increasing functional results when compared to the IASTM group.

Dry needling therapy has emerged as an effective therapeutic option for treating trigger points in the neck and relieving pain associated with them. It works by reducing muscular tension, encouraging relaxation, and increasing blood flow to the afflicted region. According to existing research, dry needling treatment can result in considerable pain reduction and improved functional results.

**Ethical clearance:** Approved by the Institutional Scientific Review Board

**Funding:** Self

**Conflict of interest:** Nil

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# Effectiveness of Percutaneous Electrical Nerve Stimulation Versus Conventional Therapy in Adults with Plantar Fasciitis

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**Abstract**

**Background:** Plantar Fasciitis is a degenerative condition of the heel. Percutaneous electrical nerve stimulation and conventional therapy was used as intervention treatment for heel pain.

**Purpose:** The Purpose of this was to compare the efficacy of Pens and Conventional therapy in management of plantar fasciitis.

**Materials and Methods:** The experimental and control groups included 30 young males and females who were randomly assigned to each group. The experimental group patients underwent Pens and conventional group underwent ultrasound treatment, plantar stretch, and exercise. Before and after four -week sessions of therapy each participant was asked to score their morning pace using a numerical rating scale and functional foot index as outcome measures.

**Result:** The experimental group showed a substantial difference compared to the conventional group ($p < 0.0001$), indicating a statistically significant outcome. When comparing both groups there was a statistically significant difference after intervention.

**Conclusion:** Patients treated for heel pain reacted well to the conventional strategy used in this study, but Pens followed by active stretching dramatically reduced pain severity and improved the quality of foot function.

**Keywords:** Pens, Dry needle (DN), Plantar fasciitis (PF), Foot function index (FFI), Numerical pain rating scale (NPRS).

## Introduction

Plantar fasciitis is identified as a degenerative disorder by its pathogenesis. Plantar fasciitis-related heel discomfort is characterised by pain and a heel spur. Plantar fasciitis typically affects young individuals and athletes. It is distinguished by the lack of inflammatory cells. The chronic, continual stretching of the plantar fascia, which results in chronic deterioration and pain while at rest, is the pathophysiology of inflammation[1].

Degenerative processes cause the plantar fascia's root, which surrounds the perifascial components, to become inflammatory. The plantar fascia is made up of the calcaneus, which also serves as the

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proper biomechanics for the foot [2] . The explanation is multifaceted, but due to several factors, overuse stress is the most likely culprit. The discomfort is concentrated in the heel. 10% of the population experiences plantar heel discomfort, and the patients tend to be active, working people between the ages of 25 and 65.

Some academic studies' prevalence rates indicate that as many as 22% of people are runners. The patient frequently reports medial and inferior heel discomfort that has worsened over time describes severe morning pain as being intense and getting worse with the first few steps out of bed [3]. Percutaneous electrical nerve stimulation is the term used to describe electrical stimulation with dry needling [4] ."Skilled intervention using a thin filiform needle to penetrate the skin that stimulates myofascial trigger point musculature and connective tissue for the management of neuromuscular disorders' defined by American Physical Therapy Association of dry needling. Regional twitch reaction, the most common type of trigger point needling is fast-in, fast-out needling [5]. A taut band contracts quickly and abruptly in response to a local twitch. The spinal cord is where this reflex begins, and it is linked to the broken motor endplate.

Regardless of the type of Pens therapy used for treatment, the dry needle should be seen as an extension of the clinician's finger[6]. The subjects were asked to list any negative side effects they had experienced throughout the clinical trial. Any symptom that the patient found disturbing and required further care was regarded as an undesirable event if it persisted for more than a week. Invasive interventional groups getting percutaneous electrical nerve stimulation have received special attention. Traditional management of PF is proper stretching to the plantar fascia. Constant stretching of plantar fascia causes chronic degeneration which causes pain while resting [7].

## Aim

To compare the effects of percutaneous electrical nerve stimulation and conventional therapy in treatment of plantar fasciitis based upon NPRS and FFI outcome scale used for evaluating pain and foot mobility.

## Material and Methods

30 patients were included in this study conducted at Saveetha medical college and hospital, SIMATS Chennai. Both gender patients were included. Initial examination was performed by an experienced physiotherapist. Patients were provided with a consent form with assurance of treatment. This study was done from April 2023 till May 2023 with random sample technique.

**Inclusion criteria**:

- Age group 25-40 years.
- Trigger point present in the calf muscle.
- Unilateral symptomatic heel pain [8].
- Severe heel pain in the morning.
- Heel spur.
- Sedentary working with a high sitting position.
- Prolonged standing.
- Patient actively willing for treatment.

**Exclusion criteria:**

- Hypersensitivity to needles.
- Needle phobia.
- Presence of coagulopathy [9].
- Dermatological disease in foot.
- H/o recent fracture and surgery.
- Peripheral arterial disease.
- Systemic inflammatory disorder.

## Outcome Measure

As a primary outcome NPRS is a valid and accurate tool for determining the pain intensity. At baseline one week after the start of treatment and later it was measured four weeks after intervention. Patients were asked to rate the average intensity of pain in the morning using a 10-point scale ranging from 0 (No pain) to 10 (worst pain). In comparison to visual analogue scale, NPRS has higher rate and better responsiveness, more convenient to use and enables fewer challenges [10,11].

Secondary outcome includes the foot function index (FFI) which was collected at baseline 1st week and 4th week. To assess indicates lower level of function and worse quality of life connected to foot mobility.

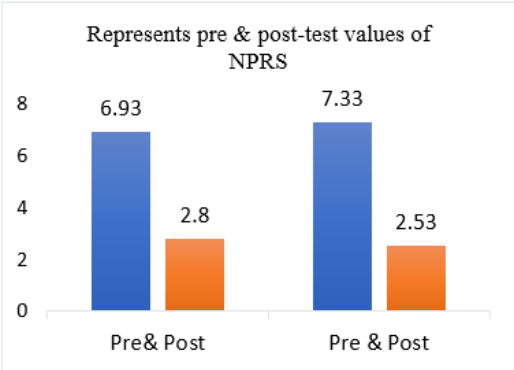
The subscale ranged from 0% to 100% and an average of three subscale scores was used to divide the overall score to bring out the effects of the study procedures [12].

## Procedures

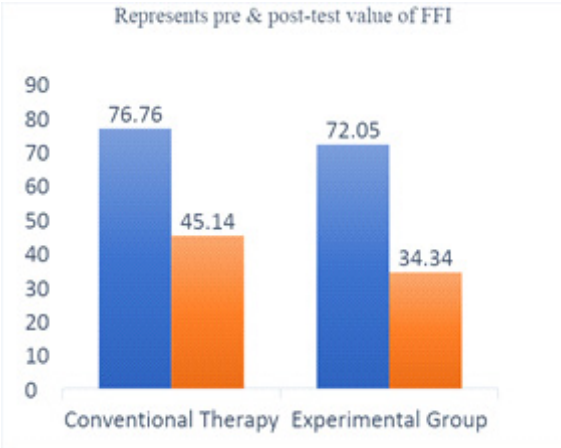
**Conventional group** Conventional received the therapeutic effects of ultrasound for 15 minutes. Adductor hallucis, Quadratus plantae, Gastrocnemius and Soleus muscle stretching for 8 sec hold and relax. Patients received treatment twice a week for a total of four weeks.

**Experimental group** Patient was evaluated for joint flexibility and palpate at the calf muscles for taut band. Specific invasive intervention was carried out with patients. Pens included the Tens modality and dry needle of 0.25-0.35 mm range was used based on patient requirement for treatment. Pens were given for 15 minutes followed by active or passive stretching at the calf muscle and home advice for ice packs is followed by soreness at the treatment area. Treatment was carried twice weekly for a total of four weeks.

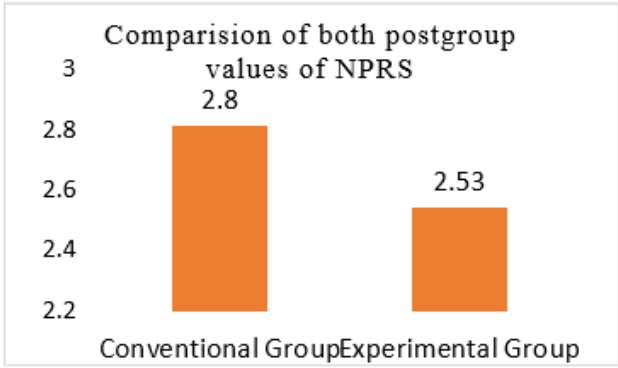
## Data Analysis



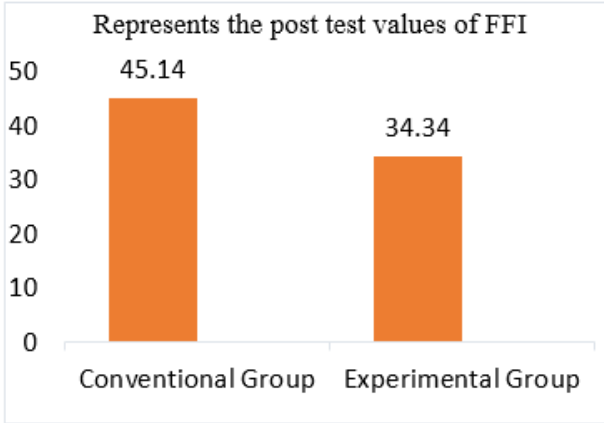

**Graph 1: Group A & Group B Paired T-test**




**Graph 2: Group A & Group B Paired T-test**




**Graph 3: Group A & Group B Unpaired T-test**




**Graph 4: Group A & Group B Unpaired T-test**

## Result

The acquired data were tabulated and analysed using descriptive and inferential statistics. Mean and standard deviation were applied to all parameters. A paired t-test was used to check for significant differences between pre and post measurement. An unpaired t-test was used to compare the performance between the groups. While the analysis cut-off was the significance level chosen as alpha $p < 0.0001$. The pre- and post-test scores of the Experimental group and the Conventional group are being compared using the Foot Function Index and Numerical pain rating scale.

In this study the data indicates that there is a statistically significant difference between the Conventional group and the Experimental group both before and after the intervention.

Based on this data analysis, it appears that the Experimental group B had a lower mean value in the outcome measure compared to the Conventional group A, and this difference is statistically significant.

## Discussion

The effectiveness of PENS is much higher than that of the traditional therapies. Physical activity of the heel, such as stretching and strengthening exercises, the therapeutic effects of ultrasound, cryotherapy, and electrical stimulation have been utilized to improve induced pain and prevent difficulty. To normalise heel pain, appropriate footwear with an insole cushion is utilized. This short-term study advances our knowledge and helps us to understand the short-term effectiveness of PENS versus standard therapy in patients with PF [13].

James Dunning et al. examined the efficacy of electrical dry needling in combination with manual therapy, exercise, and ultrasonography in heel pain. The difference in effect size for the primary outcome of morning discomfort was medium at four weeks. Furthermore, the FFI disability scale measures the quality of life of individuals with feet. Finally, the study suggests PF patients are significant [14].

According to Butts et al, Several studies have shown that focusing on trigger points can reduce pain and disability. There are no well-designed long-term studies that support the use of the in-and-out needle technique. The literature on myofascial pain syndrome supports the placement of needles in asymptomatic locations close to and far from the primary source, which causes pain. Hertz et al. reported fasciitis affects both male and female athletes and sedentary people alike. The identification of the main causes is complicated. The most frequent cause of heel pain is lower extremity radiculopathy. This leads to severe pain that causes significant disability and affects daily life[15].

Ibon et al. conducted a systematic review on Percutaneous electrical nerve stimulation in neuromusculoskeletal injuries to restore the functional activities of daily living. After evaluation the study showed a subjective improvement in plantar fascia disability and decreased pain modulatory system based on myofascial pain[16] .

According to Lara-Paloma et al.'s trials, physiotherapists with dry needling and electrical dry needling have demonstrated positive effects on persistent low back pain. Therefore, more studies are needed to assess the treatment components of physical therapists [17]. A study compared a control group that received sham treatment for plantar fasciitis to a group that underwent dry needling with electrical stimulation [18]. Comparing the active treatment group to the sham group, the study indicated that the active treatment group had much less pain and better foot function. The limitations of this study include its small sample size and absence of long-term follow-up. Attention has been paid to dry needling combined with electrical stimulation as a potential treatment for plantar fasciitis. By adding more sensory stimulation, electrical stimulation was thought to enhance the benefits of dry needling. The idea behind using dry needling along with electrical stimulation to treat plantar fasciitis is to reduce discomfort. Data currently available on the application of plantar fasciitis were examined in a systematic review published in 2019.

According to a review, combination therapy may help individuals with plantar fasciitis experience temporary pain relief and enhance functional outcomes [17,18]. The authors pointed out that the review papers were generally of low quality and that further rigorous studies are required to support these conclusions. It is important to remember that dry needling with electrical stimulation carries potential hazards and adverse effects like any medical intervention. Temporary pain at the sites of needle insertion, bruising, and in extremely rare circumstances, infection or nerve injury are some of these. As a result, it is essential to guarantee that the treatment is carried out by a qualified and licensed healthcare practitioner who adheres to the necessary safety procedures. It is recommended to consult a qualified healthcare professional, such as a physiotherapist or sports medicine specialist, who is experienced in performing dry needling techniques, as evidence supporting the use of dry needling with electrical stimulation for plantar fasciitis is still developing [19].

In order to evaluate pain and functional impairment in patients with plantar fasciitis, NPRS and FFI were used as outcome measures in clinical practice and research. NPRS provides a straightforward and easy-to-administer assessment of pain intensity, which allows clinicians and researchers to quantify pain levels and track changes

over time. NPRS provides a straightforward and easy-to-administer assessment of pain intensity, allowing clinicians and researchers to quantify pain levels and track changes over time [20].

FFI provides a more thorough assessment of foot function and its effect on daily activities. In addition to discomfort, it evaluates various functional impairments such as difficulties in walking or climbing stairs.[18]The patient's condition and the impact of plantar fasciitis on total foot function are better understood through this comprehensive approach. Both have been utilized in several research projects to investigate treatment options for plantar fasciitis. These measurements have proven sensitive to changes in pain and function following a range of treatments such as physical therapy, orthotics, corticosteroid injections, and surgical procedures [21.] The NPRS and FFI are useful instruments for evaluating pain and functional impairment in patients with plantar fasciitis. While the NPRS offers a straightforward and consistent way to gauge pain severity, the FFI offers a more thorough assessment of foot function and its effect on daily activities. Both metrics have been frequently used to assess treatment outcomes and direct patient care in research studies and clinical practice [22].

## Conclusion

This study concluded that patients with plantar fasciitis who received percutaneous electrical nerve stimulation improved significantly compared with those who received conventional therapy in terms of morning heel pain, foot health quality, and risk factors for heel pain. Additional research with a long-term follow-up should be conducted to increase the therapeutic effects of Pens in musculoskeletal conditions. Pens appears to be a promising therapeutic option for plantar fasciitis, further investigation is required to determine its optimal long-term efficacy.

**Ethical Clearance**: Ethical clearance certificate was obtained from the Institutional scientific review board for the purpose of this study. ISRB NO: 01/014/2022/PGSR/SCPT.

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**Conflict of interest:** The authors declare that they have no conflicts of interest.

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# Effectiveness of Scapular Proprioceptive Neuromuscular Facilitation with Maitland Glenohumeral Mobilization in Adhesive Capsulitis

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**Abstract**

**Background:** Adhesive capsulitis, an idiopathic condition that can cause severe disability, is characterized by fibrosis, a reduced glenoid capsule volume, and increasing pain with loss of range of motion (ROM) in the shoulder joint. In this study the efficiency of scapular Proprioceptive Neuromuscular Facilitation (PNF) with Maitland glenohumeral mobilization in adhesive capsulitis patients.

**Purpose:** This study was to evaluate the effectiveness of scapular Proprioceptive Neuromuscular Facilitation (PNF) mobilization with Maitland glenohumeral mobilization and) in subjects with adhesive capsulitis.

**Methodology:** Subjects were selected from out patient department of Saveetha Medical College and Hospital among 15 subjects following inclusion and exclusion criteria. Quasi-experimental study design, Convenient sampling is the sampling method. Range of motion and the numerical pain rating scale (NPRS) two outcome measures. Both the universal goniometer for ROM and the numerical pain rating scale (NPRS), which were used as outcome measures for adhesive capsulitis, were measured before and after the 16th therapy session. For four weeks, the treatment consisted of four-week sessions.

**Conclusion:** As a result of the findings, it was concluded that Scapular Proprioceptive Neuromuscular Facilitation with Maitland Glenohumeral Mobilization was effective in improving the Range of motion and reducing pain in Adhesive capsulitis.

**Keywords:** Adhesive capsulitis, Maitland glenohumeral mobilization, scapular Proprioceptive Neuromuscular Facilitation (PNF)mobilization, Numerical pain rating scale(NPRS), Range of motion(ROM).

## Introduction

Adhesive capsulitis, often known as frozen shoulder, is a disorder characterised by shoulder stiffness, pain, and reduced range of motion. It occurs when the tissues around the shoulder joint become thick, tight, and annoyed, causing adhesions or scar tissue to form. Although the specific aetiology of adhesive capsulitis is unknown, many variables can raise the likelihood of having the disorder. Adhesive capsulitis is more common in adults aged 40 to 60, and women are more likely than males to acquire it.is a disorder that makes daily tasks difficult by restricting

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shoulder joint flexibility. In 1872, Duplay coined the term "periarthritis scapula-humerae" to characterise the illness. However, Codman referred to it as frozen shoulder in 1934, highlighting how shoulder stiffness and pain could arise independently of external stimulation. Neviaser suggested the term "adhesive capsulitis" to designate a glenohumeral capsule ailment. The most typical cause of shoulder pain in middle-aged and older persons is adhesive capsulitis. Adhesive capsulitis is thought to be more common in females and the non-dominant hand, while the exact aetiology is unknown. It is more prevalent in those between the ages of 40 and 70 and is also considered to affect 2-3% of the general population. Primary and secondary adhesive capsulitis are the two basic types. The signs of primary or idiopathic adhesive capsulitis include a gradual onset of pain and stiffness at the gleno-humeral joint. The cause of this condition is unknown. Secondary adhesive capsulitis is known to be influenced by a number of risk factors. prior shoulder surgery or injury: Those who have undergone shoulder surgery or sustained an injury, such as a rotator cuff tear, are more likely to experience adhesive capsulitis[1]. Frozen shoulder is more common in those with diseases like diabetes, thyroid problems, cardiovascular problems, and Parkinson's disease. Stage of "freezing": Movement is restricted and the shoulder eventually becomes uncomfortable. Even weeks to even months may pass during this phase. It becomes challenging to carry out daily duties during the frozen period, even though the discomfort may subside. Four to six months may pass during this stage. The range of motion gradually increases and the restriction on shoulder mobility lessens during the thawing period. This phase may endure for a few months to several years.

The origins of a frozen shoulder are poorly understood, and they frequently occur for unknown reasons. The aetiology of frozen shoulder may be brought on by chronic inflammation in musculotendinous or synovial tissue, such as the rotator cuff, biceps tendon, or joint capsule. As the frozen shoulder progresses, the capsule that surrounds the shoulder joint shrinks, making shoulder movements uncomfortable. According to some sources, spontaneous recovery typically occurs two years after the sickness initially appears, while according to other sources, long-term limits are common without spontaneous recovery[2]. That adhesive capsulitis is a self-limiting ailment that resolves in one to three years is common. However, a number of studies have shown that 20% to 50% of patients may go on to have ongoing issues[3].

This condition develops gradually and causes pain over the deltoid insertion, sleep deprivation, painful incomplete elevation, painful external rotation, active and passive movement restriction, normal radiograph, and excruciating pain, but all patients are still able to go about their daily lives. With the possible exception of possible presence of osteopenia or calcific tendinitis in radiographs of the glenohumeral joint are largely normal in patients with frozen shoulders, which is characterised by functional restriction of both active and passive shoulder mobility[4,6,7].

When a patient arrives with shoulder pain and decreased mobility (adhesive capsulitis), clinicians should check for abnormalities in the musculotendinous structures surrounding the shoulder complex and the capsuloligamentous complex. A major finding that can be used to inform treatment strategy is the loss of passive motion in several planes, primarily external rotation with the arm at the side and in various degrees of shoulder abduction. (Recommendation supported by theoretical and fundamental data[5].

Scapular Proprioceptive neuromuscular facilitation(PNF) mobilizing: Begin by having the patient seated with their arm hanging relaxed at their side and their scapula in a neutral position. Place one hand on the patient's scapula and the other hand on their humerus. Begin by gently rocking the scapula towards the midline of the body, while applying a slight downward pressure with the hand on the humerus. At the end of the range of motion, pause and apply a gentle stretch by gently pushing the scapula away from the midline. Return the scapula to the starting position and repeat the process for the desired number of repetitions. Progressively increase the range of motion and pressure applied as the patient's comfort level allows [14,15].

Maitland glenohumeral mobilization: Maitland glenohumeral mobilization is a type of manual therapy used to treat shoulder and upper extremity

joint pain. This technique involves the use of gentle and specific manual pressure to mobilize the shoulder joint and surrounding soft tissue. The goal is to improve range of motion, reduce pain, and improve soft tissue extensibility. Start with the patient in a seated or lying position and position the patient's arm in a comfortable position. Provide a gentle pressure to the shoulder joint, using your fingers or thumb to press and move the joint in a circular motion. Move the shoulder joint in a variety of directions and angles, including anterior, posterior, medial, and lateral. Use your other hand to provide resistance to the shoulder joint in order to increase the mobilization effect. Gradually increase the pressure and range of motion of the shoulder joint, paying special attention to the patient's comfort level and any signs of pain. After the desired range of motion has been achieved, perform light stretches to further increase the mobility of the shoulder joint. Finally, apply a light massage to the affected area in order to increase circulation and relieve stress.

## Aim

The aim of this study was to evaluate the effectiveness of Maitland glenohumeral mobilization and scapular Proprioceptive Neuromuscular Facilitation (PNF) in subjects with adhesive capsulitis.

## Materials and Methodology

Quasi-Experimental Study: Assessing the Efficacy of Intervention for Adhesive Capsulitis at Saveetha College and Hospital. This study aimed to investigate the effectiveness of a particular intervention for adhesive capsulitis in a quasi-experimental design. The study was conducted at Saveetha College and Hospital and utilized a convenient sampling technique. The sample consisted of 15 individuals aged between 45 to 65 years, ensuring gender equality. Inclusion criteria required participants to have adhesive capsulitis in the freezing stage, be diagnosed with unilateral adhesive capsulitis, and have either primary or secondary origins. Participants with malignancy, skin allergies, infections, recent shoulder surgery, recent history of trauma on the affected side, and shoulder pathologies other than adhesive capsulitis were excluded from the study. The study was conducted from June 2022 to November 2022.

**Inclusion criteria**:

- Age group 45 to 65 years
- Both gender male and female
- Freezing stage of adhesive capsulitis
- Unilateral adhesive capsulitis

**Exclusion criteria:**

- Osteomyelitis
- Recent history of shoulder surgery
- Malignancy
- Metabolic bone disease
- Skin allergy

## Outcome Measures

The study used NPRS ( numerical pain rating scale and (ROM) Range of motion. NPRS measures pain severity and ROM measures shoulder movement. These measures guide treatment regimens for adhesive capsulitis.

## Procedure

This quasi-experimental study was conducted at the Physiotherapy Outpatient Department of Saveetha Medical College and Hospital (SIMATS). Fifteen subjects with unilateral adhesive capsulitis were selected based on the inclusion and exclusion criteria, and their consent forms were obtained prior to the study. The study aimed to assess the effectiveness of Scapular Proprioceptive Neuromuscular Facilitation (PNF) mobilization combined with Glenohumeral Maitland mobilization as an intervention. Before the intervention, baseline assessments of the Numerical Pain Rating Scale (NPRS) score and the range of motion (ROM) of the affected shoulder joint were recorded for all participants. The intervention consisted of Scapular PNF mobilization with Glenohumeral Maitland mobilization, which was administered four times a week for four weeks. After completing the four-week intervention, post-test measurements of the affected shoulder's ROM and NPRS score were collected and analysed. The paired t-test was utilized to compare the mean differences between the pre and post-test values of both the ROM and NPRS score.

## DATA ANALYSIS

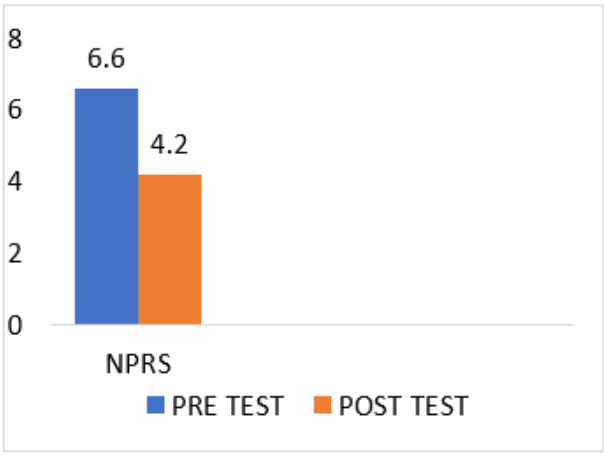



**Fig 1: NPRS paired T - Test**

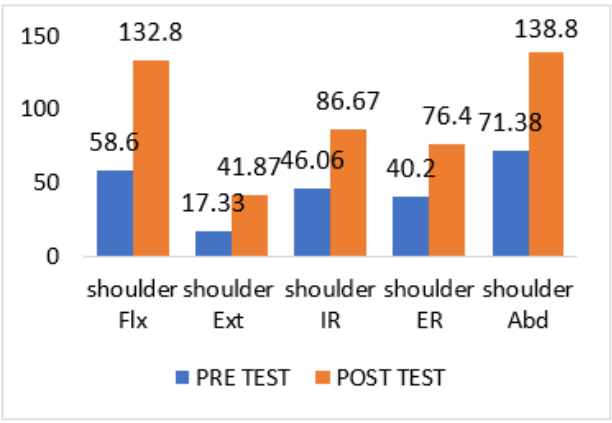



**Fig 2: ROM paired T - Test**

## Result

The study presents fifteen participant. A single numerical pain rating scale (NPRS) and range of motion (ROM) were assigned at random to 15 individuals. A statically significant difference between pre and post was found after statistical examination of the qualitative data. The post-test was significantly more than the pre-test, with a p value of 0.0001 for the post-test numerical pain rating scale (NPRS) mean value of 6.60 and pre-test values of 4.20.

The post-test mean values on shoulder flexion, extension, abduction, internal rotation, and external rotation were 132.80, 41.87, 138.73, 86.67, and 76.40, respectively, while the pre-test mean values were 58.60, 17.33, 71.35, 46.0, and 40.20. This indicates that the post-test values were significantly higher than the pre-test values.

## Discussion

This study evaluated the significance of combination of PNF and Maitland mobilization of shoulder joint causing the reduction of pain and increase in range of motion.in patients having adhesive capsulitis and scapular dyskinesis. Shimora and Kasai found a reduction in response time and improvement in range of motion due to increase in excitability. When Do Moon (2015) et al. compared the Maitland and Kaltenborn mobilization techniques, they discovered significant differences in pain and the range of motion of both internal and external shoulder rotation before and after the interventions, but not when the groups were compared for outcome measures [18].

AnnemeVan de Velde et al (2011 Mar-Apr) [19]. The treatment were 12-week scapular training regimen significantly increased the isokinetic scapular muscle strength in healthy adolescent swimmers, and Merolla et al. reported that volleyball players with scapular dyskinesis experienced an increase in glenohumeral external rotator strength following a 6-month training regimen.

Merolla et al , found an increase in strength of glenohumeral external rotators with a 6 months training program in volleyball players having scapular dyskinesis Scapular external rotators plays an important role in overhead activities. Hence these studies has shown that there is a significant increase in functional outcome, strength and patient satisfaction with incorporation of scapular approach.[16,17]

In contrast to other research, which have used PNF scapular mobilization and Maitland Glenohumeral Mobilization separately to treat adhesive capsulitis, the two therapies were combined in this study, and the results were also positive.

## Conclusion

The study aimed to determine whether Scapular PNF mobilization combined with Glenohumeral Maitland mobilization could be an effective treatment for individuals suffering from unilateral adhesive capsulitis. The findings from this study may contribute valuable insights into non-invasive physiotherapy interventions for adhesive capsulitis and could guide future treatment approaches for

improving patients' shoulder joint mobility and reducing pain. However, given the study's quasi-experimental design and limited sample size, further research with larger and more diverse populations is warranted to validate and generalize the results.

**Ethical clearance:** Approved by Institutional Scientific Review Board

**Funding:** Self

**Conflict of Interest:** Nil

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# Effectiveness of Postural Correction Versus Soft Tissue Techniques Along with Neural Mobilization in Management of Pain and Disability Associated with Cervicogenic Headache: A Comparative Study

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**Abstract**

**Background:** This study was developed to compare the effect of soft tissue technique with neural mobilization and postural correction with neural mobilization on pain and disability among patients with cervicogenic headache.

**Purpose:** The purpose of the study was to control the pain and impairment related to cervicogenic headache (CGH), this study compares the effectiveness of two interventions: postural correction and soft tissue techniques combined with neural mobilization.

**Materials and Methods:** A sum of 30 participants were recruited, based on the selection criteria from the above-mentioned study setting. The procedure was explained, and a written grant was collected from all patients before the initiation of the procedure. The subjects were allocated randomly into 2 groups. The intervention group was given the postural correction exercise along with the neural mobilization and another group was given soft tissue technique along with neural mobilization.

**Results:** The study found that there is a positive impact of postural correction along with neural mobilization on pain reduction and absence of ability that has been connected with cervicogenic headache with a significant value of < 0.0001.

**Conclusion:** The study concluded that Postural correction exercises along with neural mobilization were effective in reducing the individual's discomfort, enhancing the cervical range of motion, and reducing the level of impairment. However, the Headache Impact Test-6 (HIT-6) and Northwick Park Neck Pain Questionnaire (NPAQ) outcome measures for both groups indicated a substantial change in the post-treatment analyses; GROUP A, which received postural correction along with neural mobilization, had more significant changes than the soft tissue technique along with neural mobilization (GROUP B).

**Keywords:** Cervicogenic headache (CGH), Neural mobilization technique, Postural modification, soft tissue technique

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## Introduction

Headache is the most common type of pain, affecting 66% of the world's population[1]. As a result, it is a severe health issue that affects both quality of life and work productivity [2,3]. A disease occurring in the cervical spine, including bone, disc, soft tissue, can result in a secondary headache known as a cervicogenic headache (CGH). According to World Cervicogenic Headache Society, Cervicogenic headache (CGH) is a pain with a characteristic of referred pain, occurring in part of the head brought on by an initial nociceptive signal in muscle which is supplied by the cervical nerves[4]. Cervicogenic headache is estimated to frequent 0.4% to 2.5% of the general population, however it can affect up to 20% of people with chronic headaches[5]. Cervicogenic headache is a type of headache that affects the cervical and cranial regions and is caused by abnormalities in the cervical spine soft tissues[6]. The upper cervical ligaments, C1-C3 intervertebral discs, suboccipital muscles, C1-C2 nerve roots, ligaments of upper cervical segment, and synovial type of joints are all components that are attributing the pain in cervical areas. The sub occipital nerves may also be the cause of headaches in the occiput region since they send nerve branches to the atlanto-occipital joint, as opposed to the muscles of the cervical region, which can produce referred pain to the face and head [7]. Fifteen to twenty percent of all long term and recurring headaches are caused by it. With a restricted cervical range of motion, the pain is common in the temporal lobe area and may relate to the frontal, occipital and the region of orbital lobe[8]. Cervicogenic headaches can occasionally cause considerable radiation to the shoulders, neck, or skull. The pain is usually neuropathic or mechanical in origin, and it is correlated with certain body motions and postures as well as a limited ROM in the neck[9].

CGH can be caused by a number of different anatomic features in the cervical spine. The upper 3 spinal nerves of the cervical segment and the trigeminal nerve meeting onto second order neurons in the upper cervical spinal cords trigemino-cervical nucleus is what causes the headache. The craniovertebral connection is maintained by capsules of joint, transverse ligaments, alar ligaments and tectorial membrane[10]. The deep flexor muscles play an important function in stabilizing the cervical segments. The increased cervical lordosis is due to the weakening of the muscle. When a headache originates in the neck, prolonged posture may be an aggravating factor. The purpose of the cervical slump test is to detect aberrant neural dynamics in headache sufferers who can benefit from neural mobilization, as described for cervicogenic headache (Jull, 2002). For these patients, postural adjustment is deemed vital in their daily activities[11].

The symptoms such as headache, stiffness around neck is made worse by the neck's uncomfortable positioning, any excess pressure placed on the problematic side's upper cervical spine or occiput, and neck movement. Thus, Postural correction is chosen as an effective intervention tool in reducing the pain and disability that is caused by Cervicogenic headache. One component that has been proposed to aggravate or cause CGH is cervical dysfunction caused by improper posture. In migraine and tension-type headaches, the suggested connection between abnormal cervical position and headache has been demonstrated, although there are mixed results in CGH[12]. Cervical joint dysfunction is one of the causes of CGH and persistent headache is a common symptom after structural changes in the cervical spine[13]. Correcting head and neck posture involves strengthening, the upper trapezius, stretching the pectoralis major deep layer of flexors of the cervical spine and pectoralis minor, and the scalene. This treatment's objective was to lessen the intensity and frequency of headaches.

A form of manual physical therapy that involves hands-on techniques is called soft tissue mobilization. Stretching and deep pressure are used in soft tissue mobilization (STM) to loosen up tight muscles, reduce muscle tension and move fluids that are entrapped in the tissues, causing discomfort and inflammation. Soft tissue injuries, such as muscle strains and sprains, are treated using STM[14].

The interconnections between the mechanics and physiology of the neuronal system are included in neural mobilization. The nervous system must adjust while performing movements and integrating other actions. Neural mobilization includes mechanical events such as sliding, elongation, and compression, angulation and cross-sectional changes as well as

functional events such as axoplasm flow and intra-neural blood flow. When these processes fail or become more active, it might lead to negative neuro dynamics. Restoring the functional balance between the neural tissue's relative movement and adjacent mechanical interfaces is the primary theoretical goal of neural mobilization as the intervention of adverse neural dynamics, which brings down the pressure created on the neural tissue and helping in optimal physiology[15]. The nervous system is susceptible to neural edema, ischemia, fibrosis, and hypoxia if these dynamic protective systems have been compromised, which may result in altered neurodynamics [16].

## AIM

To compare the effect of soft tissue technique with neural mobilization and postural correction with neural mobilization on pain and disability among patients with cervicogenic headache.

## Materials and Methods

A pre-test and post-test experimental study was conducted in order to compare the efficacy of soft tissue technique with neural mobilization and postural correction with neural mobilization on pain and disability among patients with cervicogenic headache. Participants were selected from Private medical college and hospital, Thandalam according to the selection criteria in convenient sampling method. Study procedure was explained to all the subjects and informed consent was obtained from all individuals included in this study. The collection of data began in January 2023, and treatment sessions began in February 2023 for four weeks.

**Inclusion criteria**:

- Total of 30 participants of both genders, aged between 18years to 45years with cervicogenic headache,
- Unilateral or side-dominant headache without side shift,
- Headache causing neck stiffness or pain, Restricted cervical range of motion, Cervical slump test positive,
- Subject who scores less than 49 in Headache impact test (HIT- 6),
- Subjects who score less than 40% in NPQ are taken in for the study.

**Exclusion criteria:**

- Participants with Migraine,
- Hemi-cranial continua,
- Chronic tension type headache,
- Cluster headache, Headache following trauma/injury in the neck/head, Headache following vascular disorder in cranial/ cervical region are excluded.

**Outcome Measure:** The Headache Impact Test-6 (HIT-6) was created to analyze a variety of components that affect headache burden, and it has been useful in providing quantitative and useful data on the impact of headache. Pain, social function, role function vitality, cognitive function, and psychological distress are the six components of the HIT-6.

The Northwick Park Neck Pain Questionnaire (NPQ) analyses patient impairments as a result of neck pain. It helps to analyze the outcome and track symptoms over time in populations with short-term or long-term neck pain and is simple to complete and score. The questionnaire is separated into nine sections, 1) neck pain intensity, 2) neck pain and sleeping, 3) pins and needles or numbness in the arms at night, 4) duration of symptoms, and 5) carrying, 6) reading and watching television 7) working and /or housework 8) social activities and 9) driving.

## Procedure

Based on the selection criteria, a total of 30 individuals were chosen. Before beginning the procedure, all volunteers gave written informed consent after being explained about the study. The subjects involved in the study were allocated randomly into two groups as A and B. Both the groups underwent a treatment session of about 30 minutes, 3 days a week for four weeks. Group A received postural correction exercises along with the neural mobilization. In which postural correction is applied for about 15 minutes and neural mobilization is applied for about 15 minutes. The neural mobilization techniques involve Neural sliders, neural tensioners and the exercise regimen includes, Training the holding capacity of deep neck flexors, retraining cervical spine extension, Extensors of cervical spine, Co- ordination of neck flexors and neck

extensors, Retraining Scapular orientation in posture, Training scapular stabilizers, Postural re-education. Group B received soft tissue techniques including kneading, pulling, transverse strumming and skin rolling for 15 minutes, starting with skin rolling for 2 minutes followed by pulling for 2 minutes and then the transverse strumming and kneading is applied as each for 2 minutes in grade 1 initially. Then the grade was increased with patient tolerance and the technique was repeated again along with neural mobilization. Soft tissue techniques were applied to temporal muscle, sternocleidomastoid muscle, masseter muscle, suboccipital muscle and upper trapezius muscle. The pretest measures of cervical slump test, Northwick Park neck pain questionnaire, Headache Impact Test [HIT-6] were assessed and the same was assessed and recorded after 4 weeks of training as post-test values.

## Data Analysis

Statistical analysis was done with an intention to treat the cervicogenic headache by correcting the posture and applying soft tissue technique for the reduction of pain and disability. Pre and post-test values for HIT-6 and NPAQ were noted. Paired t-test was used for within group analysis, and Unpaired t-test was used for across group analysis.

**Table 1: Pre and Posttest Mean and SD of Group A (Postural correction and neural mobilization) and Group B (Soft tissue technique and neural mobilization) obtained using HIT-6.**

| Group | Parametric | Mean | SD | t value | p value |
|---|---|---|---|---|---|
| Group A | Pre-test | 68.67 | 5.07 | 24.422 | 0.0001 |
| | Post-test | 42.67 | 3.18 | | |
| Group B | Pre-test | 67.6 | 5.70 | 14.471 | < 0.0001 |
| | Post-test | 48.6 | 4.45 | | |

**Table 2: Pre and Posttest Mean of Group A (Postural correction and neural mobilization) and Group B (Soft tissue technique and neural mobilization) obtained using (NPAQ)**

| Outcome | Group | Parametric | Mean |
|---|---|---|---|
| NPAQ | Group A | Pre-test | 81.4 |
| | | Post-test | 41.2 |
| | Group B | Pre-test | 80.466 |
| | | Post-test | 48.26 |

**Table 3: Post-test mean and SD of group a vs b (postural correction and neural mobilization vs soft tissue technique and neural mobilization) obtained using HIT-6 and post-test mean and sd of group A vs B (postural correction and neural mobilization vs soft tissue technique and neural mobilization) obtained using NPAQ.**

| Group | Parametric | Mean | SD | t value | p value |
|---|---|---|---|---|---|
| Group A | Pre-test | 42.67 | 3.18 | 4.2008 | = 0.0002 |
| | Post-test | 48.60 | 4.45 | | |
| Group B | Pre-test | 41.20 | 10.02 | 2.124 | = 0.0426 |
| | Post-test | 48.27 | 8.09 | | |

## Results

The study revealed that postural correction along with mobilization of neural structures showed a significant change in reducing pain and disability, associated with cervicogenic headache with the significant p value of < 0.0001 by analysis through paired t test (Table 1 and 2). Group B, received soft tissue technique and neural mobilization also showed a considerable change in reduction of pain and disability in patients with cervicogenic headache,

analyzed using HIT-6 and NPAQ, which was analyzed using paired t-tests (TABLE 1 and 2). On comparing both group A and B, the group (GROUP A) which received postural correction and neural mobilization, showed a greater improvement than the group received soft tissue technique and neural mobilization (GROUP B), which was statistically revealed by analysis of un-paired t-test with the level of significance (Table 3).

## Discussion

The study aimed to show the effectiveness of soft tissue technique, posture correction, and neural mobilization in treating cervicogenic headaches. Postural correction plays an important role in reducing the impact of cervicogenic headaches by strengthening the neck muscles and rectifying the forward-head posture. The characteristics and effect of postural correction on headaches have been studied by Mary Kate McDonnell (2005), who took the effort to analyze the effect of posture correction combined with an exercise regimen. The author found that the modification of cervical, scapulothoracic, and lumbar region alignment had a significant positive impact on CGH[17]. In view of this finding, we decided to train the deep neck extensors and flexors, coordinate the extensors and flexors, retrain the scapular orientation, and train the scapular stabilizer in order to give postural correction for the neck.

In addition to postural correction, soft tissue techniques were also said to have a beneficial effect on CGH. Diana Hopper et al. (2013) conducted a pilot study to find the acute effects of soft tissue techniques on the involvement of upper cervical segments in CGH. Eight subjects were provided with soft tissue technique to bilateral cervical muscles and ended with a conclusion stating that soft tissue technique enhances the ROM of the upper cervical segment in the short term as measured by the flexion-rotation test[18]. With the consideration of the result obtained from this study, we made an attempt to include soft tissue technique as an intervention tool to the participants recruited in our study. By combining the scientific evidence that has been provided in the study in the aforementioned studies. We emerged with the idea of comparing the effects obtained from postural correction and soft tissue technique in reducing the pain and disability associated with CGH. In 2020, Jayabalan Prakash et al. did an experiment with 30 subjects on the effectiveness of neural mobilization along with postural correction in CGH. The authors stated that the combination of these two interventions had a positive effect on CGH by reducing pain and increasing the cranio-vertebral angle. Studies have linked the diminished neck muscular endurance with the forward neck position, which may put inappropriate physiological stresses on the cervical spine[19]. Similarly, Alejandro Ferragut Garcas et al. (2016) combined soft tissue technique with neural mobilization in the treatment of tension-type headaches. This study concluded that the frequency of tension-type headaches was controlled in patients involved in the group that received a combination of both interventions, compared with the group receiving only one intervention[14]. Also in 2016, Jaspreet et al. studied the effect of neural mobilization and awareness of the correction of posture in CGH. The study revealed that in the treatment of CGH, neural mobilization was effective[20].

So, we made the neural mobilization technique a common intervention for both groups to reduce the risk of bias. With the conclusion of all the above-mentioned studies, we designed a protocol involving soft tissue technique along with neural mobilization and postural correction along with neural mobilization for the patients with CGH to reduce pain and disability. The results of this study concluded that postural correction in combination with neural mobilization is effective in reducing pain and disability in patients with CGH. The patients who had headaches from head or neck injuries were not included in the recruitment of participants, which was the best way to enhance the sample size as these people account for around 50% of CGH. Blinding of the therapist, provided therapy was not done. Future research might try to concentrate on the long-term impact of these therapies, as this study only did a four-week follow-up.

## Conclusion

The present study concluded that postural correction exercise along with neural mobilization were effective in reducing the individual's discomfort, enhancing the cervical range of motion,

and reducing the level of impairment. However, the Headache Impact Test-6 (HIT-6) and Northwick Park Neck Pain Questionnaire (NPAQ) outcome measures for both groups indicated a substantial change in the post-treatment analyses; GROUP A, which received postural correction along with neural mobilization, had more significant changes than the soft tissue technique along with neural mobilization (GROUP B).

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 01/016/2022/ISRB/PGSR/SCPT).

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**Conflict of Interest:** Nil

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**Conflict of interest:** Authors state no conflict of interest.

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Case Series

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# Effectiveness of Task Oriented Exercise on Lower Limb in Post Stroke Patient with Lateral Medullary Syndrome: A Case Series

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**Abstract**

**Background:** Stroke has such a significant socioeconomic impact worldwide. Stroke is gaining ground in terms of public awareness, patient and carer knowledge, service improvements, and research.

**Purpose:** The aim of the study is to determine the effectiveness of task-oriented exercise on lower limb in post stroke patients with lateral medullary syndrome.

**Result:** Comparing the outcomes of the FIM and BBS pre- and post-tests, there is a positive change seen in all the 10 participants after giving a task-oriented approach as a treatment. The post-scores ($P<0.05$) of FIM have shown a significant difference in all the participants. The post-scores ($p>0.05$) of BBS also have shown betterment in the balance and reduction of fall risk.

**Keywords:** task-oriented exercises, functional training, stroke rehabilitation and balance training.

## Introduction

Stroke has such a significant socioeconomic impact worldwide. Stroke is gaining ground in terms of media coverage, patient and carer knowledge, service improvements, and research. Millions of stroke victims suffer from persistent neurological abnormalities, primarily motor and psychological, making stroke a major cause of disability. The severity of the stroke, the diseases it was linked with, the patient's age, the amount of time after the stroke, and the start of rehabilitation are the main factors that determine how long-term interventions are needed for poststroke recovery in a multidisciplinary team[1]. When patients are clinically stable and balanced, particularly about cardiorespiratory functions, and finally, when the tasks can be understood and supported by the patients' participation and involvement in the rehabilitation programmed, post-stroke rehabilitation in the subacute phase can begin. It begins in the fifth week following a stroke and lasts for roughly three months[3]. The primary cause of Wallenberg syndrome, also known as lateral medullary syndrome (LMS), is a blockage of the posterior inferior cerebellar artery (PICA), which causes a lateral medullary infarction[7].

Wallenberg gave his early reports in 1901 (autopsy findings) and 1895 (clinical descriptions). An infarct in the intracranial vertebral artery is what

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causes Wallenberg's syndrome; occasionally, PICA obstruction can also induce LMS. This syndrome also results in sensory impairments of the ipsilateral side of the cranial nerve and face, as well as sensory impairment in the contralateral side's limbs and trunk. The crossover phase discovery allows for the diagnosis of the syndrome[8]. The ability for movement requires the integrity of both hemispheres[9].

The validity and reliability of the FIM tool for stroke patients have a long history[10]. Patients who have suffered from strokes experience significant balance issues[11]. Balance deteriorates over time following a stroke; therefore, it is critical to have a quantitative indicator that clinicians may use to monitor these changes and adjust treatment as appropriate. The Berg Balance Scale (BBS) was initially designed to quantitatively assess balance in older individuals. Recent studies of physical therapists working in stroke rehabilitation revealed that the BBS was the most often used diagnostic tool across the continuum from acute care to community-based care. Understanding the BBS's significance in population analysis is essential given how frequently it is used after a stroke[12].

## Aim

The aim of the study is to determine the effectiveness of task-oriented exercise on lower limb function in post stroke patients with lateral medullary syndrome.

## Methodology

It was a descriptive study conducted on 10 subjects with lateral medullary syndrome along with lower limb weakness. Samples were selected from the outpatient department of Saveetha Medical College Hospital, Thandalam, Chennai, according to the inclusion and exclusion criteria. Total study duration was about 5 months (June 2022 – October 2022).

**Inclusion Criteria:**

- Both genders are included
- Participants were aged between 50 - 70 years.
- Unilateral or bilateral affected lower limbs in stroke
- Subject with FIM (48 to 60) were included
- Subject with BBS (30 to 41) were included
- MRI findings impression on mainly (posterior inferior cerebral artery, vestibular artery)

**Exclusion Criteria:**

- Patient is on DVT protocol
- Subjects with lower limb fracture
- Other neurological disease
- Previous physiological disorders
- Psychological problems.

## Study Procedure

Participants were selected from Saveetha Medical College and Hospital based on inclusion and exclusion standards. Complete information about the study procedure was explained to the participants and an informed consent sheet was signed by all the participants before starting the study procedure. The sample collection is done by convenient sampling. The sample size was 10. Both genders are included Participants were aged between 50 years to 70 years. Unilateral or bilateral affected lower limbs in stroke MRI findings impression on mainly (posterior inferior cerebral Artery, vestibular artery). The FIM instrument is used for assessing patient function at the beginning and end of a beneficial episode for rehabilitation. The motor and cognition subscale scores stated together determine that the FIM instrument's total score will range from 18 to 126. The BBS is a 14-item scale that uses direct performance observation to assess the risk of falling and balance function in older and balance-impaired people.

All the participants of the group received 30 minutes of therapy. There were six sessions in a week, Group of 10 patients received task-oriented exercises. Task oriented training includes, and that relates to his/her ADL activity, such as: walking, Treadmill walking, Ground exercises, Lower limb training with practical activities like reaching objects, constraint-induced (movement)therapy, and mental imagery are also used. Other methods include cycling events, aerobic training, sit-to-stand exercises, and reach tasks for balance improvement. And it was given to the patient for 8 weeks. Six workstations were made for the participants to perform tasks: 1. Reaching for objects in different directions that are out of reach in standing position, which improves in

load-shifting ability and to activate the muscles of lower limb; 2. Stepping up sideways/laterally onto blocks of different heights; 3. Sitting to standing up movements using different chair heights, this focus on strengthening the extensor muscles of leg; 4. Stepping up backward and forward onto blocks of varied sizes; 5. forward step-up and step-down onto a block; and 6. elevating and lowering the heel(s) in standing position (calf raise exercise), this is mainly to strength train the gastrocnemius muscle which is the prime muscle for standing. A statistical test used to obtain the result is Wilcoxon signed rank test with the median value.

### Data Analysis:

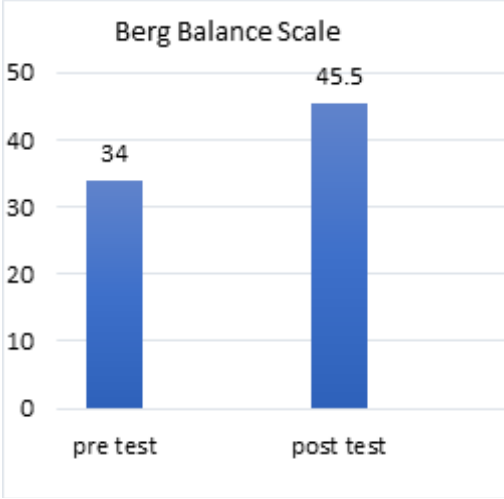



**Fig 1: Pre and Post intervention Mean values of Berg Balance Scale**

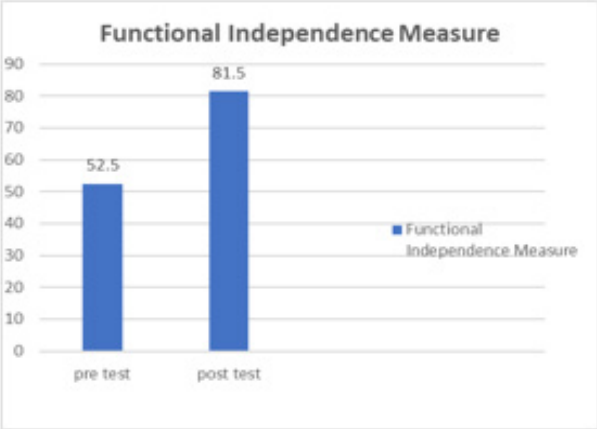



**Fig 2: Pre and Post intervention Mean values of Functional Independence Measure**

## Results

Comparing the outcomes of the FIM and BBS pre- and post-tests, there is a positive change seen in all the 10 participants after giving a task-oriented approach as a treatment. The post-scores ($P<0.05$) of FIM have shown a significant difference in all the participants. The post-scores ($p>0.05$) of BBS also have shown betterment in the balance and reduction of fall risk. The Z-value of FIM and BBS is a 2.807 and 2.818 denoting the standard deviation of the values. The mean difference of BBS (Fig 1) and FIM (Fig 2) is 11.5 and 29 which gives a statistical proof for the significant difference in their balance function and functional independence after the intervention.

## Discussion

The activities were also customized to the progress of each participant. Furthermore, this group carried out lower-extremity strength training according to the Carr and Shepherd guidelines for stroke survivors [13]. For eight weeks, five times a week over 30 minutes, the experimental group's participants engaged in task-oriented training. Subjects completed practice at a succession of workstations in the training program, which was intended as a circuit class. The workstations were created with the goal of effectively strengthening the lower limbs' bilateral muscles.

Six workstations were made for the participants to perform tasks: 1. Reaching for objects in different directions that are out of reach in standing position, which improves in load-shifting ability and to activate the muscles of lower limb; 2. Stepping up sideways/ laterally onto blocks of different heights; 3. Sitting to standing up movements using different chair heights, this focus on strengthening the extensor muscles of leg; 4. Stepping up backward and forward onto blocks of varied sizes; 5. forward step-up and step-down onto a block; and 6. elevating and lowering the heel(s) in standing position (calf raise exercise), this is mainly to strength train the gastrocnemius muscle which is the prime muscle for standing. Each participant is given 5 min to complete a workstation. Each participant is given one-to- one therapy i.e., treatment is conducted only between participant and therapist.

Chenkin J, Day GS, Shamji AI, Frost DW and Swartz RH offered a case study and review of the

literature. The identification of lateral medullary syndrome symptoms and indicators is essential for patient care. Affected people should get rapid neuroimaging to be able to rule out other acute stroke diagnoses and therapies that are illegal. Neurovascular imaging must be continuously performed to rule out vascular pathology. The prognosis for lateral medullary syndrome was favorable in comparison to other posterior circulation strokes, which was stated in a pilot study Conducted by Fernandes B, Batista F, Ferreira MJ, Evangelista I. An effective physiotherapy technique for the management of post-stroke postural dysfunctions is better in the combination of task-oriented training and strength training of affected lower limb. The two strategies complement one another since repetition of the activity necessitates some type of strength training, and strength training should be programmed according to the task human beings use in everyday life.

An Experienced and qualified physical therapist was in-charge of supervising each session and making sure that the functional level of each participant was considered when calculating intensity and time duration of exercise at every station. Subjects were instructed to give their full effort and perform as hard as possible while also hearing verbal commands, advice and corrections intended to boost their performance. The complexity of the exercise done at each workstation was also increased, including the distance walked while standing, the height of the chair when performing getting up exercises, and the size of the blocks. The number of repetitions able to perform in five minutes was also increased as a progression[14].

## Conclusion

Task oriented approach seems to improve lower limb function after stroke. Progressive repetitive training of task-oriented exercise programs also benefits and enhances the functional recovery of patients with lateral medullary syndrome after stroke.

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**Conflict of interest:** Nil

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Original Article

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# The Efficacy of Low-Level Laser Therapy and Low Intensity Pulsed Ultrasound on Functional Recovery among Experimentally Induced Peripheral Nerve Injury in Wistar Rats

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**Abstract**

**Background:** A variety of etiological factors that lead to peripheral nerve injury include crushing, traction, long fractures in bones, cutting injuries, entrapment neuropathies, infection, inflammation, and tumours of varying degrees. LIPUS has a variety of biological effects on tissues, including speeding up the regeneration of soft tissues, and lowering inflammatory reactions. In LLLT, low-level laser light with a wavelength of 808 nm is employed to trigger a biological reaction.

**Purpose:** The objective of this study was to evaluate the functional recovery of low-level laser therapy (LLLT) and low-intensity pulsed ultrasound (LIPUS) treating the sciatic nerve in rats.

**Methods:** Using simple random sampling method and the inclusion and exclusion criteria, 18 rats in total were chosen. A mechanical crush will be performed for 30 seconds using haemostatic forceps. The study's rats were divided into 3 groups at random: Group A received ultrasound for 21 days; Group B received laser for 21 days; and Group C received no treatment. The toe spread assay was used to assess functional recovery 3 weeks after surgery. **Result:** All three groups are statistically significant ($p<0.005$) when analysed using one-way ANOVA during intervention period ($7^{th}$, $24^{th}$, $21^{st}$ day) but LLLT & UST has shown better improvement in their functional index than the control group.

**Conclusion:** According to the study's findings, LLLT significantly outperforms LIPUS in improving the functional recovery of an experimentally induced rat model.

**Keywords:** animal study, physiotherapy intervention, nerve regeneration, functional recovery and sciatic nerve injury.

## Introduction

Common peripheral nerve injuries frequently prevent peripheral nerve axons from regenerating considerably, and only around 10% of patients are able to fully recover their function.[1] The reason for the poor functional results is typically attributed to

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the sluggish axon regeneration process.[2] The severity of this problem was brought home by a research done in the US, which found that 50,000 or so people experience severe peripheral nerve injuries annually, making it a major public health issue.[3] Axonotmesis, neurotmesis, and neuropraxia were the three primary forms of nerve injuries discovered by a recent analysis in Brazil that looked at 456 cases of nerve damage.[4] Wallerian degeneration manifests in the distal stump when nerve fibre continuity is broken.

Since nerve innervation is essential to the structure and appropriate operation of muscles, peripheral nerve injury has a significant impact on skeletal muscle.[5] Therefore, enhancing axon regeneration is a viable strategy for treating peripheral nerve injury. After such injuries, a number of rehabilitation strategies have been proposed to aid functional recovery. For instance, a herniated disc might directly compress and irritate the spinal canal's nerve roots. Pain, numbness, tingling, and muscle weakness can all be symptoms of nerve compression and irritation. Despite the fact that recovery is mostly effective, it frequently occurs slowly and insufficiently, which leaves the patient in despair and results in large expenses for the community as a whole.[6]

A damaged peripheral nerve can lead to functional limitations or a lack of sensation in the afflicted location. Glial cells, also known as Schwann cells, play a crucial role in the regeneration of peripheral nerves. They are a part of the peripheral nervous system and are in charge of assisting and directing nerve regeneration. It might discuss topics like how neurotrophic factors are secreted by Schwann cells, how they affect nerve cell survival and proliferation, and how they affect the entire process of nerve healing.

Wistar rats were used in this investigation because they are simple to handle, are reasonably priced, and have human-like anatomy, physiology, and peripheral nerve regeneration. This therapeutic technique, called low-level laser therapy (LLLT), has mostly been utilized to promote regeneration and speed up the functional recovery of peripheral nerves. Crush, compression, stretching, avulsion, and division are the most frequent causes of peripheral nerve harm. Despite the use of advanced and contemporary techniques for treatment and reconstruction, morphologic and functional regeneration is rarely fully achieved because of the influence of variables like the type and degree of damage, the length of denervation, the type and diameter of the damaged nerve fibres, age, and other specific variables.

Even while some degree of healing is possible, it frequently happens slowly and insufficiently, leaving the patient feeling hopeless and placing a heavy financial burden on the community as a whole.[7] The severity or extent of a peripheral nerve damage has a significant impact on the recovery process.[8] Even with microsurgical restoration, functional recovery following peripheral nerve damage is typically inadequate, especially in cases when significant nerve trunks are injured. Low-Level Laser Therapy (LLLT) induces a photochemical reaction in cells known as "biostimulation" or "photobiomodulation."

Peripheral neuropathies have so far not been successfully treated with medication, including several neurotrophic drugs.[9] Even with improvements in surgical and medical procedures, peripheral nerve injury frequently does not completely recover. The poor reinnervation of motor and sensory target areas is one of the major obstacles to obtaining maximum recovery.[10] In order to address this; novel treatment approaches that can quicken and improve the healing process can show therapeutic promise. In this study, the effectiveness of laser therapy and ultrasound in hastening functional recovery in rats with right sciatic nerve injury is being evaluated.

## Aim

The aim of this study is to evaluate and compare the efficacy of low-level laser therapy and low-intensity pulsed ultrasound in promoting functional recovery in rats with peripheral nerve injury.

## Materials and Methods

This study was conducted from July 2022 to November 2022. It was an experimental study conducted on 18 male adult Wistar rats with experimentally induced peripheral nerve injury, aged 3 months and weighing 150-300g, was chosen for the study. They were kept in cages with one other animal apiece, fed on pellets, and given water. After being weighed, the rats were divided into three groups of

six at random. Every animal underwent the exact identical surgical treatment. Groups 1 and 2 received ultrasound and laser treatment, whereas Group 3 received a control group.

**Inclusion criteria**

Wistar rats between the ages of 6 months (0.5) and 48 months (4.0) were included.

Only male wistar rats were included.

Rats that are physically active were included.

**Exclusion Criteria**

Rats with physical abnormalities and skin issues are excluded.

Rats that exhibit psychological distress or aggression are prohibited.

**Outcome measure**

Assessment was performed at baseline preoperative, 7th, 14th, and 21st postoperative days. Toe Spread Assay was used as an outcome measure.

**Procedure**

All 18 animals were given intramuscular and intraperitoneal injections of 5% ketamine hydrochloride (70 mg/kg body weight) and 2% xylazine hydrochloride (10 mg/kg body weight) in a 1:4 ratio to induce anaesthesia. Meloxicam was administered subcutaneously in a dose of 1 mg/kg to treat the pain. By carefully dissecting between the gluteus maximus and quadriceps muscles, a 3 cm long postero-lateral longitudinal thigh incision was made, exposing the right sciatic nerve. The skin hair was shaved to make the sciatic nerve area visible, and 54 N of crush injury was then caused for 30 seconds using hemostatic forceps.

**Ultrasound group (Group 1)**

In this investigation, the crush site was the only target for the pulsed-wave ultrasound, which covered a range of frequencies, durations, and spatial peaks with time-averaged intensities. With a finger probe and a pulsed intensity of 0.4 W/cm2 in a 1:1 ratio, the ultrasound used had a frequency of 1 MHz and was applied transcutaneously. The treatment area over the crush injury site was treated for 4 minutes. The transducer was placed around 2 to 3 cm distant from the sutured area over the glove water bed in order to enable effective transmission of ultrasound into the animal's lower extremities. The treatment focused on the site of the crush injury and started on the second post - operative day (postoperative day 2). It lasted for 21 days in total. On days 7, 14, and 21 following surgery, the toe spread assay was carried out and compared to the pre-injury assessment to gauge functional recovery.

**Laser group (Group 2)**

For low-level laser irradiation in this study, a portable Aluminium Gallium Arsenide Laser Diode was employed. The laser met the following requirements: an energy density of 3 J/cm2, an area length, width, and tissue depth of 1 cm, a wavelength of 808 nm (infrared light), a power of 200 mW, and continuous mode. Each session's exposure period was set to 60 seconds. Patients in the experimental group 2 had laser irradiation with a focus on the nerve damage location that had been surgically identified. The contact point approach was used to apply a laser pen at a 90-degree angle to the skin during the first 21 days following surgery. According to Monte-Raso, this method proved quantitative, trustworthy, and reproducible in rat sciatic nerve operating settings.

**Control group (Group 3)**

Control group also underwent the same surgical procedure and no treatment was provided to the animals in the control group.

**Assessment of nerve functional recovery**
**Toe spread assay**

On the seventh, fourteenth, and twenty-first days after the right sciatic nerve lesion, the toe spread measurement was performed to gauge the degree of functional recovery. Both the experimental and control animals had water-soluble black ink painted on their hind limbs, and they were both free to travel on a white paper track, leaving their prints in their behind. At first, the measurement, application of the ultrasound, and toe spread assay were all completed on the same day. Since the study was coded by animal number without mentioning the groups they belonged to, one of the authors measured the walking track using an objective manner to ensure impartial evaluation. The distance between the first and fifth

toes was used to determine the toe spread index for each experimental group, and the results were compared to those of the laser and control groups. ANOVA analyses were performed on the toe spread assay with a 5% (p0.05) between-groups significant criterion.



**Figure 1: An example of the toe spread index used to assess recovery.**

## Results

The surgical procedure and the laser, ultrasound application was well tolerated by all rats, and no animal died during the experiment. The study was conducted with a total of 18 footprint images in the different periods, preoperative, 7th, 14th, and 21st postoperative days. They were evaluated by the toe spread assay. These values are then analysed for their normality using Shapiro- wilk test and equal variance using brown-forsyth test. All the three groups passed the test. This indicates that all three groups have a similar baseline index and there is no potential bias among allocated subjects.

Toe spread assay value among all the three groups were found statistically significant comparing its pre-OP and 21st day value. The mean difference of group A is 8.95, group B is 5.81 and group C is 12.86. This shows that the LLLT group is very close to normal value showing significant difference than the other two groups. Tukey HSD test between all three groups proved that toe spread assay measure is statistically significant ($p<0.005$) between all three groups, this indicates that even the control group has shown improvement after 21 days of healing period. Hence toe spread assay has been improved in all three groups than its measure on 7th day but LLLT group has shown little more improvement then other two groups.

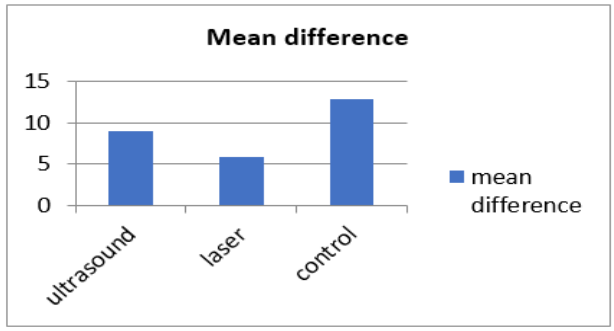



**Fig 1: Representing the mean difference for Toe Spread Assay on Pre-op, day 2, day 14 and day 21.**

## Discussion

Some evidence states that peripheral nerves do in some manner respond to therapy with ultrasound, the results of early trials were not entirely conclusive, especially when it comes to the use of ultrasound in individuals.[11] High-intensity radiation would prevent neuron regeneration, whereas low-intensity therapeutic ultrasound delivered in minute doses would promote it, according to experimental research. This demonstrates that, as was shown in rats, ultrasonic exposure within a relatively narrow intensity range has a dose-related effect that is inversely proportionate. Suganthirababu P et al., states that ulnar nerve radiation to low level laser decreases the latency and increases the amplitude.[13]

The likelihood that therapeutic ultrasound could have a positive impact on nerve regeneration is what drove the current research. Since it is not always possible to compare the outcomes of several evaluation approaches employed by the same author or to draw immediate inferences from them, evaluating peripheral nerves that are going through regeneration can be difficult. Histologic, morphometric, and electrophysiological investigations make up the majority of research on peripheral nerve regeneration; while important, these techniques don't reveal much about the functional recovery itself. Depending on the severity of the nerve injury, injuries to the peripheral nerves result in significant dysfunctions and sometimes have lifetime consequences.[15]

Suganthirababu P et al., suggest that ultrasound therapy has a capacity to either assist or inhibit physiological activity by changing the nerve conduction velocity.[14]

In order to measure the effectiveness and speed of nerve conduction, nerve stimulation experiments include stimulating a nerve and monitoring the electrical impulses that occur. The treated group (getting ultrasound thermotherapy) would be measured and compared to control groups as the authors measured and analysed nerve conduction parameters. The quantitative information and conclusions from the nerve conduction studies would be presented in the study's results section. The differences in nerve conduction parameters seen between the treated group and the control groups are most likely to be discussed by the authors. The importance of the results in relation to nerve regeneration and functional recovery following compression neuropathy will be discussed in the discussion section.

## Conclusion

Based on our samples, data, and techniques, it was possible to conclude that, when compared to LIPUS, LLLT had an advantageous effect on the functional rehabilitation of the right sciatic nerve. In the sciatic nerve damage, the healing process was improved after transcutaneously delivering therapeutic ultrasound and laser to the injury site. However, when compared, laser is more advantageous for nerve regeneration following a severe grade of peripheral nerve injury.

**Ethical clearance:** The Ethics Committee, BRULAC/SDCH/SIMATS/IAEC/01-2023/11, Saveetha University, India, approved the experimental study.

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**Conflict of Interest:** Nil

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Original Article

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# Effect of Sensory Re-Education with Aerobic Training on Sensation and Balance among Diabetic Peripheral Neuropathy Patients: A Pilot Study

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**Abstract**

**Background:** People with diabetes have 10 to 30 times higher risk of lower limb amputation than people without the disease. 85% of non-traumatic amputations in diabetic patients begin with a foot ulcer. Therefore, early intervention is necessary to control the symptoms of diabetic peripheral neuropathy and improve balance. Resistance and aerobic training reduce diabetic symptoms by lowering HbA1C levels. In order to restore functional sensibility, improve adaptive functioning, and improve balance, sensory re-education and aerobics are combined. Therefore, the aim of this study is to find out the effect of Sensory re-education and aerobics on sensation and balance among diabetic peripheral neuropathy patients.

**Purpose:** The Purpose of the study is to determine the effects of sensory re-education with aerobic training on sensory perception and balance in Diabetic peripheral neuropathy patients.

**Material and Method:** This study included diabetic individuals of both genders between the ages of 45-60, low PAR-Q risk scores and Toronto clinical neuropathy scores (TCNS) between 6 and 11. A total of 20 participants were randomly selected and received sensory re-education with aerobics for six weeks.

**Results:** Individuals with diabetic peripheral neuropathy experienced statistically significant improvement in TCNS from 9.3±1.25 to 4.5± 1.3, in BBS 48.5 ± 2.70 to 41.7±1.41, in TUG 8.12±1.28 to 6.95 ±1.30, with a P value of < 0.01.

**Conclusion:** Sensory re-education with aerobic training for 6 weeks of duration reported improvement in sensory perception and balance among people with diabetic peripheral neuropathy patients.

**Keywords:** Diabetes, Sensory loss, Sensory re-education, Aerobic training, Balance.

## Introduction

One of the most common types of neuropathies in the world, diabetic peripheral neuropathy (DPN), is a frequent consequence of diabetes mellitus. The International Diabetes Federation, reported that prevalence of diabetes was 9.3% in 2019 and is expected to reach 10.9% by 2045. Patients with DPN experience a variety of symptoms, but the most frequent ones are numbness, tingling, and pain that

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starts in the toes, bottoms of the feet, ankles, and lower shins[1]. A stocking and glove distribution of pain, paraesthesia, or lack of feeling is a hallmark of diabetic polyneuropathy It arises due to prolonged high blood sugar levels, which damage the nerves in the extremities, particularly the feet and legs. As a result, individuals may be unaware of minor injuries, blisters, or wounds on their feet, making them vulnerable to infections and complications. Sensory impairment, coupled with other factors, has a profound impact on balance and contributes to an increased risk of falls among individuals with DPN. Nearly 50% of persons with diabetes may ultimately develop diabetic peripheral neuropathy, which has been associated with significant morbidity such as discomfort, foot ulceration, and lower limb amputation[2]. Similar effects of sensory impairment are seen in the sense of balance, the capacity to recognize one's body's direction and motion in space. This might cause balance and coordination issues, which would increase the risk of falls and accidents.

Diabetic neuropathies can affect any peripheral nerve segment, from nerve roots to nerve ends, producing various patterns of aberrant sensations. Early in the course of the disease, tiny fiber involvement results in positive sensory sensations like pain, putting patients under the care of a physician[3]. Patients with diabetes who have large diameter fiber involvement have proprioceptive impairments[4]. In DPN, the sensory nerves that provide feedback about joint position and limb movement may be impaired, leading to reduced proprioceptive awareness. This can affect balance and coordination during activities that require weight shifting and precise movements. The fundamental mechanism of balance is compromised when the illness process affects the proprioceptors, which shows itself as delayed postural and righting responses. The diabetic patient's ability to balance is ultimately impaired as a result of these delays. Additionally, balance issues enhance the elderly person's chance of falling[5]. During blood analysis, it was shown that patients with diabetic neuropathy had increased HbA1C values greater than 5.6%. Exercises like resistance training and aerobics have been demonstrated to reduce HbA1C levels, which help to lessen the signs and symptoms of diabetic neuropathy[6]. Aerobic exercises, such as walking, cycling, swimming, and dancing, promote increased blood flow throughout the body, including the peripheral nerves. Improved blood circulation can provide essential nutrients and oxygen to nerve tissues, potentially slowing down nerve damage and promoting nerve repair. Weight-bearing activities can enhance balance and proprioception, even in individuals with sensory impairments.

The risk of falls and associated injuries can be decreased because of this increase in balance. It has been found that exercise increases lower-extremity balance and strength (force-generating ability) and is useful in preventing falls in older people. The BBS is widely used in clinical settings and in research to assess balance in individuals with diabetic peripheral neuropathy. A lower BBS score suggests a higher risk of falls and impaired balance, while a higher score indicates better balance control and reduced fall risk. A shorter TUG time suggests better balance and mobility, while a longer time indicates potential balance impairments and an increased risk of falls. Generally, a TUG time of 12 seconds or less is considered normal, while times above 20 seconds indicate a higher risk of falling. For people with diabetic peripheral neuropathy, combining the Berg Balance Scale and the Timed Up and Go test might yield a more thorough assessment of balance. Sensory retraining exercises, including activities that focus on proprioceptive awareness, can help individuals compensate for sensory deficits and improve balance control. Concentration and exposure to various sensory stimuli are used in sensory retraining to improve sensory awareness[8]. Using TCNS, the intensity of the symptoms and the degree of sensory loss were assessed both before and after therapy. The TCNS includes motor and sensory-motor symptoms as well as sensory and reflex findings in the lower limbs. This scale may be used to diagnose and categorize diabetic polyneuropathy and is a reliable and accurate instrument[9]. Regular monitoring and prompt treatments can greatly increase balance and lower the chance of falling, improving overall quality of life.

## Aim

The Aim of the study is to determine the effects of sensory re-education with aerobic training on sensory perception and balance among Diabetic peripheral neuropathy patients.

## Material and Method

This is a pilot study done with 20 Diabetic peripheral neuropathy subjects aged 45-60 years of both genders, from a private hospital in Chennai, during the period of June 2022 and September 2022. Participants were clearly explained about the study procedure, and informed consent was obtained. Samples were randomly selected and allocated to a single group.

**Inclusion criteria**

- Diagnosed diabetic peripheral neuropathy
- Patients of both genders between the ages of 45 and 60 will be enrolled.
- Diabetes patients who had a Toronto clinical neuropathy score of 6 to 11
- who had low risk in PAR-Q
- Low score in Berg balance scale

**Exclusion criteria**

- Uncontrolled diabetes,
- Unhealed Foot Ulcers or Infections:
- Cardiovascular Conditions
- Cognitive Impairments

**Outcome Measure:**

Assessment was done at initial and at the end of the study using

Toronto clinical neuropathy score (TCNS): The TCNS is a questionnaire with a physical examination component. Each TCNS item receives a value between 0 and 2, with higher ratings denoting more severe conditions. The sum of the scores from each of the individual components yields the final score, which ranges from 0 to 19. The questionnaire evaluates the severity of symptoms, including tingling, numbness, discomfort, and motor weakness, as well as how they affect everyday activities [10,11].

Berg Balance Scale: The BBS was used to assess functional balancing abilities and consisted of 14 tasks related to everyday living. There is a maximum score of 56 and a scale with five points for each item with a range of 0 to 4. In clinical settings, the test is uncomplicated, secure, and easy to use[12].

Timed Up and Go test: When assessing balance, mobility, and fall risk in people with diabetic peripheral neuropathy, the functional examination known as TUG is frequently employed. In order to pass the test, the subject must get out of a chair, walk three meters at a leisurely speed, turn around, and then walk back to the chair and sit down. The amount of time needed to finish the exam is noted[13].

**Procedure**

A Pilot study was conducted at Private hospital in Chennai, and the sample was collected from Neuro IP and physiotherapy OPD. Total Twenty patients with diabetic peripheral neuropathy of both genders, 12 male and 8 female, between the ages of 45-60 years, who scored 6-11 in Toronto clinical Neuropathy score were randomly chosen and assigned to one group based on inclusion and exclusion criteria. Before starting therapy, the subjects are provided with clear and concise written or verbal instructions for therapy procedure. Make sure the patient understands the proper technique and form for each exercise. At the baseline, the TCNS, Berg balance scale, and TUG were used for assessment. The trial lasted for six weeks. Advised the patient to wear comfortable clothing during the sensory re-education sessions that allows free movement and does not restrict their mobility. Suggest appropriate footwear, such as well-fitted, non-slip shoes or socks with grip, to ensure safety during exercises and to avoid slips or falls. Initially, subjects underwent aerobic training, Prior to aerobic exercise, they ensured that the exercise setting is safe and free from obstacles or hazards that may pose a risk during balance exercises or movement activities. Utilize supportive equipment, such as handrails or stable surfaces, to assist the patient during exercises, especially those involving balance training. Subjects were trained with aerobic exercises such as walking, stretching, and stationary cycling. Following sensory re-education, to start the treatment, the subjects were made to sit in a comfortable position, and the treatment area is exposed to give sensory stimulus to the affected region. Sensory re-education techniques such as tapping, fast brushing, quick icing, quick heat, vibration, and position sense were used. The total duration of therapy was 30 sessions, 5 sessions each week for 6 weeks.

**Data Analysis**

Pre-test and post-test values of Toronto clinical neuropathy score, Berg balance scale, and timed up and go test are analyzed using the Wilcoxon signed-rank-test.

## Result

All 20 subjects completed the study successfully. The pre-test and post-test values of TCNS, BBS, and TUG are presented in the following tables 1, 2, and 3. Statistical analysis shows there is a significant improvement from pre-intervention to post-intervention.

**Table 1: Comparison of Pre-test and Post-test values of Toronto clinical neuropathy score**

| Outcome | Pre-test | | Post-test | | P Value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| TCNS | 9.3 | 1.25 | 4.5 | 1.3 | <0.01 |

**Table 2: Comparison of Pre and Post-test values of Berg balance scale**

| Outcome | Pre-test | | Post-test | | P Value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| BSS | 48.5 | 2.70 | 41.7 | 1.41 | <0.01 |

**Table 3: Comparison of Pre and Post-test values of Timed up and go test.**

| Outcome | Pre-test (Sec) | | Post-test (Sec) | | P Value |
|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | |
| TUG | 8.12 | 1.28 | 6.95 | 1.30 | <0.01 |

## Discussion

This pilot study is designed to analyze the outcomes of an integrated intervention involving aerobic exercise and sensory re-education on sensation and balance in individuals with DPN. The study explored the potential benefits of this intervention in improving proprioception, vibration sense, and overall balance control, ultimately reducing fall risk in this vulnerable population. In this study, 20 subjects underwent sensory re-education and aerobic training for a period of 6 weeks to improve their sensory perception in the foot and balance. After the study period, the subjects were re-assessed for the outcomes gained. TCNS is used to evaluate sensory impairment, which encompasses sensory, motor, and reflex findings of upper and lower extremities. Assessing balance in individuals with diabetic peripheral neuropathy (DPN) is crucial to identifying their risk of falls and implementing appropriate interventions to prevent injuries. Two commonly used tests for evaluating balance in this population, the Berg balance scale and the Timed up and go test, were used in this study. The tasks on the Berg Balance Scale include standing up from a seated position, standing unsupported, reaching forward, turning 360 degrees, standing on one leg, and more. These tasks challenged different aspects of balance, including static and dynamic balance, weight shifting, and proprioception, which were assessed in this study. Timed up and go tests are performed to assess a subject's ability to get up from a chair, move three meters at a comfortable rate, turn around, and return to the chair before sitting down. It is noted how long it took to finish the exam. Morioka and Yagi Training in hardness discrimination was conducted on stroke patients undergoing rehabilitation, and the results showed a considerable improvement in postural control[14]. The hard training on discrimination was carried out standing up, which could have affected the outcomes. This is due to the fact that standing for extended periods of time alone has been shown to greatly improve postural control in stroke patients[15]. Patients with diabetic peripheral neuropathy had their sensory perception retrained using the re-education theory. It is thought that sensory rehabilitation is one of the most difficult and protracted functioning processes.

Carey L Enhancing sensory discriminating ability requires sensory retraining for at least 6 weeks after 48 weeks following a stroke. Combining sensory re-education with aerobic exercise can lower blood HBA1C levels and enhance feelings in people with diabetic peripheral neuropathy[16]. The brain's capacity to rearrange itself and adapt to new sensory inputs is known as neuroplasticity, and it may be influenced by both sensory re-education and aerobic exercise. Re-education is included in various ways

in all rehabilitation models. The sensory retraining strategy in the one study was less successful than therapies for stroke previously stated[17]. The repetitive nature of sensory re-education exercises and aerobic training may have induced favorable changes in nerve pathways, leading to enhanced sensory feedback and better integration of sensory information for balance control. Previous research exploring the advantages of aerobic exercise intervention among patients with T2D has found several beneficial changes in metabolic health, composition of the body, and the maximum oxygen absorption [18,19]. Chronic aerobic exercise dramatically reduces systolic and diastolic blood pressure, fasting glucose levels, lipoproteins with a low density, triglycerides, HbA1c, and body fat percent, according to meta-analytic research[20]. Although there is evidence that aerobic exercise is effective in treating type 2 diabetes' metabolic symptoms, further research is needed to understand how this sort of exercise affects diabetic peripheral neuropathy and the muscle-mediated activities linked to diabetes. Static and dynamic balance were assessed using the one-leg standing test with eyes open and closed, the Berg balance scale, and the timed-up-and-go test.

According to published research, these straightforward and uncomplicated tests result in a thorough evaluation of the balance system. Suganthirababu P et al., suggest sensitivity tests on the peripheral nerve and management of the nerve disorder can be done with ultrasound therapy [21]. Jannu C et al., stated that therapeutic laser plays a major role in reducing diabetic neuropathic pain [23] . Early detection of sensory impairments, combined with targeted interventions such as sensory training, balance exercises, and proper footwear, can help manage balance problems and reduce the risk of falls, ultimately improving overall safety and the standard of living for people with DPN. The results of this pilot study showed promising outcomes in the intervention group, suggesting that sensory re-education with aerobic training has a positive impact on sensation and balance among individuals with DPN, which is clinically significant. Despite the promising results, there are some constraints in this pilot study that should be taken into account. The generalizability of the results is restricted by the small sample size and the absence of a control group. Additionally, the short duration of the intervention does not allow for long-term assessment of its effects. Future research with larger, randomized controlled trials and longer follow-up periods would be necessary to validate these findings.

## Conclusion

This pilot study provides preliminary evidence that combining sensory re-education with aerobic training may have a positive effect on sensation and balance among individuals with diabetic peripheral neuropathy. Improving proprioceptive awareness, vibration sense, and overall balance control could significantly reduce fall risk and improve the quality of life for this vulnerable population. These findings warrant further investigation through larger, controlled studies to establish the effectiveness and long-term benefits of this combined intervention in managing DPN-related sensory impairments and balance issues.

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Original Article

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# Effectiveness of Low-Level Laser Therapy and Low Intensity Pulsed Ultrasound in Sensory Recovery in Experimentally Induced Peripheral Nerve Injury Rat Model

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**Abstract**

**Background:** Peripheral nerve injuries are known to cause significant functional impairment and diminished sensory recovery, necessitating the exploration of effective therapeutic interventions.

**Purpose:** The purpose of this research is to find the effectiveness of low-level laser therapy (LLLT) and low intensity pulsed ultrasound (LIPUS) sensory recovery in an experimentally induced peripheral nerve injury rat model.

**Materials and Methods**: In this study, 18 adult male wistar rats which are divided into LLLT (n = 6), LIPUS (n = 6), and control (n = 6) groups. All rats underwent a standardized procedure to induce peripheral nerve injury, while the control group received sham procedures. Hot-Plate test and Cold-Plate Tests were conducted for pre- and post-operative evaluation of sensory recovery at POD 7, 14, 21 days.

**Results**: The study's findings revealed that LLLT exhibited significantly improved sensory recovery compared to LIPUS and control groups on POD 14 and 21, indicating its potential as a promising non-invasive intervention for managing peripheral nerve injuries ($P < 0.001$).

**Conclusion:** The study recommends that LLLT is more effective when compared with LIPUS in promoting sensory recovery and enhancing in a rat model of peripheral nerve injury. Positive outcomes indicate LLLT's potential as a promising intervention for managing peripheral nerve injuries.

**Keywords:** Low level laser therapy, Sensory recovery, Peripheral nerve injuries.

## Introduction

The term "peripheral neuropathy" describes structural damage to the nerves in the peripheral nervous system as well as abnormalities in normal nerve physiology[1]. Peripheral nerve injuries can lead to substantial functional impairment and

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reduced sensory recovery, prompting the need for effective therapeutic interventions. This study sought to compare the effectiveness of two non-invasive modalities, LLLT and LIPUS in promoting sensory recovery in a rat model of experimentally induced peripheral nerve injury. The findings hold the potential to shed light on the most suitable intervention to facilitate nerve regeneration and enhance sensory recovery in individuals dealing with peripheral nerve injuries[2]. It is important to note that 1-2% of individuals treated in emergency rooms are affected by this type of injury, highlighting its widespread occurrence and clinical significance. Therefore, the investigation of effective therapeutic interventions for PNI becomes imperative to enhance the overall well-being [3,4]

The Wallerian degeneration process and the intact endoneurial tube structure make it possible to study peripheral nerve regeneration after crush injury by facilitating morphological and functional recovery [5,6,7].

A complicated chain of actions takes place during axonal regeneration. Fibres first begin to sprout in the proximal nerve stump, marking the beginning of regrowth. In an effort to reestablish connections with their respective target organs, these sprouting fibres then expand through the distal endoneurial tube, which is the protective sheath encircling the nerve.

The shape and gene expression of the neuronal cell bodies alter noticeably during this regeneration phase. Chromatolysis is a condition where changes are seen in the cellular makeup of neurons. This alteration in morphology reflects the reorganisation and adaptation taking place within the neuronal cells as they get ready for reinnervation and development.

Axonal regeneration involves gene expression alteration, enabling effective axon regrowth and restoration of functional connections with target organs. Axonal regeneration involves cellular and molecular alterations, enabling axons to connect with target organs and promote nervous system function [8,9,10]

Research evaluates LLLT and LIPUS therapies for peripheral nerve injury regeneration, focusing on cellular activity, blood flow, and tissue healing [11]

On the other hand, LIPUS Therapy improves healing by using low-intensity pulsed ultrasound waves. Ultrasound waves can pass through the tissues and stimulate cellular activity as well as the production of growth factors that aid in nerve regeneration. Hot-Plate test and Cold-Plate Tests were conducted for pre- and post-operative evaluation of sensory recovery at POD 7, 14, 21 days. The hot plate test and cold plate test are behavioral tests commonly used in preclinical research to evaluate sensory function in rat models of nerve injury. These tests assess the animal's response to thermal stimuli and provide valuable information about pain perception and sensory recovery following nerve injury[12].

The findings of this study could influence future preclinical and clinical approaches to treating peripheral nerve injuries and increase our understanding of the therapeutic benefits of LIPUS and LLLT in peripheral nerve repair [13,14]

## Aim

The main goal of this research is to evaluate the therapeutic potential of LLLT and LIPUS in promoting nerve regrowth with repairing of nerve tissues and sensory recovery following experimentally induced peripheral nerve injury in rats.

## Materials and Methods

**Study design**: Experimental design

**Study Period:** This study carried out between February 2023 and May 2023.

**Subject and Sample size**: 18 male Wistar rats from Mass Biotech (Chengalpattu) were used to conduct the study.

**Sampling technique**: Random sampling technique.

**Inclusion Criteria**

- Adult male wistar rats were included.
- Rats of average body weight of 250 gms were included
- Rats free from pre-existing neurological disorders or systemic illnesses that may confound the study results.

**Exclusion Criteria:**

- Rats exhibiting signs of infection or wound complications at the site of injury to prevent potential treatment interference.
- Physically deformed rats
- Aggressive rats and previous experimental exposed rats.

**Outcome Measure**

**Hot Plate Test:**

The hot plate test involves a supraspinally organized response, requiring sophisticated mental processing. Rats are introduced into a cylindrical chamber with a metallic floor heated by a thermode, with heat as the primary stimulus. The plate is heated at a constant temperature between 50 and 55 degrees Celsius, and two behavioral elements, paw licking and jumping, are generated. Response latency and baseline latency are measured. Rats should be removed if they don't respond within 30 seconds to minimize tissue damage. The test will be administered on Days 7, 14, and 21 to gauge response latency in each group[21].

**Cold Plate Test**

The cold plate test assesses the behavioral responses of mice and rats to low temperatures, similar to the hot plate test. It measures the animals' reaction to a temperature range of 5°C to 15°C, and measures reaction latency, which is the time it takes for the mouse to display pain behavior. The plate is cooled before placing the rodent on it, and the procedure is repeated for further statistical analysis[21].

**Study Procedure**

**Animals:**

The study involved 18 Wistar rats in controlled laboratory conditions, divided into experimental and control groups, and received standard care.

**Grouping:**

Six animals with posterior right sciatic nerve crush injury were randomly assigned to control and treated with LLLT and LIPUS therapy.

**Anaesthesia procedure:**

Rats received anaesthetic medication with 10 mg/kg xylazine and 70 mg/kg ketamine at 54N pressure.

**Surgical procedure:**

Rats were placed in ventral recumbency, and a 3-cm incision was made to reveal the right sciatic nerve. A crush injury was made 10 mm above the nerve's bifurcation, and sterile saline solution was used to maintain the nerve's moistness [15]

**Post operative management:**

Rats received penicillin-procaine prophylactic dose and nalbuphine hydrochloride analgesic.

**Intervention:**

Six injured posterior right sciatic nerves were randomly assigned to three treatment groups: control, LLLT, and LIPUS.

**Control Group:**

The animals in this group (n = 6) did not receive any special treatment; instead, they received standard care.

**Low-Level Laser Therapy Group:**

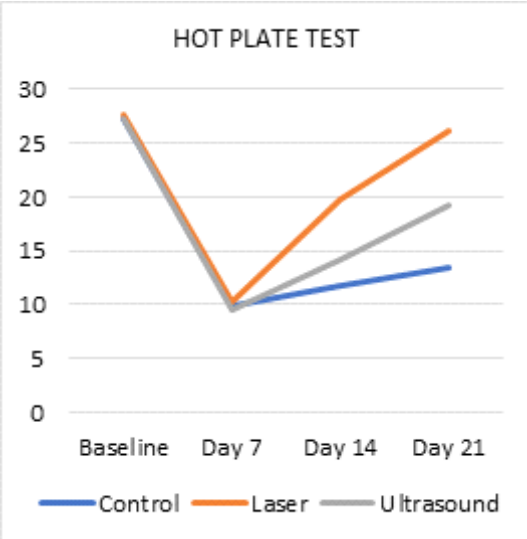
Six animals underwent compression injury to the sciatic nerve and low-level laser irradiation using a GaAIAs system from Technomed Electronics. The group was irradiated transcutaneously for 1 minute at the suture site. Laser therapy may accelerate nerve tissue regeneration in damaged peripheral nerve tissue, starting post-operatively and continuing on alternative days[16].

**Low Intensity Pulsed Ultrasound Group:**

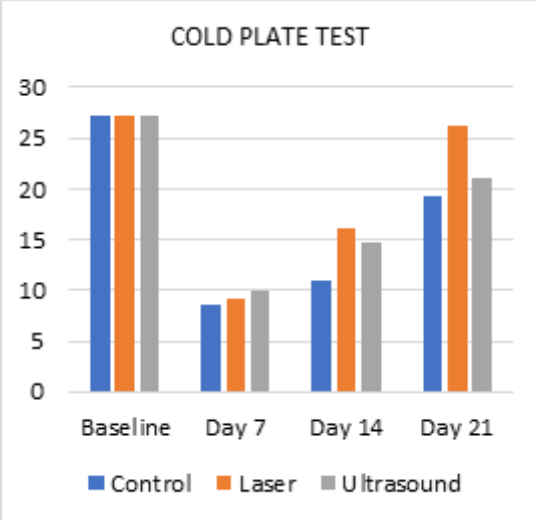
LIPUS is an affordable, non-destructive therapeutic strategy for peripheral nerve regeneration in rodents, promoting regeneration and reconstruction through ultrasonic gel application[17].

**Data analysis**

In statistical analysis, ANOVA analysis used mean and standard deviation to compare groups in a control and experimental setting.




**Graph-1. Heat sensitivity level among crush injured rats on baseline, day 7,14 and 21 after injury.**




**Graph-2. Cold sensitivity level among crush injured rats on baseline, day 7,14 and 21 after injury.**

## Results

For the purpose of assessing the pre- and post-operative sensory recovery at POD 7, 14, and 21 days, Hot-Plate and Cold-Plate Tests were performed.

**Effect Of LLLT And LIPUS On Heat Sensitivity Among CCI Rats:**

In graph 1, The hot plate test measures thermal response in rats before and after surgery. Heat sensitivity decreases on day 7. Both experimental groups showed significant improvement after treatment, but LLLT showed a greater statistical significance (p-value <0.001) when compared to LIPUS data. Latency increased with thermal stimulation, with the LASER group showing 10s to 21s latency, ultrasound group showing 9s to 19s, and control group showing 9s to 13s latency. The ANOVA and tukey test were used for multiple comparisons. The control group showed a statistically significant difference of 0.001 in multiple comparisons, with a mean difference of 18. The POD 21 vs POD 14 group showed a non-significant difference, while the POD 14 vs POD 7 group showed a non-significant difference.

In LLLT, p values showed a statistically significant result of 0.001, with mean differences in multiple comparisons. POD2 vs POD 2 was 18, POD 7 vs POD 12 was 12, POD 21 vs POD 7 was 6, and POD21 vs POD7 was 0.03. Non-significant results were found in POD21 vs POD 14 and POD 21 vs POD 7. In LIPUS, p values were less than 0.001, with a non-significant mean difference of 6 in POD 21 vs POD 14.

**Effect Of LLLT And LIPUS On Cold Sensitivity Among CCI Rats:**

The cold plate test measures latencies response to cold stimuli. Before surgery, cold sensitivity was similar, with a mean response of 27 seconds. After crush injury, cold sensitivity decreased. Rats treated with LLLT and LIPUS showed significant improvement on day 14-21, but LLLT data have shown a greater statistical significance (p value <0.001). Latency increased to 9s to 26s in LASER, 10s to 19s in ultrasound, and 8s to 21s in control groups.

The TUKEY test was used for multiple comparisons on ranks after ANOVA measurement. Statistically significant results were found in LLLT, with mean differences in baseline vs POD 2 and POD 7 values. POD21 vs POD7 values were 0.03, and POD 14 vs POD 7 values were 6. Non-significant results were found in POD21 vs POD 14.

LIPUS shows statistically significant p values <0.001 in multiple comparisons, with baseline vs POD2 having 18 differences, POD 7 having 12, and POD 21 vs POD 7 having 12. However, nonsignificant mean differences were observed in POD 21 vs POD 14, POD 14 vs POD 7, and POD 21 vs POD 14.

The control group showed a statistically significant 0.001 p value, with mean differences in multiple comparisons between baseline and POD 2 and POD 7 and POD 21. Non-significant results were found in POD 21 vs POD 14 and POD 14 vs POD 7.

## Discussion

The main goal of this research is to examine how well these two treatments promote nerve regeneration.

This study will assess the efficacy of LLLT and LIPUS in promoting nerve regeneration using various tests, including nerve conduction investigations, functional evaluations, sensory assessments, and histological examinations of regenerated nerves. Both LLLT and LIPUS have shown promise in reducing pain and restoring sensory function, although their parameters may vary across studies and rat species.

According to a 2016 study by Ching-Hsia Hung et al., therapeutic ultrasound and treadmill exercise both help reduce the pain that peripheral nerve damage causes in rats. The researchers came to the conclusion that the combination of TU and TT reduces neuropathic pain and appears to be associated with the increased levels of pro-inflammatory IL-6 and Iba1 as well as the anti-inflammatory IL-10[12].

In a 2012 study titled Effects of modified Ultrasound Parameters on the Restoration of Sciatic Nerve Injury, Zhamak et al. came to the conclusion that changing ultrasound parameters with 20 groups had an impact on the recovery of peripheral nerve injury. The effectiveness of ultrasonic parameters on the restoration of injured patients are therefore being carefully examined and compared in this study for the first time[18].

Suganthirababu P et al., suggested that ulnar nerve stimulation with low-level laser radiation increased peak to peak amplitude and distal latency[19].

A study by Chen et al. (2014) found that low-level laser therapy (LLLT) reduced inflammation and also neural regeneration in chronically compressed rat dorsal root ganglia. [20].

In 2017, Mohammadreza Mashhoudi Barez, conducted a study on the stimulating impact of low-level laser therapy on regeneration of the sciatic nerve in rats. They discovered that laser phototherapy at a precise wavelength of 780 nm can hasten the regeneration of damaged peripheral nerve tissues[20].

Turner et al.'s 2019 study found facial grimacing, nest building, and grooming as useful indicators for pain assessment in mice, offering potential for analgesic therapies[21]. This discussion aims to explore and analyze the effectiveness of LLLT and LIPUS in the context of sensory recovery in an experimentally induced peripheral nerve injury rat model.

## Conclusion

This research studied the effectiveness of LLLT and LIPUS on improving nerve regeneration and sensory recovery. In terms of neuromotor rehabilitation following compression injury of sciatic nerve, the results showed that laser therapy produced better recovery results than ultrasound treatment. As a result, more research should be done to develop appropriate standards for sensory recovery. Although many clinical studies have shown the effectiveness of LLLT in treating neuropathic pain and sensory recovery, there is still insufficient research. Future research is desired to fully understand and evaluate the long-term effectiveness of ultrasonic and laser therapy.

**Ethical Clearance:**

The study followed ethical standards for animal treatment and was approved by Institutional Animal Ethics Committee IAEC NO: BRULAC/SDCH/ SIMATS /IAEC/01-2-23/11 for the experimental procedures.

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**Conflict of Interest:** No conflict of interest.

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Original Article

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# Effectiveness of low-level Laser Therapy and Low Intensity Pulsed Ultrasound on Motor Recovery among Experimentally Induced Peripheral Nerve Injury in Wistar Rats

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**Abstract**

**Background:** Damage or disease can result in peripheral nerve injury, which is a frequent clinical issue. It frequently renders a person disabled by causing severe sensory loss and motor deficiencies along with pain, tingling, burning and other nagging sensations. A form of ultrasound called Low-intensity pulsed ultrasound, which uses far less energy than normal ultrasound (3 W/cm2). A biological reaction is triggered by low-level laser light having a wavelength of 808nm and a power range of 1-1000 mW.

**Purpose:** The Study is to find out the effect of low-level laser therapy and low intensity pulsed ultrasound on motor recovery among experimentally induced peripheral nerve injury in Wistar rats.

**Methods:** Eighteen rats were chosen in total, skin hair was removed to expose the sciatic nerve area, and the crush injury was done by hemostatic forceps for 30 seconds, the group 1 is ultrasound, group 2 is laser and group 3 is control group. The Step Length Ratio (SLR) was used as an outcome measure to assess motor recovery.

**Result:** All three groups are statistically significant ($p<0.001$) was analysed using one-way ANOVA during intervention period (7th, 24th, 21st day) but LLLT & UST has shown better improvement in their functional index than the control group.

**Conclusion:** According to the results, LLLT has more impact in motor recovery than LIPU also each treatment has substantial impact on accelerating nerve regeneration and shortening the recovery time.

**Keywords:** low level laser, rat study, compound muscle action potential, motor recovery and step length ratio.

## Introduction

Peripheral nerve injuries caused by trauma are thought to occur in roughly 300,000 cases annually.[1] The most common causes of peripheral nerve damage are stretching, division, compression, crush and avulsion. Instead of utilizing of easiest, modern options for treating, reconstructing, morphologic changes and regeneration were rarely fully achieved due to the influence of hurdles like type and degree of damage injury and its damage, diameter, length

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of denervation of the damaged nerve fibres.[2] Some cohort study stated, a prevalence rate of 1.8 to 3.3% and as the age increases so as the prevalence also increased to 82.7-86.1% in the age 16 to 59 years for women also its 78.6%-80% in men and primarily associated with RTA.[3] Nerve injuries primarily affect working people in social system of human. In addition, it affects an individuals' quality of life because motor deficiencies brought on by the injury and associated processes may last more with impaired motor functions and frequently leading to lifetime disability and morbidity.[4]

A significant nerve in the lower limbs that controls both motor and sensory activities is the sciatic nerve. Injury to peripheral nerves can damage motor and sensory abilities, making it more difficult to ambulation.[3] Atrophy of the muscles and a decrease in the interior components of the muscular fibres are being main effects such injury.[7]

The morphofunctional recovery of injured peripheral axons is caused by the regenerative neuroplasticity, which consists of three processes. That is, **Wallerian degeneration:** When the axonal membrane ruptures it causes vigorous influx of calcium ion that results because Wallerian degeneration, next phase is, **Chromatolysis:** During the process of regeneration of axon related to axonal stability and synaptic transmission, proteins which causes the gene encoding is increased.[5] Axonal growth cone: This growth is caused by regeneration of the axonal stump which is present in the proximal region. These are the stages this process has— 1) consolidation 2) protrusion 3) engorgement also is similarly 4 triggered by the entry of Ca2+ ions into the neuron. A necessary factor for the growth of axon and a required element for functional recovery and motor development which is the controller of dynamic movement of cytoskeleton structures.[6]

Low Level Laser Therapy (LLLT) made an attracted interest on a potential therapy varieties of nerve injury restoration since it is non-invasive and uses low-energy laser light to stimulate cellular processes.[8] This LLLT is a therapeutic method that has mostly utilized to encourage nerve development and hasten the functional improvement and recovery of PNS(peripheral nervous system ).[2] The potential effects of phototherapy on neurotrophic factor release, myelination, axonal growth, and nerve cell proliferation, all of which help promote nerve regeneration.[6] therefore, some specific parameter able to reach deep the target and cause biological reactions that have an impact on the chemical changes and physical changes in exposed tissues.[9] By speeding up mitosis and improving the effectiveness of tissue regeneration, LLLT encourages the differentiation of myofibroblastic in the initial stages of healing mechanism. [10] which in turn increases the ATP synthesis in a cells' mitochondria, which favours cellular processes that are pro-regeneratively activates electron transport chain and accelerates the entire process.[11] Step length was defined as the distance between a hind paw strike and the strike of the opposite hind paw. No distinction was made between the left and right measurements for stride and step lengths[17]

After sciatic nerve crush injury in rats, low intensity pulsed ultrasound contributes to quick functional and histologic improvement as well as increased brain-derived neurotrophic factor expression. High frequency sound waves are used in therapeutic ultrasound, a non-invasive medical procedure, to promote tissue healing and restoration.[7] It has been utilised to treat ailments like musculoskeletal injuries and wound healing in a number of medical specialties.[12] Discovering efficient strategies to quicken neuron regeneration and healing since peripheral nerve injuries can cause serious functional deficits. Since therapeutic ultrasound has demonstrated promise in accelerating tissue repair in other medical applications, it has been researched as a potential strategy to improve nerve regeneration. This study offered important proof in favour of therapeutic ultrasound use as a viable therapy to quicken motor recovery following peripheral nerve damage. looking into the possibility of using low-intensity ultrasound to encourage the activity of Schwann cells and improve nerve repair in the setting of peripheral nerve regeneration.[14]

The increased demand of neurological lesions has compelled the medical community to look for practical remedies that might speed up the healing of the wounded nerve and stop the progression of muscle atrophy brought on by nerve injury.[1]

## AIM

The aim of the study is to compare the effectiveness of low level laser therapy and therapeutic ultrasound on motor recovery among experimentally induced peripheral nerve injury in Wistar rats.

## Materials and Methods

The study was carried out between July and November of 2022. 18 male adult Wistar rats that were 3 months old, weighed 150–300g were selected by simple random technique and received surgically induced peripheral nerve (sciatic nerve) damage were used in the experiment. Every animal received the same surgical procedure. They were fed pellets and given water while being housed in cages with one other animal apiece. The rats were weighed and then randomly split into three groups of six rats in each group. Group 3 received a control group, while Groups 1 and 2 received ultrasound and laser therapy, respectively.

**Selection criteria**

**a) Inclusion criteria:**

- Wistar rats at age between 6(0.5) months to 48 months (4.0)
- Only Male rats were included
- Physically active rats will be included

**b) Exclusion criteria:**

- Rats with physical deformity and skin problems are excluded
- Rat with psychological distress more aggressive rats

**Outcome Measure:**

Step length ratio (SLR): Step length is the distance between the heels of one foot to the heel of the other while walking. It is an easy way to assess motor function in rats. We used a wide wooden ruler, where the rat was made to walk to see the distance of each step length. A permanent marker is used to mark the metatarsal heads of the hind foot and front foot of the rat. Then the distance between hind foot's metatarsal head to the front foot is recorded, the step length of each side's hind foot was taken at floor level using the wooden ruler as a runway. The distance is noted for both the experienced and normal side. Step length ratio was then calculated by dividing the step length of the experimented side by the normal side. This was done before the surgery (PRE-OP), 7th day of post OP (PRE-TEST), 14th day (POST-TEST) and on the 21st day of post OP (POST-TEST) for all the three groups.

**PROCEDURE:**

18 animals were given intramuscular and intraperitoneal injections of 5% ketamine hydrochloride (70 mg/kg body weight) and 2% xylazine hydrochloride (10 mg/kg body weight) in a 1:4 ratio to induce anaesthesia. Meloxicam was administered subcutaneously in a dose of 1 mg/kg to treat the pain. By carefully shaved and dissecting between the gluteus maximus and quadriceps muscles, a 3 cm long postero-lateral longitudinal thigh incision was made, exposing the right sciatic nerve. 54 N of crush injury was then caused for 30 seconds using hemostatic forceps. Then suturing done followed by pain management.

**Ultrasound group (Group 1)**

The crush site was the only target for the pulsed-wave ultrasound, which covered a range of frequencies, durations, and spatial peaks with time-averaged intensities. With a finger probe and a pulsed intensity of 0.4 W/cm2 in a 1:1 ratio, the ultrasound used had a frequency of 1 MHz and was applied transcutaneously. The treatment duration is 4 minutes. The transducer was placed around 2 to 3 cm distant from the sutured area over the glove water bed in order to enable effective transmission of ultrasound into the target area. The treatment focused on the site of the crush injury and started on the second postoperative day (postoperative day 2). It lasted for 21 days in total. On days 7, 14, and 21 following surgery, the step length ratio was carried out and compared to the pre-injury assessment to gauge motor recovery. Beginning on the third postoperative day, a 4-minute treatment session was administered once a day for 21 days.

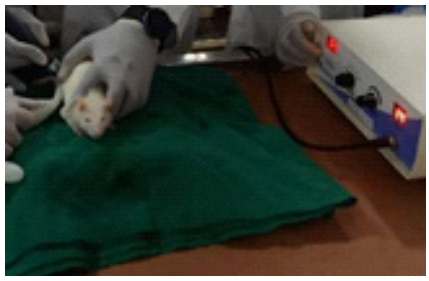


**Fig 1: Ultrasound therapy**

## Laser group (Group 2)

For LLLT, a portable Aluminium Gallium Arsenide Laser Diode was employed. The laser met the following requirements: an energy density of 3 J/ cm2, an area length, width, and tissue depth of 1 cm, a wavelength of 808 nm (infrared light), a power of 200 mW, and continuous mode. Each session's exposure period was set to 60 seconds. Rats in the experimental group 2 had laser irradiation with a focus on the nerve damage location that had been surgically identified. The contact point approach was used to apply a laser pen at a 90-degree angle to the skin during the first 21 days. According to Monte-Raso, this method proved quantitative, trustworthy, and reproducible in rat sciatic nerve operating settings.

**TABLE 1: Pre and Post-test mean values of step length ratio for LLLT, LLPU and Control group.**

| GROUPS | Pre and post-test values | | | |
|---|---|---|---|---|
| | Pre-OP | 7th Day | 14th Day | 21st Day |
| LLLT GROUP | 1.01 | 0.4 | 0.73 | 0.85 |
| LLPU GROUP | 0.96 | 0.38 | 0.59 | 0.74 |
| CONTROL | 1 | 0.4 | 0.51 | 0.61 |



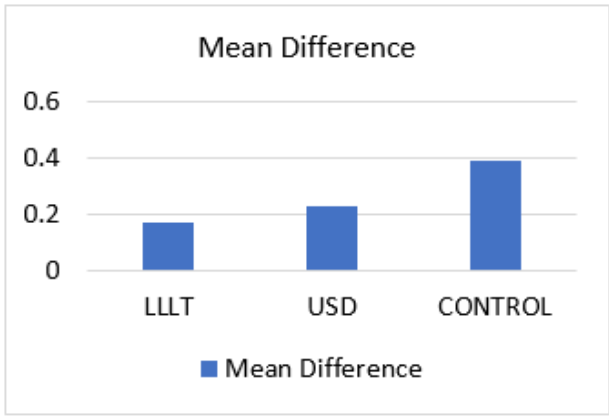
**Fig 2: LASER therapy**

## Control group (Group 3)

Control group also underwent the same surgical procedure and no treatment was provided to the animals in the control group.

## DATA ANALYSIS:

The assessed values of step length ratio was statistically analysed for their normality has been done by evaluating the values with Shapiro – wilk test, equal variance with the help of Brown forsyth test, significance among 3 groups were identified using one way repeated measure using ANOVA and pair comparison between the pre op value and 7th,14th and 21st day measure was analysed using Bonferroni and Holm multiple comparison test. The Tukey HSD test was used to compare the difference in final measure (21st day) between the three groups. SPSS statistical tools and Microsoft Office Excel were used to analyse and record the data. The ANOVA is used to analyse the SFI and SLR values of within-groups, significance threshold is fixed as 1% ($p < 0.01$)




**GRAPH 1: Mean difference of SLR among LLLT group, USD group and Control group**

## Result

The study was randomly assigned among 18 rats assigned into 3 groups which have been equally separated as 6 rats in each as LLLT group, Control group and USD group. step length ratio was measured and recorded before the surgery and post-op day of 7, day 14 and day 21 (Table 1). This indicates that all three groups have a similar baseline index and there is no potential bias among allocated subjects. One-way repeated ANOVA (analysis of variance) is used to interpret the difference of F-statistics and standard error within a group for Step length ratio (SLR) values. Comparing the mean difference of all three groups, 21st day value Group A with a mean difference of -12.43 is the least of all three groups where Group B has -13.76 and Group C has - 21.11 which is very higher than the other two groups. . Multiple group comparison by tukey test between three groups has not shown significant difference between group A and group B while group C is significant with other two groups indicating significant difference. Step

length ratio (SLR) values among all the three groups were found statistically significant comparing its pre-OP and 21st day value. The mean difference of group A is 0.17, group B is 0.23 and group C is 0.39 (Graph 1). This shows that the LLLT group is very close to normal value showing significant difference than the other two groups.

## Discussion

Nerve fibres regenerate on average at a rate of about 1 mm per day if the cellular and extracellular elements that make up a good substrate for axonal regeneration are present, as after a crush injury.[6] Sciatic nerves that were exposed to low intensity laser irradiation had considerably higher levels of GAP-43. This implies that laser therapy may encourage GAP-43 expression, which is known to be essential for nerve regeneration.[4] An axonotmetic grade of injury results from acute and chronic injuries of increased severity and necessitates not just remyelination but also axonal regeneration in order to recover. Examples of these injuries include diabetes, severe forms of carpal tunnel syndrome, and some types of trauma. Motor recovery can take up to two years for proximal lesions that necessitate axons to travel great distances before they reach target muscles or sensory receptors. According to surgical decompression for entrapment neuropathies and surgical exploration and repair following traumatic nerve injuries are common 28 therapies for incapacitating nerve injuries. Drugs for peripheral neuropathies, including various neurotrophic factors, have not yet shown effective in clinical trials.[10]

The prolonged and inaccurate effective reinnervation of motor and sensory target structures are significant barriers to a full recovery. The creation of novel therapies that hasten and enhance the healing process would have positive clinical effects.[16] Many of these studies lacked details on essential characteristics such dose, apparatus power, application duration, and method of application. This makes it difficult to comprehend their procedures, which makes it difficult to replicate their findings. It also makes it challenging to compare different studies. The results of these investigations appear to be inconclusive and debatable, which motivated us to conduct this study to determine whether LLLT may actually stimulate the recovery of sciatic nerve in functional aspect by using a rat model with crush injury of sciatic nerve.[4]

The rats were split into two groups after being injured: one group underwent low level laser treatment to the damaged sciatic nerve, while the other group served as a control and did not receive laser treatment. At particular times following the injury, the researchers evaluated the levels of GAP-43 in both groups' damaged sciatic nerves. The GAP-43 has 31 increased in LLLT group indicating nerve regeneration.[4]

Two groups in rats were created: a control group and an experimental group. The site of the nerve injury, the experimental group received therapeutic ultrasound treatment, but the control group did not. It is important to remember that this was an animal study, and more investigation would be necessary to establish the applicability and efficiency of therapeutic ultrasonography in human neuron regeneration. The effect of ultrasonic radiation exposure within a relatively limited intensity band that is inversely proportional to dose has been suggested by experimental evidence shows that when therapeutic ultrasound is applied in low intensity and in small dosage, it enhances the regeneration of nerve meanwhile high intensity irradiation would inhibit the regeneration. Low-intensity ultrasound has a variety of effects on Schwann cells, according to studies. It can boost their growth, encourage growth factor release, and improve the expression of specific neurotrophic factors, all of which are crucial for nerve regeneration and repair.[12] Prathap S et al., concluded that low level laser irradiation can increase the conduction velocity of motor nerves in diabetic neuropathy.[18]

Hence, we decided to take the most used parameter in LLLT and LLPU to find its significance in motor recovery of sciatic nerve in rats.

## Conclusion

According to the results, LLLT has more impact on motor recovery than LIPU. Also each treatment has a substantial impact on accelerating nerve regeneration and shortening the recovery time. Step length ratio has shown significant difference in motor recovery in LLLT than the LIPU group and control group had very less result than the other two groups.

**Ethical Clearance:** This original experimental study on rats was approved by the Ethical Committee, BRULAC/SDCH/SIMATS/IAEC/01-2023/11, Saveetha Institute of Medical and Technical Sciences (SIMATS), Saveetha University, India

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Effectiveness of Vagal Nerve Stimulation on Obsessive Compulsive Disorder Among Post Covid-19 Infected Individuals

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**Abstract**

**Background:** COVID-19 has impacted everyday life and many people are affected by it. Regular Hand washing, maintaining hygiene, avoiding handshaking & face-to-face interaction, social distancing, quarantine are precautionary measures which result in rapidly increasing depression and anxiety among common population and it results in OCD.

**Purpose:** This study aims to investigate the effectiveness of vagal nerve stimulation on obsessive compulsive disorder among post-covid 19 infected individuals.

**Methodology:** A total of 20 participants was selected using the Purposive sampling technique based on the inclusion and exclusion criteria. Then, the participants were allocated into 2 groups by closed envelope method and the participants in the control group receive cognitive behavioural therapy for 30 minutes, 4 sessions/week for 4 weeks. The experimental group receive Transcutaneous auricular vagal nerve stimulation. The stimulation was given for 30 minutes,4sessions/week along with CBT.

**Result:** With a p value of 0.001, transcutaneous auricular vagal nerve activation significantly reduced obsessive compulsive disorder symptoms after 4weeks in experimental group.

**Conclusion:** The Study showed that transcutaneous auricular vagal nerve stimulation was effective in reducing symptoms of OCD among post covid-19 infected individuals.

**Key Words:** Obsessive compulsive disorder, post covid- 19, transcutaneous auricular vagal nerve stimulation.

## Introduction

The COVID-19 Pandemic, which was originally detected in the month of December in Wuhan, China, is causing widespread suffering today[1]. The new coronavirus is responsible for the highly contagious as well as the severe respiratory sickness caused by it.COVID-19 has impacted everyday life and is bringing down the world economy. Numerous thousands of people have been impacted by this pandemic, either by illness or death its spread. When an infected individual sneezes, coughs, talks, or breathes, respiratory droplets are the main way that

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COVID-19 spreads. Fever, a cold, a cough, discomfort in the bones, difficulty breathing, and pneumonia are the most typical signs of this illness. Currently, there aren't any vaccines available because this is a newly viral disease that is affecting people for the first time. Therefore, a focus is placed on taking important precautions, like wearing masks, maintaining a strict hygiene regimen, and keeping a distance from others in social situations[2,3]. During a pandemic, people are afraid of the infectious agent and use a variety of preventive measures to reduce the infection, such as physical separation, regular hand washing, quarantines, and widespread public awareness campaigns on the value of washing their hands and avoid shaking hands, are preventative measures that have a rapid negative impact on the general population's levels of anxiety and despair and lead to obsessive- compulsive disorder (OCD)[4]. OCD is associated with a symptom that is very sensitive to the worry and potential for contamination, as well as thoughts of getting sick, spreading a disease, and engaging in protective behaviours to lessen the possibility of contamination. They maintain personal hygiene Obsessively in guilt to avoid spreading an infection to others and recurring worries about illness and contamination, intentional avoidance of possible contaminated environments, and compulsive washing are frequently used to describe OCD and it result in significant stresses for people with OCD[5]. OCD is a mental illness characterized by intrusive, upsetting, and constant thoughts known as obsessions, causing anxiety and suffering. Compulsions, repetitive actions or thoughts, are performed to reduce this worry. It impairs everyday functioning, relationships, and overall quality of life [6]. The cause is not fully understood but may involve genetic, neurological, and environmental factors. OCD often coexists with depression, anxiety disorders, and body dysmorphic disorder (BDD)[7]. However, it is treatable, and cognitive-behavioural therapy (CBT), especially exposure & response prevention (ERP), is an effective treatment. Medications like selective serotonin reuptake inhibitors (SSRIs) can also be used. Early intervention by a multi-disciplinary team can significantly improve the affected person's quality of life [8]. The vagus nerve aids in controlling the autonomous nervous system, which controls bodily functions like digestion, respiration, heart rate and inflammation etc. It helps in controlling emotions and affects how the body responds to stress. To increase calmness, relaxation, and general wellbeing, the vagus nerve can be stimulated [9].

In recent years, non-invasive transcutaneous auricular vagus nerve stimulation devices have become increasingly used. These devices don't require surgical implantation and are applied via external devices like clip electrodes. The clip electrode is fixed to the ear's outer surface. By providing electrical stimulation the auricular branch of the vagus nerve, which innervates the cymba concha in the ear, (TaVns), a non-invasive procedure, triggers the inflammatory reflex [10]. Therefore, the goal of the research is to find out whether the vagal nerve stimulation is effective in treating OCD in people who were exposed to COVID 19.

## Aim

To determine the effectiveness of transcutaneous auricular vagal nerve stimulation on obsessive compulsive disorder among post covid-19 infected individuals.

## Material and Methods

The research was carried out using an experimental study design between November 2022 and February 2023. The study proposal was submitted to the Institutional Scientific Review Board Committee (ISRB) and approved by the ISRB (ISRB no-01/022/2022/ISRB/PGSR/SCPT) before enrolling the Participants in the study. The participants in the study were given an open invitation to participate, and those who had a willingness in doing so were enrolled.

Both the individual who participated and the evaluated person in this study were blinded.

**Inclusion criteria:**

- Participants infected by covid-19.
- Both the genders
- Age group between 25 and 50 years.
- Participants who scored more than 50 in the DOCS scale.

**Exclusion criteria:**

- Participants who showed no signs of OCD.
- Those with a history of mental or neurological conditions,
- Pregnant women.
- Those with pacemakers, those who had received cervical vagotomies or neck chemotherapy.
- Those who had no interest in participating in the study were excluded.

**Outcome measure:**

**DOCS:** A 20-item self-report tool called the DOCS measures how severe OCD symptoms are. It has 4 dimensions a) Concerns about germs and contamination, (b)Concerns about being responsible for harm, injury or bad luck (c)unacceptable thoughts (d)Concerns about symmetry, completeness and the need for things to be 'Just right'. On a scale from 0 [no symptoms] to 4 [extreme symptoms].

**Procedure**

As a result, 20 people were chosen for this study. The study's 20 participants were each given information about it and asked for their consent. The participants were randomly divided into two groups of Ten each using the closed envelope method. Group A received transcutaneous auricular vagal nerve stimulation, for 30mins /day , 4days in a week for a duration of 4 weeks. The electrodes were placed over the cymba concha in the left ear. The selection of the stimulation settings was a sinusoidal waveform with a pulse width of 250 milliseconds, a frequency of 20 Hz, pulse width 80μs and an amplitude of 0-3 milliamperes along with CBT treatment. The stimulation followed an ON-OFF pattern, with 30 seconds of stimulation followed by 5 minutes rest. Group B received cognitive behavioural therapy for 30mins/day,4days in a week for a duration of 4 weeks. Pre and Post treatment the DOCS was used as an outcome measure to evaluate OCD symptoms. The data collected were tabulated and statistically analysed.

**Data analysis**

A statistical analysis was done with the Intention of to reduce the OCD symptoms. Pre- and post-test values for DOCS were noted. A paired t-test was used for within-group analysis, and a Mann-Whitney U test was used for between-group analysis.

**Table 1: Pre and Post-test values of Group A obtained using DOCS, indicating the reduction of OCD symptoms.**

| Outcome | Pre test | Post test | t- Value | P Value |
|---|---|---|---|---|
| | Mean & SD | Mean & SD | | |
| DOCS | 61.4±4.1 | 50.1±4.0 | 6.155 | <0.001 |

**Table 2: Pre and Post-test values of Group B obtained using DOCS, indicating the reduction of OCD symptoms**

| Outcome | Pre test | Post test | t-Value | P Value |
|---|---|---|---|---|
| | Mean and SD | Mean and SD | | |
| DOCS | 61.4±4.1 | 60.21±4.2 | 0.638 | <0.001 |

**Table 3: Post test analysis of both the group, indicating the difference in reduction of OCD symptoms:**

| Outcome | Group A | Group B | t - Value | P Value |
|---|---|---|---|---|
| | Mean and SD | Mean and SD | | |
| DOCS | 50.1±3.83 | 60.2±4.07 | -5.45 | <0.001 |

## Result

In this study we assessed the effect of TaVns on OCD among individuals. TaVns showed a significant effect in reducing symptoms of OCD at 4weeks, with a p value which is <0. 001.Though both the group showed an improvement there was significant effect of TaVns than the conventional therapy within the 4-week protocol in reduction of OCD among individuals. The obtained post-test values were analysed using Mann-Whitney-U test, revealing the statistical significance of <0.001.

In statistical analysis the intervention group has significant effect by using docs scale were analysed by Mann whitney-U test and control group also have some considerable effects.

## Discussion

This study aimed to determine the prevalence of OCD and the effect of TaVnS.vagal nerve has an impact on autonomic function of the body and considered to be safe in treating psychiatric issues. OCD is an ignored public health concern that needs more attention. Chronic OCD dramatically lowers quality of life, especially when it coexists with depression so in this study we used TaVnS for OCD.

Ang L et al., has conducted a review in 2023**,** and he says that the COVID-19's substantial effect on mental health globally is one of the major concerns it presents. Due to the epidemic, the world's population has been put in an unprecedented scenario. He stated that more people are experiencing higher levels of stress, fear, depression and other psychological issues[11].

A study Wang Y et al., in January and February 2020 with 1210 participants from 194 cities, and he stated 29% of the people surveyed indicated considerable to serious anxiety symptoms, and 17% of individuals reported considerable to severe depression symptoms, and that 54% of those who participated assessed the psychological impacts of the COVID-19 epidemic as moderate or severe[12].

In 2020, Huang and colleagues et al., conducted a survey study on, GAD, symptoms of depression and sleep quality at the time of pandemic" they stated that generalized anxiety in particular OCD and depressive symptoms were much more common in younger individuals than in older individuals. Numerous studies found that COVID-19 and OCD were associated with adults[13].

Another author named Howland RH et al., in 2020 has stated that Vagal nerve created an interaction between the human body and the peripheral functions, and that should be focused in the treatment of psychological disorders[14].

In addition to this ,Ben- Menachem et al., conducted research on stimulation of vagal nerve on epilepsy and depression, in that he concluded that vagus nerve stimulation is a potential therapy. All VNS treatment needed the placement of electrodes surgical that were linked to a activating the implanted device which is placed under the chest wall anteriorly. Although VNS which is implanted that are safe & tolerated well, risky events (AEs) have been linked to surgical technique as well as the electrical stimulation. The techniques of nVNS delivery does not require surgical implantation were developed as a result's reduces anxiety and fear-related processes in the brain while increasing peripheral inflammatory and sympathetic activation processes in the periphery and the CVS implying potential utility for a wide range of conditions associated with stress and dysregulation of stress and inflammatory systems, including irritable bowel syndrome, RA and fibromyalgia, in addition to depression and anxiety[15].

In a review by Hsiangkuo Yuan et al. on the advantages of non-invasive vagus nerve stimulation (VNS) in 2015. In that,They succeeded to have the development of VNS back to 19th century, when it was unsuccessful at first but encouraged study into using animals to regulate seizures. other types of electrical stimulation devices have been designed over time, some of which have the aim of treating cardiovascular diseases and control seizures. For the treatment of epilepsy, pain, headaches, and other conditions, non-invasive transcutaneous implants that activate the auricular is also being investigated. With better safety features, non-invasive VNS (nVNS) is thought to be equally efficient as its invasive version

Norbert Kathmann et al .,conducted a study to examine the effects of CBT for obsessive-compulsive disorder (OCD) and he conclude that individual CBT

was for OCD was provided to patients in an exposure-based, non-manualized treatment approach[16].

Covid -19 pandemic has created a considerable impact over the over all well being of the individual ie ; economical, social[17].

Non-invasive vagus nerve stimulation specifically targets the vagus A fibers connected to the brain, not the C fibers associated with other organs. However, therapeutic pathways in the brain for treating depression likely have similar connections to the peripheral nervous system. Given the financial burden, risks, and invasiveness of surgical operations, non-invasive vagal nerve stimulation shows promise as a more widely applicable technique in psychology. It could potentially serve as a substitute for conventional treatments like psychological therapy and pharmaceuticals [18].

We were not gone for any quantitative analysis like parametric test because this project is self -funded project.

## Conclusion

To Conclude, the Transcutaneous auricular vagal nerve stimulation plays a significant role in reducing symptoms of OCD among individuals. Comparing other studies, the transcutaneous auricular vagal nerve stimulation is found to be safe and effective in psychiatric illness. Because it has an influences autonomous tone, cardiac function, inflammatory reactions, and emotion regulation, anxiety disorders (OCD) .

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulation. (01/022/2022/ISRB/ PGSR/SCPT Application Number).

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**Conflict of interest:** The authors state that there is no conflict of interest**.**

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Original Article

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# Effect of Task Specific Training on Activities of Daily Living and Functional Balance Among Parkinson's Disease Patients: A Pilot Study

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**Abstract**

**Background:** In Parkinson's disease (PD) patients fear of falling, independence in day-to-day activities, and functional balance are interconnected. These impairments can significantly limit functionality and lead to disability, increasing the risk of falling by 46%. Falls can result in severe injuries and reduced quality of life.

**Purpose:** The main purpose of this study was to examine the effects of task-specific training on the functional balance and Activities of Daily Living (ADL) in individuals diagnosed with PD.

**Materials and Method:** 10 patients of the both genders who had idiopathic PD ranged from Stage I to III on the Hoehn & Yahr (H&Y) scale. Participants received task specific training for three days a week on alternate days for 8 weeks. The Unified Parkinson's Disease Rating Scale (UPDRS) parts II, Berg Balance Scale (BBS), and Activities-specific Balance Confidence (ABC) Scale were used as outcome measures. The data was tabulated and analysed using sigma plot software.

**Results:** The results showed significant improvement in functional balance on BBS from 45.60±2.36 to 50.40±1.95, ADL on UPDRS part II from 22.50±1.95 to 16.70±1.63, balance confident on ABC scale from 68.12±2.20 to 78.24±2.61 at the end of 8 weeks, with a $p$-value of $< 0.01$.

**Conclusion:** The study concludes that the task specific training significantly improves functional balance, independence in ADL and reduces fear of fall among PD patients.

**Key Words:** Fall, Quality of life, Balance, Parkinson disease, Mobility.

## Introduction

Parkinson's disease (PD) leads to significant consequences such as compromised balance and reduced mobility. The ability to carry out daily activities independently, known as functional independence, is closely linked to maintaining balance and mobility. These aspects play a vital role in performing Activities of Daily Living (ADL). Motor disturbances associated with PD can contribute to the gradual decline of balance and mobility, exacerbating the challenges faced by individuals with the condition[1]. These impairments frequently lead

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to significant functional limitations and disabilities, which makes the person more likely to fall. A four-month fall rate of forty-six percent indicates that stumbling is not only frequent in people with PD, but it also carries the risk of significant damage. Grey and Hildebrand discovered that forty percent of falls resulted in injuries. When the fall was caused by propulsion, fifty-six percent of cases had injuries. In addition, 10 years following evaluation, those with PD had a 20-fold increased risk of fractures to their hips compared. Falls-related injuries can eventually result in hospitalisation, wheelchair confinement, and/or a crippling dread of future falls, all of which may negatively impact Quality-of-Life (QoL)[2]. ADL depends on a person's motor, cognitive abilities and perception skills and serves as an important barometer of their functional ability. When patients struggle with doing ADLs, they depend on people or mechanical devices, which puts them at risk and decreases their QoL. Additionally, this circumstance increases the pressure on the carers, who are already under considerable stress from caring for the person. The caregiver's physical and mental health may be affected, and there may be a reduction in the amount of care given to the patient as a result of this load[3]. ADL performance deteriorates with the progression of PD, monitoring disease development, improving care, and reducing the burden of the condition are all aided by assessing ADL limits[4]. At present, Parkinson's disease lacks a definitive cure. Existing treatments focus on easing motor symptoms, but full motor function restoration remains elusive. Approaches include medications like levodopa to boost dopamine levels and deep brain stimulation, though some symptoms may not respond to drug-based interventions[5]. Patients worry that their movement problems, such as shaking hands, instability in their posture, and gait disruption, would cause them to lose control over their everyday lives. Unusual symptoms may cause a sense of social isolation[6]. Dopamine treatment for PD appears to increase gait-related mobility but not reactionary postural reflexes, thereby raising the risk of falls, rehabilitation and physical activity might help to lessen this[7].

Task-specific training is a form of therapy that focuses on practicing functional tasks relevant to the individual's daily activities and specific challenges they face due to their condition. By targeting these tasks in a structured and repetitive manner can improve motor skills and functional abilities related to balance and ADL.

## Aim

The aim of the study was to investigate the effect of task-specific training on functional balance and ADL among PD patients.

## Materials and method

This is a pilot study carried out in a private medical hospital in Chennai during the period between June 2022 and September 2022. 30 patients who had PD were screened, and the convenience sampling technique was used to include 10 PD patients according to the inclusion and exclusion criteria.

**Inclusion criteria**

- Idiopathic PD patients,
- PD patients aged between 60-75 years,
- PD Patients who were in stage 1, 2 and 3 of Hoehn and Yahr stage.

**Exclusion criteria**

- PD patients with psychological disorders,
- PD patients with cognitive impairments,
- PD patients with dementia,
- PD patients who are in irregular medication.

**Outcome measures**

1. The Berg Balance Scale (BBS) is a popular clinical evaluation instrument for evaluating a patient's stability and balance while doing different functional tasks. It is especially made to measure balance and the danger of falling in elderly people and people with mobility issues. The scale consists of 14 various activities that evaluate both static and dynamic balance, from standing and sitting balance to walking and turning tasks. Depending on the degree of independence and stability displayed, assign a score between 0 and 4. Higher scores indicate greater balance and a lower chance of falling. The total score runs from 0 to 56[8].
2. The Unified Parkinson's Disease Rating

Scale (UPDRS) Part II is particularly concerned with the ADL of people with PD. It evaluates numerous motor components of daily functioning activities and offers an understanding of how the illness affects a patient's capacity to carry out such chores. Range of total scores: 0-52 A higher score means that you depend more on other people to do daily tasks[9].

3. The Activity-Specific Balance Confidence (ABC) scale measures a person's confidence in their ability to keep their balance while engaging in particular activities. Participants are asked to assess their degree of confidence in performing each task on a scale from 0% to 100%. This method is frequently used with elderly people or those who have balance problems[10].

**Procedure**

The selected participants were clearly explained about the research procedure and informed consent was obtained. BBS, UPDRS Part II and ABC were assessed as Pre-test values before proceeding to the training. The task-specific training program was carefully crafted to meet the specific needs and capabilities of the patient and was given to the patient for 8 weeks, with the primary objective of improving their balance and functional abilities. The program comprises ten distinct workstations, each tailored to target different aspects of balance and functional performance. To ensure the patient's readiness and prevent injuries, the program starts with a thorough 10-minute warm-up session. The warm-up includes a range of dynamic exercises, such as marching in place, neck circles, arm swings, shoulder circles, trunk rotation, active stretching of hip flexors, hamstring and calf. The program's design emphasizes progressive difficulty and complexity, allowing the patient to gradually challenge themselves as they progress. As the patient gains confidence and mastery at each workstation, the level of difficulty is increased to promote continuous improvement. Throughout the activities at each workstation, the patient is encouraged to hold an object, which adds an extra element of challenge. By integrating object-holding into the exercises, the patient's stability and proprioception are further developed, enhancing their overall balance and functional performance. At each workstation, the patient completes a set of tasks specifically tailored to target different aspects of balance and functional ability. After completing all the tasks at a workstation, the patient is given a one-minute interval for rest and recovery before moving on to the next workstation (Table 1). Post-test values are recorded as the same as pre intervention values at the end of 8$^{th}$ week and the values are tabulated and analysed.

**Table 1: Task specific training**

| Workstations | Progression |
|---|---|
| 1. Rising from chair to standing | 1. Different chair heights<br>2. Rubbery surface |
| 2. Chair-to-6-meter walk | 1. Different chair heights<br>2. Rubbery surface |
| 3. Negotiating three-meter obstacles | 1. Obstacles with different heights<br>2. Rubbery surface |
| 4. Step-up exercises | Different stepper heights |
| 5. Six-meter object retrieval while walking | Rubbery surface |
| 6. Figure of eight gait pattern walking | Rubbery surface |
| 7. Ascending and descending stairs with rail support | 1. Progression of step heights from 15 cm to 20 cm<br>2. Rubbery surface. |
| 8. Touching several points marked in a semicircle | 1. Rubbery surface.<br>2. During the task, the patient has to hold the objects in their hand. |
| 9. Standing and reaching for an object placed in front of them | 1. Placing feet wider, together and in tandem position.<br>2. On a stable and rubbery surface. |
| 10. Balancing on a foam platform | During the task the patient has to hold the objects in the hand. |

**Data Analysis**

The demographic data of the participants were analysed using descriptive statistics, including measures such as the mean and standard deviation which has been represented in Table 2. Pre-test values and Post-test values of BBS, UPDRS Part II and ABC are analysed by Wilcoxon signed rank using sigma plot software.

## Results

The results showed significant improvement in functional balance on BBS from the mean value of 45.60±2.36 to 50.40±1.95, ADL on UPDRS part II from the mean value of 22.50±1.95 to 16.70±1.63 and balance confident on ABC scale from the mean value of 68.12±2.20 to 78.24±2.61 at the end of 8 weeks training, with a *p*-value of < 0.01 (Table 3).

**Table 2: Demographic characteristics of the participants**

| **Age (Mean±SD)** | 65.8 ± 3.42 |
|---|---|
| Hoehn and Yahr stage | |
| Stage 1 | 2 |
| Stage 2 | 6 |
| Stage 3 | 2 |
| Disease duration (Mean±SD) | 3.8± 1.16 |

**Table 3: Comparison of Pre-test values and Post-test values**

| **Outcome** | **Pre-test (Mean±SD)** | **Post-test (Mean±SD)** | **p-value** |
|---|---|---|---|
| BBS | 45.60±2.36 | 50.40±1.95 | < 0.01 |
| UPDRS PART II | 22.50±1.95 | 16.70±1.63 | < 0.01 |
| ABC | 68.12±2.20 | 78.24±2.61 | < 0.01 |

## Discussion

This research evaluated the task-specific training on functional balance and ADL in PD patients. The program's structure ensures that the patient engages in a wide variety of activities, targeting various muscle groups and movement patterns. This comprehensive approach helps to address any potential imbalances and enables the patient to progress holistically in their balance and functional capabilities. This personalized approach ensures that the patient is consistently challenged while maintaining a safe and effective training environment. In a pilot study in order to improve gait performance among PD patients, a series of dual task training programs was developed and Four weeks of one-on-one training sessions were dedicated to walking while carrying out various cognitive activities. The outcomes showed that following the four-week training program speed of walking and gait variation during DT greatly improved, which also states that a Task-specific DT gait training program for PD patients is feasible to implement. Even in tasks that were not particularly addressed, the training program had a favourable impact on DT gait performance[11]. One of the most important things in rehabilitation is the surrounding environment which plays a key role in the outcome of the patients. According to the previous study participants walked every day for a week in the Swedish highlands for two years in a row. Low-intensity exertion, a lack of time constraints, and minimal group contact were the defining characteristics of the walking exercise. The results of the study emphasize how interdependent the environment, body, and mind are. This relationship becomes more important when a person has a disease like PD, which affects their capacity to regulate their bodily motions, voluntary mobility, and energy levels[12,13]. Steno Rinalduzzi et al. stated Multiple sensory inputs must be integrated in order to produce the proper neuromuscular reactions, which in turn trigger motor modifications for posture control. In the sensory regulation of balance, the proprioceptive, vestibular, and ocular systems all play important roles[14]. Cognitive impairment is also an important symptom in PD. Recent research stated complex everyday tasks might be challenging for PD patients with minor cognitive impairment. Functional activities can be used to mix cognitive and physical training to improve cognitive functioning, results also showed significant improvement[15,16]. Motivated people may experience hurdles related to their particular diseases that prevent them from engaging in regular exercise[17]. Fear of falling, independence in day-to-day activities, and functional balance have a significant association that may be impacted by the medication phase and the severity of the illness, The

cortisol level measurements has been found associated with the fatigue levels in parkinson's disease[18] Lack of physical activity contributes to gradual declines in the performance of ADL. On the other hand, engaging in regular exercise can stimulate dopamine synthesis in the remaining dopaminergic cells, helping to counteract the negative impacts and potentially improve ADL performance[19]. By following this task-specific training program, the patient can expect to see steady improvements in their balance, stability, and overall functional performance, ultimately leading to enhanced mobility and QoL. This study has a couple of limitations, including the exclusion of individuals with cognitive impairment and a relatively short training duration of 8 weeks. For future research, the authors recommend expanding the sample size to improve the study's statistical power. Additionally, they suggest including cognitively impaired PD patients to gain better insights into outcomes for this subgroup. Furthermore, the authors propose conducting a comparative study between task-specific training and game-based training to determine which approach is more effective in rehabilitating PD patients.

## Conclusion

This study concludes that task-specific training has a substantial positive impact on PD patients. It significantly enhances functional balance, leading to improved independence in performing daily living activities. Furthermore, the training regimen effectively reduces the patients' fear of falling, addressing a common concern of PD patients. These findings highlight the potential of task-specific training as a valuable intervention to enhance the overall quality of life for PD patients and minimize the risks associated with falls.

**ISRB approval:** This research work has been approved by the ISRB committee.

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Original Article

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# Effect of Vagal Nerve Stimulation on Swallowing in Subjects with Post Stroke Dysphagia

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**Abstract**

**Background:** The study was developed to find the effect of auricular transcutaneous vagal nerve stimulation on difficulty in swallowing in post stroke dysphagia.

**Purpose:** The purpose of this research is to extensively investigate and analyse how VNS impacts swallowing in people with post-stroke dysphagia**.**

**Materials and Methods**: A total, 30 individuals have been selected mainly according to the criteria of both the inclusion and exclusion, from the above-mentioned study setting. The study was explained to subjects and written consent was collected from all subjects prior to the initiation of procedure. The subjects included the study was randomly allocated into 2 groups The participants in group A will receive Transcutaneous auricular vagal nerve stimulation, which is given for 20 min with the frequency of about 25 Hz, amplitude: 1 mA, pulse width: 360 μs using clip electrode being placed in Cymba Concha, along with the conventional exercises and Group B will receive Neuromuscular electrical stimulation will be given as Interrupted direct current at 30 Hz for 100ms, and the intensity was increased until perceptible visible contraction.

**Results**: Auricular transcutaneous vagal nerve stimulation showed a significant effect in improving swallowing functions at 4 weeks, with a p value which is < 0.001.

**Conclusion:** This study showed that the transcutaneous auricular vagal nerve stimulation showed a positive effect in improving swallowing functions in patients with dysphagia.

**Keywords:** Dysphagia, swallowing dysfunction, Transcutaneous auricular vagal nerve stimulation, Functional oral intake scale, Dysphagia outcome and severity scale.

## Introduction

A stroke is a medical emergency caused by an abrupt disruption of continuous blood flow to the brain. When a blood vessel in the brain becomes blocked or restricted, or when one bursts and flows blood into the brain, a stroke occurs. A stroke, like a heart attack, requires quick medical intervention[1]. Stroke is the world's second leading cause of

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death, mainly among the elderly[2]. In 2016, 80.1 million people worldwide had a stroke (95 percent confidence interval: 74.1–86.3), with 41.1 (38.0–44.3) million women and 39.0 (36.1–42.1) million males[3]. Cerebrovascular diseases (CVD) are on the rise in India, owing to the rapid escalation of risk factors like high BP, diabetes mellitus, smoking, and obesity, which impact a large proportion of the adults. Global Burden of Disease study says that stroke caused 619,000 deaths in India, with 28.5 million Disability Adjusted Life Years lost, underscoring the fact that CVD causes significant mortality and morbidity[4]. The most commonly affected artery in acute stroke is the middle cerebral artery. It has four primary branches that branch straight from the internal carotid artery: the M1, the M2, the M3, and the M4. The lobes of the brain, and deeper structures involving the internal capsule, caudate nucleus and thalamus, receive blood from these veins. Because of its extensive supply, stroke occurring in the MCA region can present with a wide range of symptoms, occurring based on the branches and structures being injured[5]. Patients who suffer from a stroke are prone to many complications. Comorbid diseases including hypertension, diabetes, heart disease, or other illnesses are frequently present in these people, which raises the possibility of systemic medical issues during the recovery from a stroke. However, a number of difficulties may develop as a direct result of the brain injury itself, from the following impairments or immobility, or from stroke related treatments. These incidents frequently obstruct neurological rehabilitation in stroke patients and have a significant impact on their final prognosis. Following a stroke, cardiac problems, pneumonias, venous thromboembolism, fever, discomfort, dysphagia, incontinence, and depression are extremely common and mostly require for specialized therapies for their prevention and treatment. The need of this study is to look at the possible impact of Vagal Nerve Stimulation on swallowing function among individuals who have post-stroke dysphagia. We require to gain useful insights into the safety, effectiveness, and utility of this innovative treatment intervention as a rehabilitative tool for dysphagic patients by examining its effects. The goals of this study are differed. In the beginning, we want to see how Vagal Nerve Stimulation affects swallowing physiology in the short and long-term using clinical tests, imaging modalities, and patient-reported outcomes. Second, we want to understand the underlying neuronal processes by tracking changes in brain activity with functional imaging modalities like fMRI or EEG. Dysphagia is a dysfunction of the complex and interconnected sensorimotor system. Since there is an increased risk of aspiration pneumonia and its complications, neurogenic dysphagia (ND) is association with substantial morbidity, mortality, and social costs in subjects with neurological illnesses of various etiologies. Dysphagia, or difficulty in swallowing, is a commonest complication of acute stroke, with a frequency as high as 47 percent. In different neurological diseases, an irregular pattern of swallowing or flow of bolus disturbance from the mouth to the oesophagus is a major concern. One of the first barriers on the road to recovery for the wide majority around the 6.2 million post-stroke survivors in the United States is swallowing difficulties. After a stroke, dysphagia which is only increasing morbidity and mortality, which also had a major effect on quality of life. After a stroke, dysphagia may be caused by a wide range of complications. In a study, 19% patients of dysphagia developed bronchopneumonia which is compared to 8% of population those without the dysphagia; however, this difference which did not have statistical significance. Aspiration of food/saliva may result in an infection of the chest. Dehydration may also be a problem for patients. After a stroke, nutritional status declines, however it is unresolved whether this is related to problems with swallowing. Dysphagia could be an independent indication of a poor prognosis following a stroke. Although dysphagia was not taken into account as an independent variable in the research, it is known that it increases mortality in people with clinically identifiable swallowing problems[6-8]. Vagal nerve stimulation is a well-known treatment option for a wide range of neurological conditions. Because of the low danger of side effects, it's also effective in clinical trials for a variety of illnesses. Non-invasive transcutaneous vagal nerve stimulation includes transcutaneous auricular vagal nerve stimulation (taVNS) and cervical transcutaneous vagal nerve stimulation. The vagus nerve transmits afferent and efferent nerve impulses that is associated with swallowing. The locus coeruleus and the nucleus

tractus solitarii are activated when the vagus nerve is stimulated in the cavum concha, according to a systematic study. The Nucleus tractus solitarii, along with its adjacent structure of reticular origin and nucleus suspicion in the medulla oblongata that is present ventrally, is the swallowing reflex's central pattern generator and is the primary target of VNS[9]. FOSS is a scale that assesses functional outcomes. The FOIS is a statistically verified food and liquid intake scale for patients with stroke. It is often used to analyse the functional oral intake of post stroke patients with dysphagia. The swallowing results were classified into seven levels (scores 1–7). Tubes are required for levels 1–3. On a scale of 1 to 7, total oral consumption is measured. For the therapist, it is easy, clear, and effective. The Dysphagia Outcome and Severity Scale is a scale with 7 score that was established to rate the functional difficulty of dysphagia depending on objective assessment and give suggestions for independence level, diet level, and nutrition type[10].

## AIM

The study is aimed to find the effect of Transcutaneous auricular vagal nerve stimulation on difficulty in swallowing in post stroke dysphagia.

## Materials and Methods

**Study design**: Experimental study.

**Subjects**: Subjects were selected from Saveetha medical college and hospital.

**Sampling technique**: Concealed envelope method

**Study Duration:** The collection of data began in January 2023, and treatment sessions began in February 2023 for four weeks.

**Sample size**: 30

**Inclusion criteria**:

- Subjects of all age.
- Subjects of both genders.
- Subjects with the history of post-stroke with swallowing difficulty
- Subjects who score 3 and less than 3 in FOIS scale
- Subjects who score less than 3 in DOSS scale.

**Exclusion criteria**:

- Subject with swallowing difficulty caused by any other neurological disorders
- Subjects who are not interested in participating in this study
- Subjects with psychological disorders.
- Subjects with skin allergies
- Trauma that occurred recently
- Unstable vitals
- Recent surgeries involving the neck and adjacent structures.
- Symptomatic cardiovascular diseases

**Outcome measure:**

FOIS:

The Functional Oral Intake Scale is a statistically verified food and liquid intake scale for patients with stroke. It is often used to measure the oral intake functionally of poststroke patients having dysphagia. The swallowing results were classified into seven levels (scores 1–7). Tubes are required for levels 1–3. On a scale of 1 to 7, total oral consumption is measured. For the therapist, it is easy, clear, and effective.

DOSS: The Dysphagia Outcome and Severity Scale is a scale with points of 7 that was established to rate the difficulty in functional component of dysphagia depending on assessment and give suggestions for independence level, diet level, and nutrition type.

**Procedure**

The subjects were divided into 2 groups. Both the groups received the treatment protocol for around 4 weeks. The participants in group A received Transcutaneous auricular vagal nerve stimulation for 20 min in the frequency of 25 Hz, amplitude: 1 mA, pulse width: 360 μs using clip electrode being placed in Cymba Concha, along with the conventional exercises and Group B received NMES which was given as Interrupted direct current at 30 Hz for 100ms, and the intensity was increased until perceptible visible contraction. The patient was in a supine position with a pillow beneath his head. Inactive electrodes were implanted at the nape of the neck, while active pen electrodes were put on either side of the hyoid bone in the pharyngeal muscles along with the conventional exercises.

**Data analysis**

Statistical analysis was done on an Intention to treat the swallowing difficulty after the stroke. Pre and post-test values for FOIS and DOSS were noted. Wilcoxon signed-rank (non-parametric) test was used for within group analysis and Mann Whitney was used for across group analysis.

**Table 1: Pre and Post-test values of Group A obtained using FOIS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

| TEST | MEAN | SD | W value | Z value | P value |
|---|---|---|---|---|---|
| PRE-TEST | 3 | 1 | 120 | 3.462 | <0.001 |
| POST-TEST | 6 | 5 | | | |

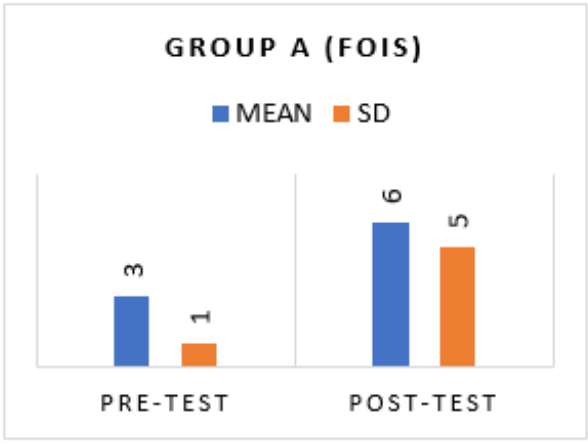



**Fig 1: Pre and Post-test values of Group A obtained using FOIS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

**Table 2: Pre and Post-test values of Group B obtained using FOIS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

| TEST | MEAN | SD | W value | Z value | P value |
|---|---|---|---|---|---|
| PRE-TEST | 3 | 1 | 120 | 3.542 | <0.001 |
| POST-TEST | 5 | 4 | | | |

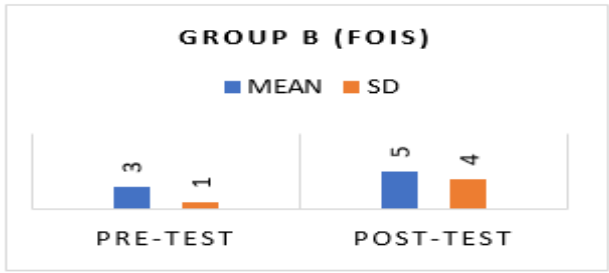



**Fig 2: Pre and Post-test values of Group B obtained using FOIS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

**Table 3: Post-test values of Group A and B obtained using FOIS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

| GROUP | MEAN | SD | T value | p value |
|---|---|---|---|---|
| GROUP-A | 6 | 5 | 294 | <0.008 |
| GROUP-B | 5 | 4 | | |

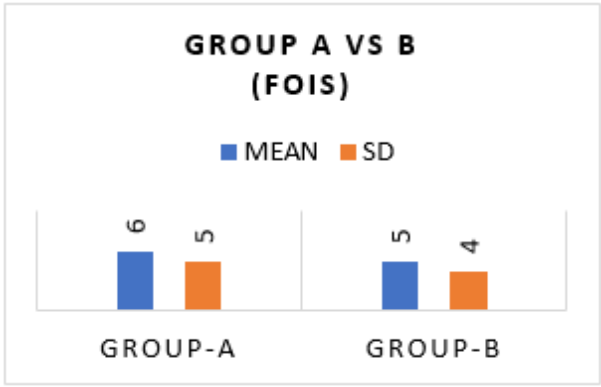



**Fig 3: Post-test values of Group A and B obtained using FOIS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

**Table 4: Pre and Post-test values of Group A and B obtained using DOSS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation**

| TEST | MEAN | SD | W value | Z value | P value |
|---|---|---|---|---|---|
| PRE-TEST | 2 | 1 | 120 | 3.460 | <0.001 |
| POST-TEST | 6 | 5 | | | |

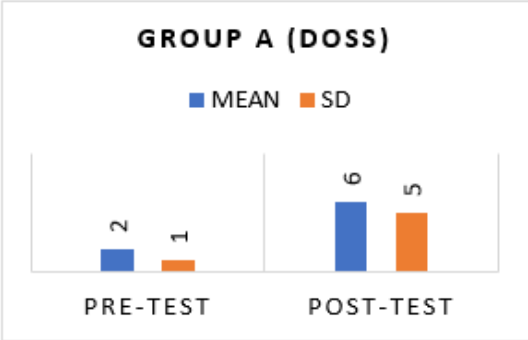



**Fig 4: Pre and Post-test values of Group A and B obtained using DOSS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

**Table 5: Pre and Post-test values of Group B obtained using DOSS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

| GROUP | MEAN | SD | T value | p value |
|---|---|---|---|---|
| GROUP-A | 6 | 5 | 308.5 | <0.001 |
| GROUP-B | 5 | 4 | | |

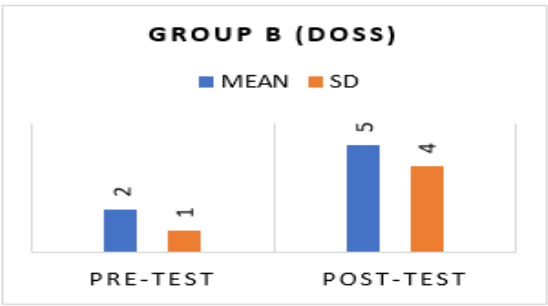



**Fig 5: Pre and Post-test values of Group B obtained using DOSS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

**Table 6: Post-test values of Group A and B obtained using DOSS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

| TEST | MEAN | SD | W value | Z value | P value |
|---|---|---|---|---|---|
| PRE-TEST | 2 | 1 | 120 | 3.473 | <0.001 |
| POST-TEST | 5 | 4 | | | |

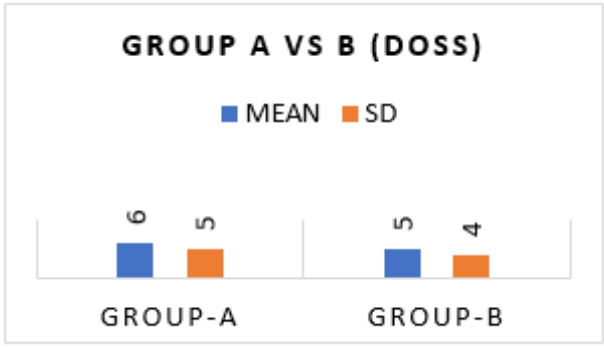



**Fig 6: Post-test values of Group A and B obtained using DOSS, indicating the improvement in swallowing functions by transcutaneous vagal nerve stimulation.**

## Results

In this study, we analysed the effect of transcutaneous auricular vagal nerve stimulation on swallowing difficulty in post-stroke dysphagia patients. Transcutaneous auricular vagal nerve stimulation showed a significant effect in improving swallowing functions at 4 weeks, with a p value which is < 0.001. There was an improvement in swallowing functions in both the groups, after receiving the treatment for 4 weeks. The improvement of swallowing functions in Group A (experimental group) and Group B (control group) has been analysed using Wilcoxon signed rank test, both of which showed a significance in improving swallowing functions (TABLE 1 and TABLE 4).

Group B (control group), also showed a considerable improvement in improving the swallowing functions in subjects with dysphagia, was analysed using FOIS and DOSS and level of significance were calculated and tabulated (TABLE 2 and 5).

Post-test values of both the group which was obtained using FOIS and DOSS were analysed using Mann Whitney U test and were tabulated, it showed that transcutaneous auricular vagal nerve stimulation was more effective than the conventional therapy in improving the swallowing functions in patients with Dysphagia (TABLE 3 and 6).

## Discussion

The goal of the study was to determine the effect of transcutaneous auricular vagal nerve stimulation on

swallowing dysfunction in patients with dysphagia. Dysphagia has a considerable negative impact on QOL in addition to increasing morbidity and mortality following a stroke. Aspiration pneumonia is the second-most feared complication of dysphagia after stroke. The frequency of lung infection increased by 17% when dysphagia was discovered on bedside clinical examination[11]. Although most patients with post-stroke dysphagia recover on their own, it persists in certain patients, which has an impact on their QOL. Thus, there are certain treatment techniques used to overcome the post stroke dysphagia. Both compensatory and rehabilitative strategies are used in dysphagia treatment. While compensatory measures are adapted to bring down dysphagia symptoms without changing the function, rehabilitative methods are framed to improve the physiology of swallowing, increase swallow risk, and increase tolerance for the less restrictive diet[12].

Subjects with cerebral infarction and swallowing difficulty received NMES treatment, a day for 20minute with intervals of 3 seconds for the period of 12 days with a intensity of 28 mA and pulse width of 800 ms, with a a two-day break and then other 12-day treatment, according to Yanfang Zenga's investigation[13]. F Marrosu in 2007 carried out the investigation with multiple sclerosis patients and found that improvement is believed to be VNS related since the NTS, the primary brainstem, visceral component of the vagus, is involved in modifying CPGs associated to the swallowing and olive complex pathway. The data collected point to another therapeutic use for VNS and could signify a unique approach to treating patients with advanced MS[14].

While there are certain studies suggesting about the adverse effects of the invasive method of vagal nerve stimulation, Hoarseness, voice changes, dyspnea, cough, throat discomfort, neck pain and tingling and twitching in the neck muscles, headache, dysphagia and chest pain are common AE along with VNS activation. Most of VNS adverse effects were observed during the stimulations on phase and appear to be dose-dependent, making it possible to lessen them by carefully adjusting the VNS parameters[15]. Thus, we made a try to overcome all this drawback by choosing a non-invasive method of stimulation of vagus nerve by transcutaneous auricular method with TENS 7000.

In 2018, A. Kumaresan conducted a quasi-experimental study in which A total of 30 post-stroke dysphagic subjects were chosen for a EMG examination of the masseter, submental, and infrahyoid muscles. For four weeks, neuromuscular electrical stimulation was applied to the Pharyngeal muscles. The values were collated and statistically examined at the last day of the fourth week after the test. He concluded that in terms of amplitude, neuromuscular electrical stimulation has a more positive effect on swallowing muscle activation in post-stroke dysphagia[18].

## Conclusion

To conclude, the Vagus nerve plays a significant role in post-stroke patients with Dysphagia by providing a significant improvement on application of transcutaneous auricular vagal nerve stimulation for 4 weeks.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 01/024/2022/ISRB/PGSR/SCPT).

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**Conflict of interest:** The authors report no conflict of interest.

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Original Article

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# Effectiveness of Low Level Laser Therapy and Low Intensity Pulsed Ultrasound on Neuropathic Pain among the Experimentally Induced Peripheral Nerve Injury in Rat Model

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**Abstract**

**Background**: Peripheral nerve injury creates an impact on the inflammatory process, leading to an elevation in Hypoxia-inducible factor-1 alpha levels, which contributes to the development and progression of neuropathic pain. An innovative approach to alleviating neuropathic pain involves targeting inflammation.

**Purpose**: This study aims to compare the effect of Low-Level Laser Therapy (LLLT) and Low-Intensity Pulsed Ultrasound (LIPUS) on neuropathic pain among the experimentally induced peripheral nerve injury in rat model.

**Methods**: Rats with induced sciatic nerve crush injury were randomly divided into three groups: control, LIPUS treatment, and LLLT treatment. Mechanical paw withdrawal threshold analysis was performed before the injury and from POD 2nd, 7th, 14th, and 21st to assess effectiveness of the treatment.

**Result**: Low-Level Laser Therapy (LLLT) group showing statistically greater improvement on POD 14 and 21 compared to both the LIPUS group and the control group in terms of paw withdrawal threshold measurements among rats with crush-induced neuropathic pain ($P < 0.001$).

**Conclusion:** This study found that the use of LLLT has a beneficial effect in the management of neuropathic pain and control of analgesia compared to LIPUS by inhibiting the upregulation of HIF-1α synthesis during ischemia, hypoxia, and inflammation. However further studies are recommended to analyze long term results in larger sample to control neuropathic pain

**Key Words**: Injury, Inflammation, Laser, Ultrasound, Rats, Sciatic nerve

## Introduction

Trauma to the peripheral nerve induces inflammation leading to neuropathic pain which is commonly perceived in the skin that is innervated by

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the inflamed peripheral nerve[1]. Following the nerve injury there will be a phenomenon known as action potential that is ectopic and nerve hyper excitability. Injured nerve provides changes in both structural and functional actions[2]. One of the significant changes is generation of abnormal action potential in the location where they are not intended to produce. These abnormal action potential leads to pain signals that are spontaneously carried to brain even there is no external stimulus. Another significant change is hyper excitability of the injured nerve. After injury nerve becomes more vulnerable and responsive even to mild stimulus leads to constant painful sensation[3].

Degeneration of axon due to degradation of myelin, proliferation of glial cell, compromise of blood-nerve barrier, permeation and proliferation of macrophages are all symptoms of the complex process known as Wallerian degeneration, which is brought on by metabolic processes or mechanical damage to peripheral nerves. Macrophages emits cytokines and other substances that influence myelin phagocytosis, Low level laser therapy has gained popularity because of its positive effects on arthritis, neuropathic pain and nerve regenerating effects[4,18]. Hypoxia inducible factor-1α are produced whenever oxygen is lacking resulting in ischemic environment or during inflammation. It is necessary to maintain the process of inflammation by enhancing the proinflammatory cytokines secretion such as IL-1b and TNF. It is helpful in carrying out the pathway of inflammation. Inhibiting the hypoxic state and downregulating the inflammatory effects are useful strategies in order to prevent neuropathic pain[5].

HIF-1α is an essential molecule that controls the development of proteins involved in oxygen regulation and cellular survival, enabling cells to become adapted to low-oxygen environments. It is a key target for therapeutic approaches since its abnormal function has been linked to numerous illnesses[6]. Low Level Laser Therapy (LLLT) showed positive effects on chromatolysis, a process that occurs after trauma and motor neuron degeneration. In rat sciatic nerves that have been crushed, the severity of chromatolysis was reduced. The molecular basis of LLLT's action involves the increased synthesis of several molecules with neuroprotective properties, such as calcitonin gene-related neuropeptide and transforming growth factor beta-1. Additionally, LLLT demonstrated decreased nitric oxide activity, which is a neurotoxic compound. LLLT has the potential to promote nerve repair and neuroprotection by modulating various molecular pathways involved in nerve regeneration and protection against neurotoxicity. It is also helpful in decreasing neuropathic inflammation by inhibiting the secretion of HIF-1α[7, 18]. Low intensity pulsed ultrasound proved its biological effects by promoting the production of certain cytokines consisting of angiogenesis, as well as anti-inflammatory cytokines and other components involved in tissue healing[20]. This suggests that it has beneficial effects on pain relief and tissue healing may be mediated, at least in part, through its modulation of these cytokines and healing factors in the treated area[8, 19].

## Aim

The study aimed to assess the effects of low-level laser therapy and low-intensity pulse ultrasound on neuropathic pain in crush injured rats.

## Material and Methods

**Study Design**: Experimental design.

**Study Period:** This study carried out between February 2023 and May 2023.

**Sample**: The study involved 18 male Wistar rats from Mass Biotech (Chengalpattu).

**Inclusion Criteria**

- Wistar rats
- Adult age group
- Healthy rats without the sign of illness or distress
- Average of 250grams

**Exclusion Criteria**

- Physically deformed rats
- Aggressive rats,
- Previous Experimental Exposed rats
- Signs of wound infection

**Materials Used**

- Laser: Provided by TECHNOMED ELECTRONICS.

- Ultrasound: Provided by RAPOSTIM MEDI TECH.
- Monofilament.

**Quarantine and Housing:** The rats were quarantined for 7 days in a controlled room with a temperature and a light/dark cycle of 12 hours. Three rodents were housed in single cages. The rats were provided with water and pelleted feed during the study.

**Surgical Procedure**

During the study, rat surgery was conducted under anesthesia with ketamine hydrochloride (70mg/kg) and xylazine hydrochloride (10mg/kg). The rats were placed in a ventral recumbency position, and a 3cm incision was made on the skin to expose the right sciatic nerve, which was then crushed for 30 seconds using hemostatic tweezers with a force of 54 N, resulting in a 3mm long crush injury[9]. The surgical site was closed with silicon 3/0 thread, and the rats were placed in individual cages. To manage post-operative pain, a single subcutaneous dose of meloxicam (1mg/kg) was administered (Figure 1).



**Fig-1: Exposure of sciatic nerve**

**Outcome measures**

**Mechanical paw withdrawal threshold:** The mechanical withdrawal threshold of rats is assessed using Von Frey filament on POD 7, 14, 21. Rats response to mechanical stimuli is observed in the present study. Rats were placed on the metal mesh plate (40x40cm dimension) and nine filaments (1.0, 1.4, 2.0, 4.0, 6.0, 8.0, 10.0, 15.0, 26.0 g) were used to apply perpendicularly to the hind paws on the plantar surface for 3 to 5 seconds until the filament bend to S shape. Stimulation is initiated on 1g filament, and if no withdrawal response is observed, next filament is used, until the rat shows a withdrawal response. The response might be escaping, shaking, licking, squeaking. When there is no withdrawal response shown by the rat, the estimated threshold for a rat is 26g, considering the study's sensitivity[10, 21].

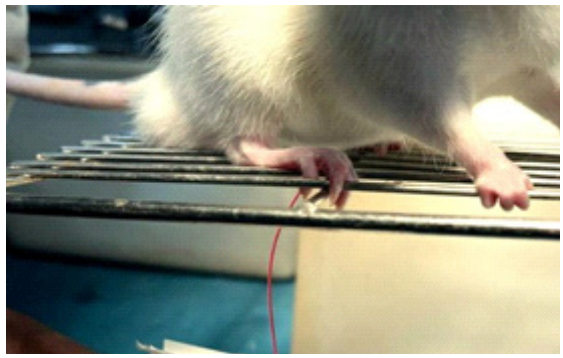


**Fig 2: Represents application of filament to the plantar surface of the hind paw**

**Grouping:** In the study, rats with induced crush injuries were divided into three groups: control group, LIPUS group, and LLLT group. Neuropathic pain was evaluated using mechanical paw withdrawal threshold test. The treatment protocols were followed until POD 21 for all three groups.

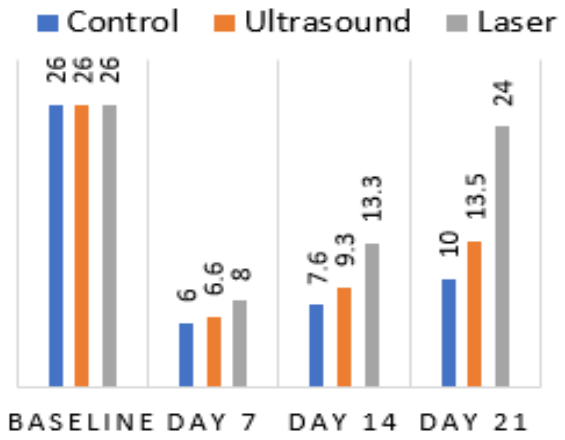
1. Control Group: Rats in this group received no specific treatment after the crush injury was induced.

2. Low-Intensity Pulsed Ultrasound (LIPUS) Group: Rats were positioned right laterally, and treatment began on Postoperative Day 2 (POD 2) using the water bag technique. Ultrasound with a frequency of 1MHz and power density of 1.4 W/cm² was applied in a pulsed mode using a finger probe. The treatment was given for 4 minutes per day on alternate days until POD 21

3. Low-Level Laser Therapy (LLLT) Group: Rats were treated with Gallium Arsenide laser therapy using a red infrared beam with a wavelength of 808nm. The laser was applied in continuous mode with a power of 200mW and energy density of 3J/cm². The beam area had a length and width of 1cm, and the tissue depth of treatment was 1cm. The treatment duration was 1 minute, applied in a grid method. Treatment started on POD 2 and continued until POD 21, with the laser beam applied perpendicular to the treatment area for 1 minute.

**Data analysis**

The study presented data as mean ± standard deviation and Repeated Measures ANOVA followed by Bonferroni t-test has been used and analyzed in SPSS, Significance threshold of P value < 0.05 is considered significant.




**Graph 1: X-axis shows quantification of pain on baseline, POD 7, 14, 21 and Y-axis shows varied thickness of Von Frey filament in grams.**

## Results

**Impact of LLLT & LIPUS on Mechanical Allodynia:**

In mechanical paw withdrawal threshold, baseline measurements between the groups has no significant difference. On 7$^{th}$ POD, threshold has been found to be decreased in crush injured rats, reduction in the withdrawal threshold has been found in CCI rats, which indicates that the mechanical allodynia is present, it is one of the neuropathic pain type where a stimulus which is nonpainful provides exaggerated pain response. After the intervention, threshold has been increased in both the LLLT group and LIPUS group on 14$^{th}$ & 21$^{st}$ POD. Repeated-measures ANOVA has been used for statistical analysis.

Following ANOVA multiple group comparison at one particular point was done using Bonferroni t-test. In LLLT all the multiple comparison procedure showed statistically significant result of p value <0.001 with a mean difference between baseline vs POD 7 is 18, baseline vs POD 14 is 12.66, baseline vs POD 21 is 1.83, POD 21 vs POD7 is 16.16, POD21 vs POD14 is 10.833, POD14 vs POD7 is 5.33.

LIPUS also showed statistically significant result with p value of <0.001 in multiple comparison procedure with a mean difference between baseline vs POD7 is 19.33, baseline vs POD 14 is 16.33, baseline vs POD 21 is 12, POD 21 vs POD 7 is 7.33, POD 21 vs POD 14 is 4.33, POD 14 vs POD 7 is 3.

In control group, mean difference of multiple comparison between baseline vs POD7 is 20, baseline vs POD 14 is 18.66, baseline vs POD21 is 16, POD 21 vs POD 7 is 4, POD 21 vs POD 14 is 2.66 showed significant result of p value <0.001. However, mean difference between POD 14 vs POD 7 is 1.33 showed a non-significant p value of 0.182

Intervention groups showed significantly effective results, however low level laser therapy group showed statistically more improvement than the LIPUS group & control group in paw withdrawal threshold measurements among crush injured rats for neuropathic pain (P < 0.001) (graph 1).

## Discussion

The current research offers compelling evidence supporting the positive impact of laser irradiation and ultrasound therapy on neuropathic pain. These treatments demonstrate the ability to reduce inflammation, stimulate tissue regeneration, and influence biochemical reactions such as HIF-1α and proinflammatory cytokines, all of which contribute to their beneficial effects. In the later stages of the experiment, behavioural changes can indicate allodynia, which is experiencing pain from non-painful stimuli. Researchers efficiently identified these changes by measuring withdrawal thresholds using von Frey filaments. On day 7, it was not able to differentiate between the two groups. On the other hand, gait analysis demonstrated high specificity and successfully detected differences between the two groups at earlier time points in the study[21].

Many studies revealed that pro-inflammatory cytokines were elevated following CCI, but their overexpression was significantly reduced by LLLT. Numerous treatments have been developed to prevent or manage neuropathies, as they can significantly impact patients' social, economic, and medical well-being. LLLT has recently got popularity in various medical and rehabilitation fields and is

being explored as a potential option for neuropathic pain (NP) management. Based on the results of previous study, LLLT appears to reduce DRG glial cell activation, inhibit CCI-induced behavioral hypersensitivity, and suppress pro-inflammatory cytokines. The study's authors hypothesize that glial cell involvement may be one potential mechanism behind these beneficial effects of LLLT in neuropathic pain[11]. Another study stated that LLLT may impact HIF-1a activity and could be a cutting-edge and practical therapeutic approach to reducing hypoxia in tissue, ischemic process and inflammatory processes thereby inhibiting neuropathic pain as well as promoting nerve regeneration[12]. Previous research found that in order to improve neural function, LLLT is highly helpful by elevating the level of VEGF protein and NGF, thereby repairing the myelin sheath among injured nerve tissues[16]. According to MonteRaso et al., LIPUS ultrasound is believed to primarily affect the tissues supporting axons. It accelerates neural tube regeneration and facilitates the early removal of barriers that may impede the formation of new axoplasm. By promoting a conducive environment for nerve regeneration, LIPUS can contribute to the overall recovery and restoration of nerve function[13,17]. Another study stated that the antinociceptive effect of LIPUS is believed to have a biophysical basis, as neither a placebo effect nor an impact arising solely from massage was observed. This suggests that the pain relief seen in the rats after LIPUS treatment is not due to psychological factors or general physical manipulation but is likely a result of the specific biophysical effects of LIPUS on the cells and mediators involved in pain modulation[14,15]. Although all clinical trials demonstrated the effectiveness of LLLT in managing neuropathic pain, there were discrepancies regarding the application parameters. In conclusion, the study revealed that LLLT has positive benefits in alleviating neuropathic pain, but further research with rigorous scientific methodologies is necessary to develop treatment protocols that can fully capitalize on the effects of LLLT & LIPUS in neuropathic pain management.

## Conclusion

The study's conclusion highlights that low level laser therapy (LLLT) provides more beneficial effects compared to low intensity pulsed ultrasound in altering the inflammatory process at the injury site, promoting tissue healing, and reducing neuropathic pain in crush injured nerves. However, the researchers recommend further studies to analyze the long-term results using larger sample sizes to ensure the treatment's efficacy and safety.

**Ethical clearance:** The study commencement took place after receiving approval from the Institute Animal Ethics Committee (IAEC) with the reference number

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Original Article

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# Effect of Vagal Nerve Stimulation on Anxiety and Sleep Disturbances among Geriatric Population: A Pilot Study

**Sakthi. R[1], Vignesh Srinivasan[2], Prathap Suganthirababu[3], Priyadharshini Kumar[4], Dhanusia S[5], Kumaresan A[6], Surya Vishnuram[7]**

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**Abstract**

**Background**: Anxiety during the COVID-19 pandemic has been a significant concern for people of all age groups, including geriatric individuals. The elderly population has faced unique challenges during this time, which can contribute to increased anxiety levels. The uncertainty and fear surrounding the pandemic can lead to increased anxiety and stress, which can negatively impact sleep quality and duration.

**Purpose:** The aim of this study is to find out the effect of vagal nerve stimulation on anxiety and sleep disturbances among geriatric population.

**Methodology:** Using the Purposive Sampling method, a total of 20 individuals were chosen based on the inclusion and exclusion criteria. The participants were divided into two groups using the closed envelope method, and they took part in therapy sessions lasting 30 minutes, three times per week for a period of four weeks. The control group received Jacobson's progressive relaxation technique, whereas the experimental group received non-invasive Transcutaneous auricular vagal nerve stimulation.

**Result:** With a p value of 0.001, transcutaneous auricular vagal nerve activation significantly improved sleep quality and reduced anxiety after 4 weeks.

**Conclusion:** Study showed that transcutaneous vagal nerve stimulation was effective in reducing Anxiety and improving sleep quality in geriatric population.

**Key Words:** Anxiety, insomnia, geriatrics, covid-19

## Introduction

Anxiety during the COVID-19 pandemic is a very common and understandable response to the challenging and uncertain circumstances that many people have been facing. The pandemic has brought significant changes to daily life, including concerns about health, economic hardships, social isolation, and disruptions to routines. Psychopathology could be brought on by immune system disruption brought on by an infection, and psychiatric aftereffects have been noted following prior coronavirus outbreaks. High-burden non-communicable illnesses including PTSD,

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major anxiety, and mood disorders are all linked to years of living with a disability. We recommend in light of the troubling effects experienced by COVID-19 survivors, there is a growing focus on advancing research related to inflammatory biomarkers. This research aims to aid in the diagnosis and treatment of emerging psychiatric conditions that may arise as a consequence of the virus. Assessing the psychological disorder of COVID-19 infection on psychological wellness, current insights on irritation in mental health care, and the current observation that worse inflammation results in worse depression[1].

The aged are a group of people who are vulnerable to all three: physical, emotional, social, and financial difficulties. Therefore, staying inside and avoiding social interaction for several months straight is one of the world's recommended treatments for them. Loneliness is a real risk factor for health and wellbeing[2].

The first group to leave interactions in our country as a technological step within the context of isolation measures was people over the age of 65 and those with chronic diseases, who were seen as being at high risk of mortality due to "immunosenescence," which is known as immunodeficient status developing due to aging[3].

The elderly may be one of the most vulnerable groups of people during the lockdown. Older people typically display many changes in their sleep patterns as a result of the physiological process of aging. During the pandemic emergency, stress levels rose, and people's symptoms of anxiety and depression were exacerbated. According to several research, younger people experience higher levels of anxiety, depression, and stressful situations[4].

Elderly people frequently experience chronic sleep issues. For a restful sleep, an individual must get enough total sleep time and sleep that is in harmony with their circadian cycle. More than half of senior individuals encounter at least one recurring sleep problem. In primary healthcare settings, chronic sleep issues such as insomnia and excessive daytime sleepiness are commonly observed[5].

For the elderly, loneliness is a big risk factor that can compound their issues. For the elderly, things got harder when COVID-19 began. More harm is looming in their future as a result of the COVID-19 epidemic, the ambiguity around the disease's dimensions, and the biological effects of aging[6].

During this pandemic, sleep issues like insomnia, diminished sleep, and poor sleep quality have been a common complaint. It is crucial to comprehend if these issues grew worse throughout the pandemic because sleep disorders and complaints related to sleep affect the elderly frequently in a range of twenty percent to fifty percent around the world[7].

Different methods and strategies are used in anxiety management to deal with and lessen anxious sensations. Due to safety and tolerability concerns, tricyclic antidepressants are typically used as second-line treatments for anxiety disorders despite having adequate efficacy data. These medications have the benefit of acting quickly. Sleep management are there was some advice for all. The Academy advised managing anxiety and stress through journaling and talks and post emotional content on social media, Practice good habits, such as frequent exercise. Health care professionals were advised to let their coworkers or supervisor know if they needed a little nap after a long shift. The Academy recommended CBT as the initial therapy option for a sleeping disorder with considerable daytime functioning due to its proven efficacy and lack of side effects[8].

This study mainly concentrates on vagus nerve, through its input and efferent channels, the vagus nerve, a significant part of the nervous system that controls emotions, regulates metabolic balance and is crucial for the neuro-endocrine-immune axis, which helps to maintain homeostasis[9]. Many studies have been done through invasive method. Hence, the study aim is to find out the effect of vagal nerve stimulation on anxiety and sleep disturbances among geriatric population.

## Aim

To determine the effect of vagal nerve stimulation on anxiety and sleep disturbances among geriatric population.

## Material and Methods

The research project was designed as a pilot study with the primary aim of exploring the effectiveness

of transcutaneous auricular vagal nerve stimulation (a non-invasive procedure) in reducing anxiety and enhancing sleep quality among geriatric participants. This pilot study was conducted in a private hospital in Chennai. Before commencing the research, the study was ethically approved by a Scientific Study Board and followed all necessary regulations and ethical guidelines a rigorous review by the Scientific Study Board of a private college. The study was assigned the approval number 01/026/2022/ISRB/PGSR/SCPT.

Before enrolling in the study, each participant's informed consent was obtained, and the study employed a double-blind design to enhance the validity of its findings. The study was conducted from January 2023 To February 2023 .

**Inclusion criteria**

- Participants with both geriatric genders.
- Age group: 60 and above years.
- Participants with a pre-test of anxiety who scores more than 17 in generalized anxiety scale 7.
- Participants with a pre-test of anxiety who scores more than 17 in insomnia severity scale.

**Exclusion criteria**

- History of various neurological and psychological disorders.
- Lack of interest in participating.

**Outcome measure:** The GAD-7 total score, derived from the seven items, falls within the range of 0 to 21. Scores between 0 and 4 are indicative of minimal anxiety, scores between 5 and 9 suggest mild anxiety, scores between 10 and 14 suggest moderate anxiety, and scores between 15 and 21 indicate severe anxiety[10]. The ISI has been used in numerous research investigations and has been found to be a valid and reliable indicator of the severity of insomnia. Seven things make up the ISI, and each one is evaluated from 0 to 4 on a scale. Higher scores indicate more severe insomnia, with a total score that runs from 0 to 28[11]

**Procedure**

In this study, the participants were divided into 2 groups, referred to as Group A and Group B, using the closed envelope method. Both groups underwent a 4-week intervention involving 30-minute therapy sessions, conducted three days a week. The experimental group received a transcutaneous auricular vagal nerve stimulation. Stimulation is applied to the vagal nerve in the Cymba concha of the left ear by using clip electrodes and lasted for approximately 20 minutes during each session. The stimulation followed an ON-OFF pattern, with 30 seconds of stimulation followed by 5 minutes rest. The frequency was set at 25 Hz, the amplitude at 1 mA, and the pulse width at 330 seconds.

The control group received Jacobson relaxation technique for 20 minutes. At the end of the four-week treatment period, a post-test analysis was conducted to evaluate the effects of the interventions on the participants. The evaluation was performed using two scales: the GAD scale and the ISS scale.

**Data analysis**

Statistical analysis was performed to evaluate the efficacy of a treatment on anxiety and sleep disorders. The study gathered pre- and post-test data for two outcome measures: Generalized Anxiety Disorder (GAD) and Insomnia Severity Index (ISI). The data was analyzed using 2 non-parametric tests: the Wilcoxon Signed Rank Test for within-group comparisons and the Mann-Whitney U Test for between-group differences.

**Table 1: Baseline characteristics of included population.**

| Characteristics | Group A | Group B |
|---|---|---|
| Age (mean ± SD) | 61.7 ± 1.9 | 61.4 ± 1.5 |
| Gender No of male | 6 | 4 |
| No of female | 5 | 5 |
| GAD scale | 14.1± 1.8 | 14.1 ± 1.8 |
| ISS | 14.6± 1.5 | 14.6± 1.5 |

**Table 2: Comparison of intervention group pre and post-test analysis, which were obtained using GAD**

| Outcome | Pre test | Post test | Z Value | P Value |
|---|---|---|---|---|
| | Mean and SD | Mean and SD | | |
| GAD | 12±16 | 8±10.0 | -2.82 | <0.001 |

**Table 3: Comparison of control group pre and post-test analysis, which were obtained using GAD**

| Outcome | Pre- test | Post- test | Z Value | P Value |
|---|---|---|---|---|
| | Mean and SD | Mean and SD | | |
| GAD | 12±16 | 11±14.0 | --2.91 | <0.001 |

Group B (control group), also showed a considerable improvement in reducing anxiety symptoms, revealing a Z value of -2.913and W= -55

**Table 4: Comparison of intervention group pre and post-test analysis, which were obtained using ISS**

| Outcome | Pre- test | Post- test | Z Value | P Value |
|---|---|---|---|---|
| | Mean and SD | Mean and SD | | |
| ISS | 13±16 | 8±10 | -2.82 | <0.001 |

**Table 5: Comparison of control group pre and post-test analysis, which were obtained using ISS**

| Outcome | Pre- test | Post- test | Z Value | P Value |
|---|---|---|---|---|
| | Mean and SD | Mean and SD | | |
| ISS | 13±16 | 11±14 | -2.85 | <0.001 |

**Table 6: Post test analysis of both the group, indicating the difference in improvement of reducing anxiety**

| Outcome | Group A | Group B | t Value | P Value |
|---|---|---|---|---|
| | Mean and SD | Mean and SD | | |
| ISS | 8.0±10 | 11±14.0 | 63 | <0.001 |

**Table 7: Post test analysis of both the group, indicating the difference in improvement of sleep quality**

| Outcome | Group A | Group B | t Value | P Value |
|---|---|---|---|---|
| | Mean and SD | Mean and SD | | |
| ISS | 8.0±10 | 11±14 | 56 | <0.001 |

## Results

The study involved 2 groups, Group A (intervention group) and Group B (control group), each comprised of 10 members. Group A received transcutaneous auricular vagal nerve stimulation, while Group B received Jacobson relaxation technique. The study was conducted over a period of four weeks, starting from February 2023.

Data collection began in January 2023, and all participants remained in their respective groups until the end of the research. To assess the outcomes, the researchers used two scales, these scales were administered as pre-tests to both groups before the therapy began to establish baseline characteristics. After the four-week treatment period, the same scales were used as post-tests to evaluate the changes in anxiety and sleep event impact in both groups. The statistical analysis of the study revealed significant results. For Group A, which received transcutaneous auricular vagal nerve stimulation, the p-value was less than 0.004. This indicates that the combination of treatments had a significant effect on the participants' anxiety levels and improved sleep quality.For Group B, which received only conventional treatment, the statistical analysis also showed a significant p-value of 0.018.

## Discussion

The study aims to explore a novel and non-invasive approach for vagus nerve stimulation (VNS) to alleviate nervousness and sleep problems among the geriatric population. Vagus nerve stimulation is a therapeutic technique that involves the application of electrical impulses to the vagus nerve, a major nerve in the body responsible for various physiological functions, including mood regulation and sleep-wake cycles. During the COVID-19 pandemic, anxiety and sleep problems have been particularly prevalent among geriatric populations. A lack of structured activities may also affect sleep patterns and quality.

In 2021, Subash das, et al., conducted a study anxiety and depression among elder individuals during pandemic, He stated that seventy-five of the participants in the study were in the 60–70 age range, and the majority were men who were married and belonged to nuclear families[12].

In 2022, Umran varli et al., conducted a research on health anxiety in elderly patients and the author concluded that the earlier study that examined data from China found that the hospitalization rate after receiving a COVID-19 diagnosis rose with age, reaching 18 percent for people over the age of 80. The fear of dying and losing something causes older people to worry more about their health and see illnesses as being more serious[13].

In 2021, Qian-qian zhang et al., conducted a study on prevalence of sleep disorders and he concluded that during the epidemic, nearly one in four older Chinese adults experienced symptoms of sleeplessness, routine evaluations of sleeplessness symptoms, and, as needed, psychiatric evaluation and treatment[14].

In 2022, Yating wu et al., conducted a research on vagus nerve stimulation for sleep problems and the author concluded that anxiety and despair are frequently present alongside sleeplessness, and they can also make it worse. It has been demonstrated that emotional improvement can enhance both the quality and quantity of sleep and also he stated that with good safety and great compliance with daily stimulation, the t-VNS treatment also considerably reduced the level of depressive symptoms and anxiety as measured by the HAMD and HAMA scores[15]. The study's limitation and recommendation is that, since it was self-funded, no quantitative analysis, such as a parametric test, was performed. Instead, scales were used to assess the data, and geriatrics were included in the study's population. This paper highlights the significant effects of the COVID-19 on geriatrics. In the future, the population will be examined in greater detail in order to establish the prevalence of anxiety and sleep disorders in the general population.

## Conclusion

In conclusion, our study provides information on how vagal nerve stimulation (VNS) may be utilized as a non-invasive therapeutic method for senior populations during the pandemic to reduce anxiety and improve sleep quality. In conclusion, transcutaneous auricular vagal nerve stimulation for 4 weeks significantly improved the vagal nerve, which plays a vital role in lowering anxiety and sleep disorders.

**Ethical clearance:** An institution and private hospital in Chennai obtained approval from the ISRB committee to undertake human research in accordance with all relevant institutional and national laws. Application01/026/2022/ISRB/PGSR/SCPT.

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Original Article

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# Effect of Vagal Nerve Stimulation on Cognitive Impairment Among Subjects with Anterior Cerebral Artery Syndrome: A Pilot Study

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**Abstract**

**Background:** Cognitive dysfunction, including impairments in attention, memory, executive function, and processing speed. This study was developed to determine the effectiveness of transcutaneous auricular vagal nerve stimulation on cognitive impairment among subjects with anterior cerebral artery syndrome.

**Purpose:** The purpose of the study is to compare and evaluate the effectiveness of two non-pharmacological methods of treatment for cognitive impairment patients with ACA syndrome.

**Material and Methods:** The project was conducted as a pilot study in a private hospital in Chennai. The experimental group (group A) received transcutaneous auricular vagal nerve stimulation for 20 minutes and conventional strengthening exercises for the affected limb for 10 minutes. Group B got conventional cognitive training (20 minutes) and strengthening exercises (10 minutes). Following the four-week treatment, a post-test analysis was performed using the Montreal cognitive assessment scale.

**Results:** The post-test analysis obtained a mean value of about 27.25 and SD 1.5 for group A, whereas group B revealed 22.75 ± 1.25, mean ± SD, and a significant P value of 0.004.

**Conclusion:** Non-invasive transcutaneous auricular vagal nerve stimulation has been proven to be an effective approach for preventing vascular dementia.

**Keywords:** Cognition therapy, vascular dementia, electrical stimulation, nerve stimulation

## Introduction

Cognitive impairment is seen as a step that occurs between healthy aging and brain cell damage[1,2]. Cognition is a mental action or a set of phases including learning, comprehension, and the senses. It also involves high cognitive abilities, such as focus, memory storage, decision-making, planning, judgment, and reasoning[3].

According to data, there is a 1.8 percent incidence of cognitive impairment in senior adults around the age of 60, a 5.1 percent incidence in those around the age of 70, a 15.1 percent risk in those in their 80s, and a 35.7 percent risk in those in their 90s[4–7]. Cognitive impairment is caused by various factors, such as any disease process, hereditary factors, mutations in the genes due to poor lifestyles, and nutrition deficits[8].

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If the frontal lobe is damaged, the patient will have difficulty planning and understanding. Injury to the parietal lobe manifests as a decrease in dressing ability and visual-spatial function. When the temporal lobe is involved, language and memory issues arise[3]. To be more precise, cognitive impairments are seen following an acute ischemic stroke, which is due to atherosclerosis of the large artery. The cognitive decline resulting in dementia following brain infarcts is collectively called multi-infarct dementia[8]. More evidence points to the probability that Alzheimer's disease may emerge as a result of vascular cognitive impairment[9]. Post-stroke cognitive impairment is linked to demographic and vascular origin variables such as age, education, and job[10].

Typical ACA infarct symptoms include changed mental status, verbal fluency issues, incontinence, reduced responsiveness, and a difficulty or desire to communicate[11]. Focus, executive function, memory storage, and visuomotor speed limitations are signs of the gradual cognitive decline caused by cerebrovascular disease[12]. Damage to the brain parenchyma, including hyperintensities of white matter in radiological data and the improper functioning of perforating arterioles, venules, and capillaries, are features of vascular cognitive impairment[13]. It ultimately became clear that a systematic strategy was needed for investigating people with cognitive impairment. The examination, radiological tests, and laboratory testing all contribute to a thorough assessment of cognitive impairment. A diagnosis is made to evaluate the severity of the impairment and the source of the cognitive deficit[4].

The Montreal Cognitive Assessment (MoCA) is a screening exam used to evaluate mild cognitive impairment in the elderly. When compared to another commonly used cognitive evaluation test, two possible benefits of MoCA are the evaluation of execution abilities and the presence of more complex visual building task[14].

The intervention for cognitive impairment is expected to focus on the relationship between neuronal activity/neurovascular coupling and blood vessels, the organization of molecular clearance and leukocyte trafficking, the related macroscopic waste clearance system, and the function of the blood-brain barrier[15]. Non-pharmacological cognitive impairment management aims to address a broad variety of disciplines that improve cognition, behavior, mood, and psychological symptoms. According to authors, treatments are classified into four types: holistic approaches, cognitive methods, alternative approaches, and short psychotherapy[16,17].

Non-pharmacological intervention is found to be more effective than the pharmacological treatment method in treating cognitive decline[18]. Transcutaneous auricular vagal nerve stimulation (taVNS) has been proven to be effective in improving cognition in patients with cognitive impairment. The Food and Drug Association authorized vagus nerve stimulation at the cervical level as a therapy for refractory epilepsy in 1997, and it was approved as a longer-term treatment for refractory depression in 2005[19].

Despite its effectiveness, the surgical strategy of vagal nerve stimulation has significant technical challenges and, as a result, a limited spectrum of usage. As a result, non-invasive vagus nerve stimulation was developed. The two non-invasive treatments employed were stimulating the ear and applying superficially to the cervical nerve[20, 21]. The aim of this study is to determine the effectiveness of transcutaneous auricular vagal nerve stimulation on cognitive impairment in anterior cerebral artery syndrome.

## Aim

To analyze the effect of transcutaneous auricular vagal nerve stimulation on cognitive impairment among subjects with anterior cerebral artery syndrome.

## Material and Methods

The research project was conducted as a pilot study in a private hospital in Chennai to investigate the efficacy of transcutaneous auricular vagal nerve stimulation in improving cognitive abilities in patients with anterior cerebral artery syndrome. A private college's Scientific Study Board approved a human population study in line with all applicable laws and regulations (01/027/2022/ISRB/PGSR/SCPT). Following a thorough description of the procedure, individuals were selected from the private hospital with their signed consent. There was

blinding of both the participant and the evaluated participant involved in this study. The study duration is from January 2023, and treatment sessions began in February 2023 for four weeks.

**Selection criteria:** Eight participants were selected, representing both genders, based on the following eligibility criteria: **Inclusion criteria**:

- Participants with ACA syndrome,
- Participants with a pre-test Montreal cognitive assessment scale score of less than 25, were eligible to participate.

**Exclusion criteria:**

- Participants who had a history of various neurological diseases,
- recent injuries, mental instability,
- lack of interest in participating in the study were excluded.

**Outcome measure:** A fast screening assessment tool, the Montreal Cognitive Screening, was developed to identify MCI in elderly people. MoCA is a 30-point test that can be finished in under 10 minutes and evaluates a number of skills, including execution, short-term recall of memory, visuospatial abilities, focus, concentration, memory of work, language, and time and space orientation. MoCA has a Cronbach's Alpha of 0.715, which indicates strong internal consistency. At a cutoff of 26, the MoCA area under the curve has a sensitivity of 97.8%, a specificity of 67.2%, and a 95% confidence interval of 0.672–0.849 [22].

**Procedure**

The participants were separated into two groups, A and B, using the closed envelope method. Both groups received 30-minute therapy sessions three days a week for four weeks. The experimental group (group A) received transcutaneous auricular vagal nerve stimulation for approximately 20 minutes (30 seconds ON and 5 minutes OFF), with clip electrodes placed on the Cymba concha of the left ear at a frequency of 25 Hz, amplitude: 1 mA, pulse width: 330 s, and conventional strengthening exercises for the affected hemiparetic limb for 10 minutes. Group B got conventional cognitive training (20 minutes) and strengthening exercises (10 minutes). Following the four-week treatment period, a post-test analysis was performed using the Montreal cognitive assessment scale.

**Data analysis**

A statistical analysis was done with the Intention of treating the cognitive impairment after the stroke (ACA syndrome). Pre- and post-test values for MOCA were noted. A paired t-test was used for within-group analysis, and a Mann-Whitney U test was used for between-group analysis.

**Table 1: Baseline characteristics of population included.**

| CHARACTERISTICS | GROUP A | GROUP B |
|---|---|---|
| AGE (mean ± SD) | 43.25 ± 2.38 | 44.5 ± 2.29 |
| DURATION (mean ± SD) | 7.75 ± 1.47 | 7.82 ± 1.11 |
| MoCA | 20.25 ± 2.38 | 20.25 ± 1.47 |

**Table 2: Pre and Post-test comparison of Group A (taVNS)**

| Group A | MEAN ± SD | t value | p value |
|---|---|---|---|
| Pre-test | 20.25 ± 2.75 | -9.89 | 0.002 |
| Post-test | 27.25 ± 1.5 | | |

**Table 3: Pre and post-test comparison of Group B (conventional cognitive training).**

| Group A | MEAN ± SD | t value | p value |
|---|---|---|---|
| Pre-test | 27.25 ± 1.5 | 4.7 | 0.018 |
| Post-test | 22.75 ± 1.25 | | |

**Table 4: post-test comparison of both Group A and B (taVNS and Conventional cognitive training).**

| PARAMETRICS | Mean ± SD | t value | p value |
|---|---|---|---|
| Group A | 27.25 ± 1.5 | 4.59 | 0.004 |
| Group B | 22.75±1.25 | | |

## Results

The collection of data began in January 2023, and treatment sessions began in February 2023 for four weeks. Following the treatment phase, the post-test analysis was carried out using the Montreal Cognitive Assessment.

The statistical analysis of the study revealed a significant p value of less than 0.004 (Table 4) for

those who underwent transcutaneous auricular vagal nerve stimulation in addition to conventional strengthening training. Both groups had the same baseline characteristics in the pre-test (Table 1).

MoCA testing was done on both Group A and B before the therapy started. Group A underwent conventional strengthening training for 10 minutes each week for four weeks while also receiving transcutaneous auricular vagal nerve stimulation for 20 minutes. The patient's post-test analysis then made use of the same outcome. The data collected before and after the treatment was recorded, and the paired t-test was used to look into the difference. The statistical analysis shows that P = 0.002 is significant (Table 2).

Group B received standard cognitive training and muscle-strengthening exercises. The paired t-test was used to examine the differences between the data acquired before and after the test. With a p value of 0.018, it also showed statistical significance (Table 3).

On comparing, the post-test values obtained in both group A and B was analyzed using Mann-Whitney U test and it revealed a statistically significant p value of 0.004 (Table 4).

## Discussion

The study aimed to find out the effectiveness of transcutaneous auricular vagal nerve stimulation on cognitive impairment in ACA syndrome. There are various complications that occur following a stroke. Post-stroke cognitive impairment is common in stroke survivors and has a negative impact on their health. Stroke-related cognitive impairment is usually accompanied by other disorders, such as depression[23]. The most uncommonly addressed area of cognitive decline that requires substantial attention in order to avoid dementia is cognitive decline of vascular origin. Clancy U. et al. conducted research on cognitive damage caused by small vessel disease, the neuropsychiatric symptoms of small vessel disease as an indication of cognitive impairment. The research discovered a progression in white matter hyperdensities linked to neuropsychiatric symptoms[24].

Looking into the available therapeutic methods or preventive measures for vascular dementia, we studied certain studies that discussed the management of cognitive impairment. The pharmaceutical intervention included the administration of donepezil, galantamine, and rivastigmine, as well as cholinesterase inhibitors. An author conducted a double-blind trial in 2003 with a focus on vascular cognitive impairment and discovered the significant effect of donepezil on cognition. However, there was still a discrepancy in global cognitive functioning[25,26]. In 2010, Similarly others attempted to develop preventive strategies for post-stroke cognitive impairment. The author observed that there is no obvious treatment option for preventing post-stroke cognitive decline. The author suggests that further study is needed to develop a clear strategy for preventing cognitive loss after a stroke[27].

Because there was not much significance to be found in pharmaceutical therapy, a special emphasis was placed on the non-pharmacological approach to cognitive impairment. Berg-Weger M. et al., 2017 revealed evidence-based non-pharmacological therapy to be a cost-effective therapeutic strategy with no adverse effects. Stimulation therapy has been shown to be more effective in terms of improving cognition and quality of life[18].

In addition to this, there is another emerging effective non-invasive therapeutic method for improving cognitive function: transcutaneous auricular vagal nerve stimulation, a modulating method that uses electrical stimulation to stimulate the branch of the afferent vagal nerve. taVNS differs from transcranial direct current stimulation (tDCS) and transcranial alternating current stimulation (tACS). Boon P. et al. investigated the effect of vagal nerve stimulation on cognition in 2006. The author concluded that vagal nerve stimulation is a potential therapy in the management of cognitive decline after analyzing the literature on the effect of vagal nerve stimulation on cognition[28]. On the other hand, Ruhnau P. et al., in 2021, studied the effect of transcranial auricular vagus nerve stimulation in combination with ear-EEG. The author found that this closed-loop combination of taVNS and ear-EEG has been demonstrated to be a supportive device for the healthy population as well as a potential tool for the treatment of neuropsychiatric illnesses. The author also recommended that future studies concentrate on maximizing the long-term efficacy of taVNS[29].

As a result, we decided to administer the effective therapeutic technique taVNS to patients who were diagnosed with ACA syndrome—cognitive decline. We had a desire to conduct an experimental investigation to determine the efficacy of non-invasive vagal nerve stimulation, which would reduce the danger of adverse effects. Prior to that, we decided to take a chance and perform this pilot research to see if transcutaneous auricular vagal nerve stimulation improved cognitive ability.

The Montreal Cognitive Assessment Scale (MoCA), the most reliable and precise tool for detecting mild cognitive impairment, was employed as the outcome measure in this study. MoCA was used for both the pre- and post-test analyses. In 2021, research compared the MoCA with the Oxford Cognitive Screen, finding that the Oxford Cognitive Screen was not any better at detecting cognitive impairment in post-cognitive impairment than the MoCA[30].

Since this study was self-funded, authors haven't performed any quantitative analysis, like biological markers. The study is unique since it addressed the population's post-stroke cognitive loss and vascular dementia by providing a special non-invasive, efficient, and safer treatment approach. This research helps in the prevention of dementia in people with cognitive impairment.

## Conclusion

According to the results of the current study, non-invasive vagal nerve stimulation performed trans-auricularly resulted in a greater improvement in cognitive function than conventional cognitive training, with a significant value of $p = 0.004$. Participants who underwent conventional cognitive training also showed improvement. But when comparing the two groups, those in group A who received transcutaneous auricular vagal nerve stimulation showed a more significant improvement in treating the cognitive symptoms of ACA syndrome.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 01/027/2022/ISRB/PGSR/SCPT).

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**Conflict of interest:** The authors state that there is no conflict of interest**.**

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Original Article

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# Effect of Vagal Nerve Stimulation and Jacobson Relaxation Technique on Agoraphobia among Post Neurological Ill-Patients: A Pilot Study

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**Abstract**

**Background:** This study was developed to determine the effectiveness of transcutaneous auricular vagus nerve stimulation and Jacobson relaxation technique on agoraphobia among subjects with post neurological ill-patients.

**Purpose:** The purpose of the study is to compare and evaluate the effectiveness of two non-pharmacological methods of treatment for Agoraphobia patients with Post neurological ill-patients.

**Methods:** The research project was conducted as a pilot study in a private hospital in Chennai. The experimental group (group A) received transcutaneous auricular vagus nerve stimulation for approximately 20 minutes (30 seconds ON and 5 minutes OFF) and a conventional Jacobson relaxation technique for 10 minutes. Group B got conventional cognitive behavioral therapy (20 minutes) and the Jacobson relaxation technique (10 minutes). Following the four-week treatment period, a post-test analysis was performed using the Severity measure of agoraphobia.

**Results:** The study found that there is a positive impact of transcutaneous auricular vagus nerve stimulation and Jacobson relaxation technique on agoraphobia in post neurological ill patients. The analysis obtained a mean value of about 18 and an SD of 26 for group A, whereas group B revealed 24.8 ± 4.40, mean ± SD, and a significant P value of <0.001.

**Conclusion:** When compared to group B, those in group A who received transcutaneous auricular vagus nerve stimulation improved more significantly when dealing with agoraphobia of post neurological ill patients. As a result, non-invasive transcutaneous auricular vagus nerve stimulation and Jacobson relaxation technique have been proven to be effective approaches for preventing agoraphobia.

**Keywords:** Anxiety, relaxation, electrical impulses, vagal nerve, transcutaneous, agoraphobia.

## Introduction

An anxiety disorder is defined by a fear of situations in which the individual feels worried or panicked, such as open areas, crowded areas, and places where rescue appears difficult. Agoraphobia is a form of phobia, often known as irrational fear. The

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current claim is that agoraphobia is only an example of endogenous depression[1]. Agoraphobia is the most common type of phobia, affecting 5-12 percent of Americans at some point in their lives. Agoraphobia affects women twice as much as it does males, and it usually strikes between the ages of 15 and 35[2]. The current weighted prevalence of Agoraphobia in India (95 percent confidence interval: 2.54-2.60) was 2.57 percent. The female gender, 40-59 age range was mostly affected. Research on women and their fear of heights has found that the percentage of female-to-male anxiety incidence ranges from 1.6 and 3.1[3].

Victims of psychological, physical, and child abuse are more likely to be women. In addition, a fear of height reactions in women is worse, and suffer greater impairment as a result of it than males[4]. The various factors that induce agoraphobia are Depression, additional phobias such as claustrophobic and social phobia, as well as a different form of anxiety disorder such as generalized anxious disorder or OCD, a history of sexual or physical abuse, a problem with substance abuse, and a family history of agoraphobia are all risk factors for developing agoraphobia are all examples. Diseases of the brain, central nervous system, and autonomic nervous system are known as neurological disorders. It is critical to separate the many forms of neurological illnesses before detecting the signs and symptoms of neurological difficulties. There are a variety of neurological conditions, including Alzheimer's disease a type of dementia (AD), Migraine headaches, Epilepsy, Parkinson's illness, and Multiple sclerosis is a disease that affects people[5].

The pathophysiology of agoraphobia is people with agoraphobia are terrified of being in public places or circumstances where they cannot readily flee. They feel imprisoned, helpless, or embarrassed in these types of settings and situations, which causes them to panic or become incapacitated. After a panic episode or neurological illness, a person may acquire agoraphobia[6]. Fear of subsequent neurological attacks, for example, may lead a person to avoid situations similar to those in which the initial attack occurred. The Severity Measure of Agoraphobia was used to diagnose agoraphobia. On a five-point scale, each item on the measure is assessed. A total score of 0 to 40 indicates the severity of agoraphobia, with higher numbers indicating more severe agoraphobia[7].

When someone has anxiety or severe fear in post-neurological situations, according to the Diagnostic and Statistical Manual of Mental Disorders (DSM-5) criteria, they are said to have an anxious disorder. A sort of therapy called Jacobson's relaxation technique gradually tightens and releases particular muscle groups. Relaxation practices can provide several health benefits. a reliable source, such as anxiety reduction, a reliable source, work-related stress reduction, a reliable source, blood pressure reduction, lowering the chance of seizures, and enhancing your sleeping habits. The current treatments for agoraphobia are medications including Selective serotonin reuptake inhibitors and Benzodiazepines[9].

Psychotherapy and CBT are the other treatments. taVNS is used to treat disorders non-invasively by applying a current to the cutaneous receptive field produced by the auricular extension of the vagus nerve, which is located in the outer ear. In the previous twenty years, basic, medical, and transformational research have all focused on taVNS. For a number of disorders, it has been used as a replacement for pharmacological therapy. Some barriers to the advancement of this discipline have gradually come to light as a result of the rapid comprehension of how to apply taVNS to disease and health in humans. Here, we provide a thorough analysis of the field's history and current state of study[10].

In classical vagus nerve stimulation, a surgically implanted device under the chest stimulates the implanted vagus nerve, which is connected to the left vagus nerve. When you switch on the device, it delivers electrical signals to your brain stem, which then sends messages to certain parts of your brain. Non-invasive transcutaneous auricular vagus nerve stimulation devices, which do not require surgical implantation and are applied using external appliances such as clip electrodes, have become popular in recent years. The clip electrode is attached to the outside of the ear. In a non-invasive procedure called transcutaneous auricular vagal nerve stimulation (taVNS), the vagus nerve's auricular branch, which innervates the ear's Cymba Concha, is electrically stimulated in order to trigger the inflammatory reflex. Recent studies have shown that patients who have recovered from neurologic illness can treat their agoraphobia with transcutaneous auricular vagal nerve stimulation.

Initial stimulation of the vagus nerve enhances memory and quality of life by boosting slow-wave sleep and decreasing anxiety[11,12].

Despite its effectiveness, the surgical strategy of vagal nerve stimulation has significant technical challenges and, as a result, a limited spectrum of usage. As a result, non-invasive vagus nerve stimulation was developed. The two non-invasive treatments employed were stimulating the ear and applying superficially to the cervical nerve[13]. The aim of this study is to determine the effectiveness of transcutaneous auricular vagal nerve stimulation and Jacobson relaxation technique on agoraphobia in post neurological ill patients.

## AIM

To determine the effectiveness of transcutaneous auricular vagal nerve stimulation and Jacobson relaxation technique on agoraphobia among subjects with post neurological ill patients.

## Material and Methods

The research project was conducted as a pilot study in a private hospital in Chennai to investigate the efficacy of transcutaneous auricular vagal nerve stimulation and Jacobson relaxation technique in improving agoraphobia in patients with post neurological ill patients. A private college's Scientific Study Board approved a human population study in line with all applicable laws and regulations (01/027/2022/ISRB/PGSR/SCPT). Following a thorough description of the procedure, individuals were selected from the private hospital with their signed consent. There was blinding of both the participant and the evaluated participant involved in this study during the period of June 2022 and September 2022. Participants were clearly explained about the study procedure and informed consent was obtained.

**Selection criteria:** Eight participants were selected, representing both genders, based on the following eligibility criteria: Participants with post neurological ill patients, as well as those with a pre-test Severity measure of agoraphobia score of less than 40, were eligible to participate. Participants who had a history of various neurological diseases, recent injuries, mental instability, or a lack of interest in participating in the study were excluded.

**Outcome measure:** A fast screening assessment tool, the Severity measures of agoraphobia, was developed to identify Agoraphobia in Post neurological ill patients. On a five-point scale, each item on the measure is assessed (0=Never; 1=Occasionally; 2=Half of the time; 3=Most of the time, and 4=All of the time). A total score of 0 to 40 indicates the severity of agoraphobia, with higher numbers indicating more severe agoraphobia. The severity measure of agoraphobia includes a variety of factors, including the stability of the person's symptoms and the state of their therapy; the measure may be completed at regular intervals as clinically required to monitor changes in the severity of the person's agoraphobia over time. High scores on a given domain over time may point to important and troublesome areas for a person who could require additional evaluation, care, and monitoring. Your choice should be based on your clinical expertise.

### Procedure

The participants were separated into two groups, A and B, using the closed envelope method. Both groups received 30-minute therapy sessions three days a week for four weeks. The experimental group (group A) received transcutaneous auricular vagal nerve stimulation for approximately 20 minutes (30 seconds ON and 5 minutes OFF), with clip electrodes placed on the Cymba concha of the left ear at a frequency of 25 Hz, amplitude: 0.1-10 mA, pulse width: 250 μs, and conventional Jacobson relaxation therapy for 10 minutes. Group B got conventional cognitive behavioral therapy (20 minutes) and Jacobson relaxation technique (10 minutes). Following the four-week treatment period, a post-test analysis was performed using the Severity measure of agoraphobia.

### Data analysis

Statistical analysis was done with the intention of treating agoraphobia after the stroke (post neurological ill-patients). Pre- and post-test values for SMA were noted. A paired t-test was used for within-group analysis, and a Mann-Whitney U test was used for between-group analysis.

**Table 1: Baseline characteristics of population included.**

| CHARACTERISTICS | GROUP A | GROUP B |
|---|---|---|
| AGE (mean ± SD) | 43.25 ± 2.38 | 44.5 ± 2.29 |
| DURATION (mean ± SD) | 7.75 ± 1.47 | 7.82 ± 1.11 |
| MoCA | 18.25 ± 20.18 | 24 ± 26.47 |

**Table 2: Pre and Post-test comparison of Group A (taVNS + Jacobson relaxation technique)**

| Group A | MEAN ± SD | t value | p value |
|---|---|---|---|
| Pre-test | 25 ± 18.25 | 210 | <0.001 |
| Post-test | 18 ± 26 | | |

**Table 3: Pre and post-test comparison of Group B (conventional Jacobson relaxation technique).**

| Group A | MEAN ± SD | t value | p value |
|---|---|---|---|
| Pre-test | 26.5 ± 4.38 | 10.925 | <0.001 |
| Post-test | 24.8 ± 4.40 | | |

**Table 4: post-test comparison of both Group A and B (taVNS + Jacobson relaxation technique and Conventional Jacobson relaxation technique).**

| PARAMETRICS | Mean ± SD | t value | p value |
|---|---|---|---|
| Group A | 18 ± 3.08 | -5.6 | <0.001 |
| Group B | 24.8±4.4 | | |

## Results

Both groups were allocated with 4 members. Because it was intended to treat both groups, the intervention group (group A) received transcutaneous auricular vagus nerve stimulation and Jacobson relaxation technique while the control group (group B) received conventional Jacobson relaxation technique. Nobody in either group left before the research had ended. The collection of data began in January 2023, and treatment sessions began in February 2023 for four weeks. Following the treatment phase, the post-test analysis was carried out using the Severity measure of agoraphobia.

The statistical analysis of the study revealed a significant p-value of less than 0.001 (Table 4) for those who underwent transcutaneous auricular vagal nerve stimulation in addition to the conventional Jacobson relaxation technique. Both groups had the same baseline characteristics in the pre-test (Table 1).

SMA testing was done on Group A before the therapy started. They underwent the conventional Jacobson relaxation technique for 10 minutes each week for four weeks while also receiving transcutaneous auricular vagal nerve stimulation for 20 minutes. The patient's post-test analysis then made use of the same outcome. The data collected before and after the treatment was recorded, and the paired t-test was used to look into the difference. The statistical analysis shows that $P < 0.001$ is significant (Table 2).

Before and after the treatment period, Group B underwent the same examination. Group B received the standard Jacobson relaxation technique. The paired t-test was used to examine the differences between the data acquired before and after the test. With a p-value of <0.001, it also showed statistical significance (Table 3).

On comparing the effect of transcutaneous auricular vagus nerve stimulation along with the Jacobson relaxation technique and conventional Jacobson relaxation technique the post-test values obtained in both group A and B was analyzed using the Mann-Whitney U test and it revealed a statistically significant p value of <0.001 (Table 4).

## Discussion

This study describes the non-invasive method for the stimulation of the vagus nerve auricularly in reducing fear among patients with post-neurological conditions. Following a diagnosis of a post-neuro condition, fear and panic attacks are common symptoms that have an effect on the daily life of participants. Post-neurological conditions include a year after stroke, TIA, TBI, dementia, parkinsonism, and other neurological disorders. All the post-neurological patients have been developing fear, panic, and feelings of being trapped, helpless, or embarrassed[14]. This study has decided to examine the current therapy choices for agoraphobia following these conditions because there is not much literature available identifying the optimal treatment approach to reduce agoraphobia.

In Xiao X, Hou X, et.al suggested that Vagal nerve stimulation has been demonstrated to have a

positive impact on reducing agoraphobia, according to research that has established its impact on agoraphobia. It lessens fear, a psychological element that is extremely unique among individuals with post-neurological conditions, by stimulating the vagus nerve auricularly [15,16].

Daruj Aniwattanapong, Justine J List et al., titled Effect of Vagus Nerve Stimulation on Attention and Working Memory in Neuropsychiatric Disorders: A Systematic Review suggested that there is not enough excellent proof that VNS is an efficient treatment for enhancing working memory and attention in individuals with neuropsychiatric illnesses, despite the fact that we found some encouraging outcomes from trials that were eligible. Additional research is required to determine the effectiveness of this intervention. Memory function after VNS was shown to significantly improve from a within-subject design of experiments. Three nonrandomized controlled experiments indicated that following VNS, the attentional ability was greatly enhanced. Cohort studies that compared VNS and surgery discovered improvements in attention in both groups. In nine out of twelve pre-post investigations, attention or working memory had improved following VNS. Although one trial for mood disorders revealed an important boost in attention after VNS, the other did not [17,18].

Most of the studies were conducted through invasive vagal nerve stimulation, whereas Bashar W. Badran, and Christopher W. Austelle discussed the safety and utility of taVNS, which is that the potential of taVNS as a secure at-home wearable therapy for a range of neurologic illnesses is enormous. According to the study's findings, psychological adjustments like reducing fear, panic attacks, functional capacity, and social interaction all showed mild to moderate increases, as did overall well-being and quality of life[19,20].

Looking into the available therapeutic methods or preventive measures, we studied certain studies that discussed the management of agoraphobia. The pharmaceutical intervention included the administration of Selective Serotonin reuptake inhibitors. A vital part of treating agoraphobia involves medication. The advantages of medication, however, may differ based on the underlying cause and the unique patient response.

Kyriakoula Merakou, Konstantinos Tsoukas et al., entitled The Effect of Progressive Muscle Relaxation on Emotional Competence: Depression-Anxiety-Stress, Sense of Coherence, Health-Daily Life and Well-Being of Jobless Greeks: An Intervention Study suggested that in the study, 50 long-term jobless individuals with anxiety problems took part. Those who participated were segregated into two groups: the intervention group (30 people) got counseling services in addition to an 8-week training program in the gradual relaxation of muscles, and the control group (20 people) received simple counseling services. Among the two groups, there were significant differences in the studied variables, with the intervention group experiencing better results. The intervention group demonstrated improvements in well-being. The control group showed no discernible change over the course of the period of follow-up[21].

Tejal C. Nalawade1, Dr. Nitin S. Nikhade2 et al y suggests that Jacobson's PMR technique may be beneficial in decreasing fear, anxiety, and depression symptoms in older persons, as well as enhancing Quality-of-Life Enjoyment and Satisfaction. Progressive Muscle Relaxation can help negate some of the consequences of stress reaction by releasing tension in the body when practiced and incorporated into an individual's lifestyle[22].

Jonathon A. Nye, Bradley D. Pearce et al suggested that the taVNS was demonstrated to increase vagal tone in PTSD patients and suppress long-term fear reactions during extinction training in healthy human participants, according to the researchers. Noninvasive VNS technology would be a valuable addition, allowing for more research into the circuit of PTSD and treatment-resistant depression, as well as a novel and very acceptable therapeutic choice for patients suffering from serious and recurrent depression and PTSD [23,24].

Gagandeep Singh, Vasudev Singh, et al suggested that the development of fear and anxiety disorders after TBI was proven to be an excellent indicator of social, intimate, and occupational dysfunction, as was seen in our patient, according to the case study The condition of a with Panic Attacks The act of

manifestation after Trauma Brain Injury. However, there was a correlation between compensation claims and the prevalence of psychiatric disorders. According to the case study, some people with TBI may have psychological issues that linger for decades. It further highlights the significance of all patients receiving psychiatric continuation after TBI. The study was limited by the small sample size and the use of one outcome measure to rule out agoraphobia. Furthermore, large sample size research with additional outcome measures was required[25].

Since this study is self-funded, we haven't performed any quantitative analysis, like biological markers. The study is unique since it addressed the population's post-stroke cognitive loss and vascular dementia by providing a special non-invasive, efficient, and safer treatment approach. This research helps in the prevention of dementia in people with cognitive impairment[26].

## Conclusion

According to the results of the current study, non-invasive vagal nerve stimulation performed trans-auricularly and the conventional Jacobson relaxation technique resulted in a greater improvement in agoraphobia than the conventional Jacobson relaxation technique, with a significant value of p = 0.001. Participants who underwent the conventional Jacobson relaxation technique also showed improvement. But when comparing the two groups, those in group A who received transcutaneous auricular vagal nerve stimulation and Jacobson relaxation technique showed a more significant improvement in treating the agoraphobia of post neurological ill-patients.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, and institutional regulations. (Application Number 01/027/2022/ISRB/PGSR/SCPT).

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**Conflict of interest:** The authors state that there is no conflict of interest

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Review Article

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# Effectiveness of Low Level Laser Therapy and Low Intensity Pulsed Ultrasound on Neurotrophic Factors in Experimentally Induced Peripheral Nerve Injury Wistar Rat: A Systematic Review

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**Abstract**

**Background:** Peripheral nerve injury is developed from the various etiological factors such as crushing,traction,long bone fracture ,cutting injury,entrapment neuropathies ,infection, inflammation and various degree of tumours. LIPUS and LLLT has a variety of biological impacts on tissues, including increasing bone fracture repair, accelerating soft-tissue regeneration, and suppressing inflammatory reactions.

**Purpose:** The main purpose of this research is to determine the efficacy of LLLT and LIPUS in relation to neurotrophic factors in experimentally induced peripheral nerve damage .

**Materials and Methods:** A systematic review was done to investigate the effectiveness of LLLT and LIPU in experimental induced rat model. Articles are systematically searched in search engines PubMed,MEDLINE and Google Scholar database according to inclusion and exclusion criteria.

**Results:** Out of the four review articles that are eligible, three support low intensity pulse ultrasound therapy's potential to promote nerve regeneration, while one article supports low level laser therapy's enhance nerve regeneration.

**Conclusion:** The study conclude that LIPU has huge supporting evidence on nerve regeneration influencing the neurotrophic factors and LLLT has least supporting evidence on influencing the neurotropic factors on experimental induced rat model. Advance research need to carried out in vivo animal model to evaluate the effectiveness of both the LLLT and LIPU in experimentally induced rat model at proven dosages.

**Key Word:** Neurotrophic factors.laser therapy,ultrasound,sciatic nerve, regeneration

## Introduction

Peripheral nerve damage results from a variety of etiological reasons, including crushing, traction, long bone fracture, cutting injury, entrapment neuropathies, infection, inflammation and various degree of tumours[1]. In accordance with the severity

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of the nerve injuries. Seddon divided Peripheral nerve damage into three categories: Neurapraxia, Axonotmesis, and Neurotmesis. The mildest form of traumatic peripheral nerve injury is neuropraxia. It is distinguished by focal segmental demyelination at the damage site with no loss of axon continuity or surrounding connective tissues. Either neurotmesis, in which the entire nerve fibre is ruptured, or axonotmesis, in which the axons and myelin sheaths are damaged, but the connective tissue is maintained. When a peripheral nerve is injured, it causes various levels of impairment as well as secondary muscle atropy. peripheral nerve system axons can regenerate and remyelinate following traumatic damage, after a process known as Wallerian degeneration. The sciatic nerve, the body's largest nerve, is made up of two parts: tibial and common peroneal components, both originated from the lumbosacral plexus.

Endogenous chemicals that regulate cell proliferation and differentiation, migration ,survival in the nervous system are known as neurotrophic factors.The neurotrophins NGF,BDNF and NT-3 have a beneficial effect on the survival and phenotypic expression of primary sensory neurons in the dorsal root ganglia and motoneurons in the spinal cord during peripheral nerve regeneration. Other neurotrophic factors, including as CNTF, GDNF, and LIF, act on neuronal cells in a variety of ways that appear to overlap and enhance the effects of neurotrophins.GGF also has a role in nerve regeneration in an indirect manner. The close interaction between neuronal and glial cells during peripheral nerve regeneration is highlighted by the creation of GGF by neurons, which promotes Schwann cell proliferation[2].BDNFs have been shown to regulate myelinogenesis[3], while GDNF influences sensory nerve regeneration[4]. NGF has demonstrated the effectiveness of neuroprotection and axon development[5]. Motor neuroprotection has been found to be effective by the CNTF. Schwann cell proliferation and myelinogenesis are influenced by bFGF. IGF-2 protects motor neurons[6]. NF3 has a negative influence on myelinogenesis and NF4 has a sensory neuroprotective effect[7].

In LLLT, a biological reaction is induced by low-power laser light with a wavelength range of 632 to 1064 nm and a power range of 1-1000 mW. Biostimulation or photobiomodulation is the term used to describe the process by which LLLT causes a photochemical reaction in the cell[8,9].Gallium arsenide is used as a semiconductor or diode to create an invisible infrared laser with a wavelength of 904 nm. The ability to provide either a continuous or pulsed output is a benefit of a semiconductor laser diode.Rochkind et al. conducted an double-blind randomized study. According to morphological data, the laser-treated group had more myelinated axons overall after the reconnection of the nerve deficit with a PGA neurotube during postoperative 780 nm laser phototherapy[10].

LLLT was found to be an effective treatment for radial nerve palsy in a research[11].Rats with crush injuries to the sciatic nerve were treated with low-power pulsed lasers (wavelength of 904 nm, dose of 4 J/cm2,Gallium Arsenide) and the results showed that the lasers successfully facilitated nerve regeneration[12].

LIPUS (low-intensity pulsed ultrasound) is a type of ultrasound that uses substantially less energy (<3 W/cm2) than standard ultrasound.LIPUS has a variety of biological impacts on tissues, including increasing bone fracture repair, accelerating soft-tissue regeneration, and suppressing inflammatory reactions.LIPUS of 250mW/cm2 greatly accelerated axonal regeneration, according to functional and pathological data. This indicated that nerve regeneration in autografts had improved[13].

## Methods

### Search Strategy

The effectiveness of LLLT and LIPUS in peripheral nerve injury induced rat model was investigated by the researcher's independent search of the published studies from 1995 to 2022 in December 2022. Screening for articles are conducted systematically in the MEDLINE, Google Scholar, and PubMed databases. Open access articles are screened in the database. "Neurotrophic factor, Nerve regeneration, Rat model, Low level laser therapy, Low intensity pulsed ultrasound" represent a number of related search terms. Language limitations are observed. Only English-language articles are chosen.

**Inclusion Criteria:**

- Open access and full text articles
- Neurotrophic Factors outcome includes "*brain-derived neurotrophic factor ,NT-3,NT-4,vascular endothelial growth factor,wet weight ratio of the gastrocnemius muscles*"
- Sciatic Nerve Crush injury.
- The article published in the year between 1995- 2022

**Exclusion Criteria:**

- Systematic reviews and meta-analysis articles are excluded.
- Articles which were not published in English language are excluded.

**Data Extraction:**

The species and strain, sample size, nerve injury, crush injury procedure, intervention, intervention parameters, and outcome measurements are among the data that are separately extracted by researchers from each publication (Table1).

**Table 1: DATA EXTRACTION**

| Author | species and strain | sample size (n) | nerve injury | crush injury procedure | interventions | interventions parameters | outcome measures |
|---|---|---|---|---|---|---|---|
| wenli jiang .et.al[13] | sprague dawley rats | n = 80<br>CG= 20<br>LIPUS- LOW DOSE<br>=20<br>LIPUS-MID DOSE =20<br>LIPUS- HIGH dose =20 | Sciatic nerve | The reverse autograft was 10 millimetres long.<br>40mg.kg−1 of 2% sodium pentobarbital administered intravenously as anaesthetic | low intensity pulsed ultrasound | ultrasonic probe diameter:<br>2.5 cm, acoustic frequency of 1 mhz, twenty<br>percent duty cycle, and 1 khz pulse repetition frequency.<br>lipus-low dose(250m w/$cm^2$)<br>lipus-mid dose(500m w/$cm^2$)<br>lipus-high dose(750m<br>w/$cm^2$)<br>total treatment<br>5 minutes per treatment, every alternate day, | catwalk automated gait analysis system, a function analysis of the sciatic nerve is performed.<br>cmap electrophysiological assessment<br>measurement of axon development using the nf200 protein and toluidine blue staining<br>gastrocnemius wet weight muscles<br>gastrocnemius musclesblood perfusion<br>western blotting for identifying the nf- kb p65 protein expression. |
| lessandr a esper .et.al[17] | wistar rats | n = 36<br>group 1 (n=12)<br>IG = 6<br>CG = 6<br>group 2 (N=12)<br>IG = 6<br>CG = 6<br>GROUP 3<br>(N=12) IG = 6<br>CG = 6 | sciatic nerve | The right hind paw's thigh level was cut, and an incision was made 5 mm before the sciatic nerve bifurcation over the course of 30 seconds using the highest pressure setting (three clicks) of a hemostatic forceps.<br>anesthetic agent: intraperitoneal injection, with a xylazine (10 mg/kg) and<br>ketamine hydrochloride (100 mg/kg). | low level laser therapy | 632.8 nm, the wavelength<br>size of spot: 0.10 cm2.<br>beamshapecollimated<br>mode: continuous<br>power:<br>5.0 mw<br>power density: 0.5mw/ cm2<br>irradiation time<br>:20 sec<br>number of points irradiated :10<br>energy density: 10 j/ cm2 | mrna expression of :<br>bdnf<br>ngf<br>nt-3<br>using rt-pcr |

Continue.....

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| wang.et. al[18] | lewis rats | n=18<br><br>sham (n=9) and LIPUS (n=9) | sciatic nerve | A 2-mm crush injury was produced at the area just below the gluteal tuberosity using a typical surgical hemostat.<br><br>anesthetic agent:<br><br>a mixture anaesthetic made with 0.15 mg/ kg medetomidine hydrochloride, 2 mg/kg midazolam, and 2.5 mg/kg butorphanol tartrate is administered intraperitoneally. | low intensity pulsed ultrasound | acoustic frequency of 1mhz, pulsed at 1 khz 140 mw/cm2 (sata), 115 repetitions per second, 20% duty cycle, and 5 minutes every day. | 1.the kinematic evaluation 3d motion capture set-up consists of four 120 hz charged coupled device (ccd) cameras, a treadmill, and data processing software.<br><br>2.axon growth is measured histomorphometrically using toluidine blue staining.<br><br>3.quantitative real- time pcr:bdnf, ngf, ngfr, and vegfa. |
| xue- jun ni<br><br>.et.al[19] | sprague<br><br>-<br><br>dawley rats | n= 80<br><br>group : LIPUS<br><br>controlgroup :SHAM exposure | sciatic nerve | Hemostatic forceps were used to totally rupture the nerve fibres in a 3-mm portion of the nerve after 30 seconds of crushing.<br><br>anaesthesia: at a dosage of 0.3 ml per 100 g of body weight, an intraperitoneal injection of a compound agent containing 4.25 g chloralhydrate, 2.12 g magnesium sulphate, 0.886 g pentobarbital sodium, 14.25 ml absolute ethyl alcohol, 33.8 ml 1, 2 - propyl-ene- glycol, and double-distilled water was given. | low-intensity ultrasound | 1 mhz frequency, continuous wave mode, and 0.2 w/cm2 .<br><br>with a treatment time of 1 minute per day. | catwalk gait analysis<br><br>electrophysiologi cal test : compound muscle action potential (cmap)<br><br>weight wet ratio of the target muscle<br><br>electron microscopy : axon growth measurement<br><br>rt-pcr :<br><br>mrna level of bdnf |

## Results

### Peripheral Nerve Induced Rat Model With Low Level Laser Therapy:

Only one of the four eligible articles support to claim that low level laser treatment is effective in treating peripheral nerve damage and accelerating nerve regeneration. The article has demonstrated the significant impact on four major neurotrophic factors.

### Peripheral Nerve Induced Rat Model Using Low Intensity Pulsed Ultrasound:

Three of the four eligible articles support the evidence that low intensity pulsed ultrasound can heal damaged peripheral nerves and promote nerve regeneration. According to this study's outcome measure, these articles have a considerable impact on a variety of different outcomes. They demonstrate a favorable effect on neurotrophic factors and the wet weight ratio of the gastrocnemius muscles.

## Discussion

The review's studies, which were conducted in

three different species of Sprague Dawley rats, Wistar rats, and Lewis rats and focused on the sciatic nerve crush because it can be quickly and easily exposed, found that LIPUS AND LLLT had positive effects on axonal growth,wet weight ratio of gastro enemies muscle, Sciatic functional index, and neurotropic factors.Wenli Jiang et al. performed sciatic nerve reversed autologous nerve transplantation on the right side of

Sprague-Dawley rats, and then randomly administered 250mW/cm2, 500mW/cm2, or 750mW/cm2 LIPUS for 2–12 weeks following surgery. Axonal regeneration was greatly accelerated by LIPUS of 250mW/cm2, according to functional and pathological outcomes. FABRCIO. et. al came to the conclusion that therapeutic ultrasound and low-level laser therapy are effective for nerve regeneration. In comparison to the use of ultrasound in the neuromotor recovery following sciatic nerve compression damage, it also shown better recovery after laser therapy intervention. To support the findings of this experimental demarcation, it is recommended that additional research be done with the aim of analyzing the morphological changes in this tissue.

Tianshu Wang et al. conducted research on the modulation of neurotropic factors and functional recovery of LIPUS in a rat model. The results show that both of these outcomes are positively regulated by brain-derived neurotropic factors.IHSAN F.R. et al. arrived to the conclusion that the LLLT speeds up healing, aids in nerve regeneration, and appears to cause a significant amount of structural and cellular change in 2007. Additional clinical trials may produce therapeutic relevance in planned surgery or microsurgery and plausible clinical advancements. Juanita J. et. al. came to the conclusion that infrared light with optimized parameters promotes quicker nerve regeneration and increased functional recovery in a surgically repaired peripheral nerve.

HUA ZHANG, M.D. et.al states that LIPUS administration to Schwann cells is effective in promoting cell division and neurotrophin gene expression. The in vitro results presented in our study already indicate that this approach should prove useful for research on peripheral nerve regeneration, even though additional studies are undoubtedly needed to further optimize the delivery of LIPUS and identify the signal-regulated mechanisms accountable for the molecular responses[14,15,16].TIANSHU WANG et al. came to the conclusion that LIPUS upregulates the expression of BDNF's gene and proteins . How rapidly functional and histologic changes take place in rats after sciatic nerve compression injury may be affected more by the higher expression of BDNF at the region farthest from the lesion.In a study to determine the impact of low intensity pulsed ultrasound on neurotropic factors, XUE-JUN NI. et. al. found that there were significant mRNA expression alterations of brain-derived neurotropic factors.The recovery of Vibrissa movement in the laser + crush group was noticeably higher than that of the crush group, and similar to sham group values, according to a study on the effects of LLLT on facial nerve regeneration following crush damage in rats by Bohan Li. et. al. Additionally, when compared to the crush group, laser + crush treated mice had larger regenerated axons and thicker myelin sheaths. The damaged facial nerve caused by crushing was effectively restored by LLLT[17,18,19].

**Limitation**

This systematic review made no note of the animal's gender or age. The location of the study's execution is also unknown.

## Conclusion

According to the results of this systematic review, LLLT and LIPU have a substantial impact on accelerating nerve regeneration by enhancing neurotrophic factors and shortening the recovery time. To assess the efficacy of both LLLT and LIPU, advanced research must be conducted in an in vivo animal model.

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Original Article

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# Effect of Vagus Nerve Stimulation in Vestibular Function among Subjects with Stroke

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**Abstract**

**Background:** The background of the study is the incidence of vestibular dysfunction among stroke subjects which indirectly affects the balance function and early recovery of daily activities like sitting, standing and walking.

**Purpose:** The main objective of this study is to investigate the vestibular dysfunction using Vestibular evoked myogenic potential (VEMP) and efficiency of Transcutaneous auricular vagal nerve (TaVNS) stimulation among Middle cerebral artery (MCA) stroke survivors.

**Method:** Thirty subjects were randomly assigned into one of two groups: Group A (Transcutaneous auricular vagal nerve stimulation with conventional stroke rehabilitation) and Group B (conventional stroke rehabilitation and epley's maneuver). The pre-test measures of vestibular function were assessed by VEMP (an electrophysiological diagnostic tool). The intervention group received Transcutaneous auricular vagal nerve stimulation for 30 minutes, and a single session per day for 4 weeks along with conventional stroke rehabilitation whereas the control group received Epley's maneuver exercises along with conventional stroke rehabilitative exercises for 60 minutes, 6 days/week, and a single session per day for 4 weeks.

eeks. The same VEMP test was measured after 4 weeks of treatment as post-test values.

**Result:** The pre and post-test values were significantly different between group A and group B ($p \geq 0.001$) indicating that TaVNS has a major impact on recovery of vestibular dysfunction among stroke participants.

**Conclusion:** The transcutaneous auricular vagal nerve stimulation is found effective for improving the vestibular function and balance.

**Keywords:** Balance, vestibular apparatus, vagal nerve, VEMP.

## Introduction

Stroke is a common and most prevalent neurological condition affecting all age groups. It causes a variety of dysfunctions, impairments and disabilities, among which balance impairment is associated with poorer functional recovery. Middle cerebral artery stroke causes postural instability and balance dysfunction more often than other arteries

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[1]. The specific mechanism behind the impairment of balance in stroke is still unclear but it is a known fact that the vestibular system has an important function of maintaining and controlling the equilibrium of the body through defined cerebellar pathways. Just like gait, tone, coordination, Balance is also a major function of the body that keeps the line of gravity within the body's base of support with minimal or no postural sway while doing day-to-day functional activities [2]. There are multiple reports stating the prevalence of balance impairments after stroke ranging as low as 16.7% to as high as 83% [10]. The balance impairment caused by stroke can be complex, but normally the brain is the major structure that sends signals to the muscles through the nerves to make them move and that when a stroke damages the brain, it will also be affecting the signals that produce and transmit. Balance impairments are commonly caused due to the ischemic changes happening in cerebellar or vestibular pathways. Finding effective acute therapy is crucial for delivering early relief and improving patient outcomes because vestibular dysfunction can be severely debilitating and have a major influence on a survivor's quality of life.

The tenth cranial nerve, vagus nerve is a main branch of the parasympathetic nervous system which has different branches and auricular branch is a branch from the main bundle which innervates the human ear. The Auricular branch of vagus nerve (ABVN) is also called Alderman's nerve or Arnold's nerve is the core system that can provide non-invasive vagal nerve stimulation, which is called as transcutaneous auricular vagus nerve stimulation (TaVNS) [3]. The brainstem has a vital structure called "the nucleus of the solitary tract" (NTS) that can control the sensory signals of cardiovascular, gustatory, respiratory and oral tactile function. This nucleus gets projected to the locus coeruleus, where Vagal nerve stimulation (VNS) is thought to be mediated [4]. A Different stimulus from the vagus nerve is transmitted to the central nervous system and cortex via this primary structure NTS. Researchers started focusing on it in the 20th century. Various studies have made assumptions about the regions of the brain that the non-invasive vagal nerve stimulation (nVNS) may activate according to the area of focus. The neuromodulatory impact starts immediately after the vagal nerve is electrically stimulated. Two important brain neuromodulators, the noradrenergic locus coeruleus and the cholinergic nucleus basalis, are quickly activated by a VNS pulse [15]. Stimulation over cymba concha of the ear approach may be used to treat Alzheimer's disease, Parkinson's disease, dystonias and multiple sclerosis in addition to treating depression, epilepsy, headaches, and autism issues. It was found to be protective in a rat model of cerebral ischemia [6]. Hence using this place for stimulation in human beings is much safer.

The body's adaptations and motions to restore stability and keep an upright posture are referred to as postural responses. There is a strong correlation between the patients' levels of postural instability and balance issues and the severity of vestibular impairment. There are different pathways in the body that connect to the vagal nerve network. Stimulating the auricular branch will reciprocate the effect through the vagus nerve pathway and enters the vagal bundle which projects into the brain via the brainstem where the central pathway of vestibular apparatus is present. Stimulating the vagal nerve stimulates the solitary nucleus since a vagal cell body exists in it, thereby the stimulation is carried over to vestibular pathways. Though there are several neuro modulations to stimulate vestibular systems, an emerging transcutaneous auricular vagal nerve stimulation (TaVNS) is yet to be explored for its influence over vestibular pathways.

TaVNS can be used to enhance the benefit of conventional rehabilitation therapy on the recovery of disrupted balance functions, which is a sensory feedback mechanism affected by acute hemorrhagic or ischemic stroke. Hence it is essential to understand its effect on sensorimotor functions like balance.

## Aim

The aim is to determine the impact of vagal nerve stimulation on vestibular function and its effect on balance function.

## Methods and Materials

It was an experimental study conducted at Saveetha hospital. 30 Participants were selected by convenient sampling method depending on the inclusion and exclusion criteria from Physiotherapy out-patient department and Neurology In-patient

ward of Saveetha hospital with sub-acute MCA (Middle cerebral artery) stroke (>1 month). Full procedure of the study was explained to the participants and a printed informed consent was given and got signed for their willingness to participate in the study. Participants with willingness to participate in the study are only proceeded with the study methods. Entire study procedure took around 5 months, selection of participants took around 2 months and the study duration for one participant was 4 weeks (1 month) which was conducted between September 2022 to January 2023.

**Inclusion Criteria**

- Both male and female between the ages of 40 years to 60 years.
- Participants with reduced/abnormal Vestibular evoked myogenic potential (VEMP).
- Participants with the ability to stand with minimal assistance.
- Berg balance scale score of <20.

**Exclusion Criteria:**

- Participants with ear infection, ear pain, sensory loss in ear or hearing loss, other neurological or psychological diseases and cardiac complications.

**Outcome Measure**

Vestibular evoked myogenic potential (VEMP) is an electro diagnostic procedure with short-latency potential induced by vibration or sound which induces the activation of vestibular receptors. When this potential is applied to inferior oblique muscle of neck, Modulated electromyographic response from the muscle is used to measure the cervical VEMP (cVEMP). This was measured in the neurophysiology laboratory, Saveetha hospital with the help of laboratory staff. The values were obtained before the study and at the end of study (after 4 weeks).

**Procedure**

Participants were then randomly allocated into two groups (Group A and Group B) using the closed envelope method and their pre-test values are tabulated. Post-test values were measured at the end of 4 weeks.

**Group A: Transcutaneous auricular vagal nerve stimulation (TaVNS)**

TaVNS group was treated with TaVNS using TENS7000 (Figure 1) along with conventional stroke rehabilitation exercises for a period of 4 weeks. TaVNS was given through clip electrode on cymba concha of the ear (Figure 2) for a period of 30 minutes/session/day using TENS7000 (Acutens) apparatus through a clip electrode daily with the pulse ratio of 3: 1 (40 seconds of stimulation and 3 minutes interval), frequency: 25 Hz, pulse width: 60 mA, amplitude: 200 μs, placement: cymba concha of left external ear. Intensity given during the TaVNS is adjusted according to the level above the participant's detection threshold and less than their pain threshold.

**Group B: Control group (Epley's maneuver technique)**

Control group was treated with Epley's maneuver technique: 1 time along with conventional stroke rehabilitation exercises for 6 days/week with a duration of 1 hour every day.



**Figure 1: Transcutaneous auricular vagal nerve simulator (Acutens/TENS 7000)**

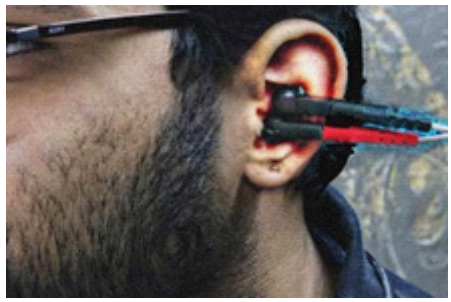
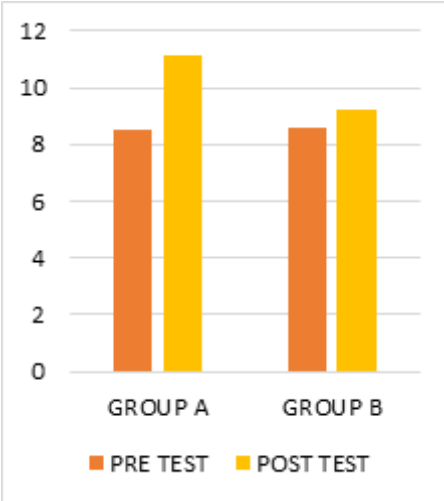


**Figure 2: Placement of electrode at cymba concha of the ear**

**Data Analysis**

Both pre-test and post-test values were recorded and statistically analyzed for their normality using the Shapiro-Wilk test. Brown Forsythe test is used for testing the equal variance. Paired t-test is used to find the significance.




**Graph 1**

INTERPRETATION: Difference of post-test mean values of GROUP A and GROUP B is 1.847, which shows that post-test mean value of Group A is higher and the group.

## Result

The study was randomly allocated to a group of 30 patients. Each group was allocated 15 participants each. The mean and standard deviation of the data were statistically analyzed. Obtaining a p-value of less than 0.001 was judged significant. The data acquired were statistically significant between the pre-test and post-test of group A, with a mean value of 8.52 in the pre-test and 11.10 in the post-test. Also, the data acquired were statistically significant between the pre-test and post-test of group B, with a mean value of 8.58 in the pre-test and 9.25 in the post-test according to the statistical analysis performed on the quantitative data for cVEMP. This indicates that both the groups have shown betterment in their vestibular function after the treatment period of 4 weeks. Between group significance was calculated using Student t-test and the mean difference between intervention group and control group was found significant with a confidence interval of 1.331 to 2.363. Thus, comparing the mean difference of the two groups, transcutaneous auricular vagal nerve stimulation group has produced better post-test values than the conventional treatment and was found to be beneficial in improving the vestibular function than conventional treatment in stroke survivors. Both Group A and Group B, showed a considerable improvement in vestibular function. But Group A had a mean value higher than group B which indicates that TaVNS is more beneficial than control group's treatment. The difference in the mean values between group A and B is greater than would be expected by chance. On comparing both the groups, significant difference in their statistics is observed (P = <0.001).

## Discussion

The impact of trans auricular vagal nerve stimulation was having a positive result in improving the balance via vestibular function, though there is no direct way of analyzing it. There was found to be a significant improvement in the electrodiagnosis of vestibular apparatus as assessed by VEMP. According to Jai-ni-li et al., ta-VNS has a positive influence on acute stroke patients' overall neurofunctional recovery. The mechanisms of VNS action in the acute stage of stroke were thought to be nerve regeneration, neural protection, neural plasticity and angiogenesis [14]. Non-invasive transcutaneous methods of vagus nerve stimulation is a feasible alternative way to produce VNS without using any surgical implant has recently become popular. Noninvasive nVNS can be delivered in two main ways. The auricular branch of the vagus nerve (ABVN) is the focus of the first technique, known as TaVNS, which involves applying stimulation to the superficial skin of the cymba concha and tragus of the external ear. The tragus and cymba concha are the two principal locations for auricular VNS. According to recent studies, there is uncertainty regarding the vagal branches' innervation of the tragus because of discrepancies in a study using human cadavers that examined the human auricle's innervation [4]. Additionally, irregularities in electrode placement and skin contact will develop different effects on varying tissue impedance when the nerve is stimulated. This difference from person to person may hinder the effectiveness of tVNS stimulation.

For instance, the electrode might stimulate the auriculotemporal branch of the mandibular nerve, which is a neighboring nerve to the vagus nerve. This variation happens when the electrode is positioned over the auricular skin in a very limited area with dense innervation. The evaluation and interpretation of the effects of vagus nerve stimulation are made more challenging by this dual recruitment. Studies indicate that TaVNS is useful in a variety of rehabilitation problems, even though the effect is not evident [8]. Outcome measure used in this study only interprets vestibular function while TaVNS should be assessed with different parameters and in different functions. This study has shown a significant difference in the recovery and improvement in balance function when it is combined with conventional stroke rehabilitative therapy. Furthermore, studies need to be done on its individual effect over the conventional therapy, also the improvement of balance should be justified whether it is improved because of the vestibular pathway. In a rat study using taVNS stimulation, it was hypothesized that VNS stimulated the proliferation of hippocampal progenitor cells in the adult rat dentate gyrus, allowing these progenitor cells to assist in the healing of injured neurons after ischemic injury [15]. Ethically cleared rat studies are the proof that TaVNS can reverse the damage caused to the neurons of the CNS following stroke which gives an overall effect of AVNS in the rehabilitation of stroke. This again gives a hypothesis of development in vestibular function seen in this study can also be due to the reversal effect caused by TaVNS in CNS pathways that produces vestibular function.

Invasive vagus nerve stimulation's (VNS) Activity within afferent vagal projection locations was also observed in functional MRI studies, where the brainstem, postcentral gyrus, hypothalamus, hippocampus, thalamus, nucleus accumbens, amygdala, and insula are the area's most frequently impacted by taVNS and VNS [12]. Even Though there was a better improvement observed in a different conditions, it is possible that additional variables, such as coexisting illnesses, the cause of a stroke, an individual's unique anatomy, or medications or disorders that affect neuromodulatory function, could affect the effectiveness of VNS therapy. [7]. The potential for this therapy to speed-up the participant's recovery will be maximized by testing the clinical improvement of paired VNS therapy among the vast stroke populations and by continuing to develop parameters for stimulation and rehabilitative concepts to individualize and optimize the intervention for patient sectors. When TaVNS is combined with a rehabilitative framework as opposed to giving only conventional rehabilitative training, animal models with behavioral abnormalities of chronic ischemic stroke, and traumatic brain injury and intracerebral hemorrhage shows better improvement. According to several studies, VNS increases neuronal plasticity by energizing neuromodulatory systems in tandem with training. The cholinergic basal forebrain and the noradrenergic locus coeruleus are activated physically by VNS [13]. Since neuroplasticity is the base which improves the left-over neurological pathways and returning the normal function, increasing its neuronal activity through TaVNS is a remarkable development in neurological rehabilitation. Possible explanations for the increases in proprioception seen in the patients can also be due to the improvement in range of motion and strength which has been made possible by TaVNS-assisted exercises. It's likely that the extended range of joint motions caused by the injury of the affected limb will eventually increase sensory feedback, which in turn increases neuroplasticity of sensory pathways in the cerebral cortex. When the relationship between improved motor performance and sensory feedback is taken into consideration, it is reasonable to hypothesize that motor and sensory repair are mutually reinforcing positive feedback loops. Along with this, a combination of taVNS helped in the rewiring of the neuronal pathway that produces sensorimotor feedback back to the CNS. Wide research on combining TaVNS with other different interventions is essential for incorporating this intervention into rehabilitation. TaVNS is thus a wide area that needs to be understood and can be put into rehabilitation for the betterment of the neurological population. Small sample size and treatment is initiated at different times for every participant affecting the similarity are the limitations of the study.

## Conclusion

The transcutaneous auricular vagal nerve stimulation has a positive impact and improvement of vestibular function among stroke survivors. Even

though there was no direct measure or assessment regarding the improvement of balance, the study enhanced the recovery rate and improved their functional balance.

**Ethical Clearance:** Taken from institutional ethical committee.

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**Conflict of Interest:** Nil

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Original Article

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# Effectiveness of Strength Training among Post Covid Subjects in Activities of Daily Living

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**Abstract**

**Background:** The current COVID 19 caused by severe acute respiratory syndrome. COVID 19 is not limited to the respiratory system but has widespread involvement. Some specific problems are described, including severe muscle weakness and fatigue, joint stiffness, dysphasia, psychological problems, impaired functioning concerning mobility, activities of daily life and work get affected. Rehabilitation care for COVID-19 survivors must therefore be delivered by specialist multidisciplinary team, need focused and planned for the longer term to meet the needs of these individuals.

**Purpose:** To evaluate the effect of strength training exercise and conventional care on levels of dyspnea and post COVID functional levels among post COVID-19 participants.

**Materials and Methods:** 30 individuals diagnosed with post COVID-19 were selected based on the inclusion and exclusion criteria. Post COVID-19 patients were selected from the inpatient ward, Saveetha hospital. The selected subjects were allocated into 2 groups. Strength training group and conventional group. Strength training group were treated with diaphragmatic strength training and conventional group was treated with thoracic mobility exercise. The effectiveness of the treatment was assessed at the end of 6 weeks, using various outcome measures.

**Conclusion:** We conclude, Diaphragmatic strength training exercise has better impact in improving in functional levels among post COVID-19.

**Key Word:** COVID-19, diaphragmatic breathing, strengthening exercise, daily activities

## Introduction

The current COVID 19 caused by severe acute respiratory syndrome. COVID 19 is not limited to the respiratory system but has widespread involvement including gastrointestinal tract and liver, with evidence of prolonged faecal shedding and feco oral transmission. SARS-CoV-2 (severe acute respiratory syndrome-coronavirus-2) is a novel coronavirus that causes COVID-19, a highly contagious respiratory illness The disease is transmitted by inhalation or contact with infected droplets and the incubation period ranges from 2 to 1[1]. The symptoms are usually fatigue, cough, sore throat, fever malaise, breathlessness among others. The disease is mild in most people; in some (usually the elderly and those with co morbidities), it may progress to pneumonia, acute respiratory distress syndrome (ARDS) and

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multi organ dysfunction[2]. Rehabilitation is important for patients with COVID-19. In the intensive care unit (ICU), patients frequently spend a lot of time immobile. Patients frequently spend long periods of time in the prone position, which can result in post-ICU dysphasia, muscle weakness, myopathy, and neuropathy due to critical illness, as well as decreased joint mobility, neck and shoulder pain, difficulty standing, and impaired balance and gait, with subsequent limitations in daily activities[3].

It is necessary to formulate rehabilitation program for these patients to help them restore physical and respiratory function and to reduce anxiety and depression to restore a good quality of life. It is necessary to formulate rehabilitation program for these patient to help them restore physical and respiratory function and to reduce anxiety and depression to restore a good quality of life[3,4]. Patients are affected by neurological, respiratory and musculoskeletal systems. Poorer health is associated with higher risk for severe respiratory complications from the COVID-19[4].

About 30% to 80% of people have cognitive impairments, which include difficulties with focus, memory, processing, and problem-solving. About 30% of patients experience psychological symptoms like anxiety and despair, while 10% to 50% of patients express signs of post-traumatic stress disorder.

As soon as patients have achieved cardiopulmonary stability and meet established safety criteria, physical rehabilitation can begin. They undergo not only physical weakness, but may also suffer from problems on the psychosocial, pulmonary, physical and cognitive domain[5].

A precise and consistent pharmaceutical treatment plan and breathing exercises are the most crucial steps in treating dyspnea and associated symptoms. The current global availability of pulmonary rehabilitation treatments is disturbingly low, even though it is beneficial at enhancing physical performance and quality of life after hospitalization. Airflow restriction is a significant health issue that is not only caused by a straightforward respiratory condition but also by a number of other underlying issues[6]. Therefore, improving respiratory function is crucial for preserving ADL and QoL in older patients who had COVID-19 and were discharged with positive outcomes[7]. Strengthening exercise regimens can result in a combination of central and spindle mechanisms, an increase in gamma motor activity, and an improvement in the central processes of motor control[8].

This study aimed to determine whether diaphragmatic breathing and strengthening were effective in treating post COVID.

## Aim

To evaluate the effect of strength training exercise and conventional care in activities of daily living among post COVID-19 participants.

## Material and Method

It was an experimental study conducted on 30 subjects with post COVID, age between 25- 45 yrs , taken from Saveetha Medical College and Hospital, Chennai during the period of July 2022 to August 2022. Convenient sampling Technique using closed-envelope method.

**Inclusion Criteria:**

- An adult between 25 to 45 years.
- Subjects who had confirmed with RT-PCR test negative after the post-COVID.

**Exclusion Criteria:**

- Subjects who had other systemic problems, joint degeneration, awaiting other surgeries.
- Participants with low muscle mass in observation, handgrip strength less than 24kg and slow gait speed were excluded.
- Participants with prior exercise training, under medication, history of lower limb surgeries, fractures, cardiac problems, respiratory Problems and any other contraindications for strengthening exercise were excluded.

**Outcome Measure:**

- PCFS SCALE: Post COVID functional scale.
- Dyspnea scale.

**PCFS scale:**

A respondent chooses a whole number (0-4 integers) on the PCFS that best describes the functional

activity of the post- COVID. Score- 0 represents no functional limitations, score- 1 represents negligible functional limitations, score- 2 represents slight functional limitations, score- 3 represents moderate functional limitations, score- 4 represents severe functional limitations.

*3.6.2. Dyspnea scale:*

The degree of baseline functional impairment brought on by dyspnea is measured using the MRC Dyspnea scale.MRC dyspnea grade describes grade-0 evaluate only breathless with strenuous exercise, grade-1 they get short of breath when hurrying on level ground or walking up a slight hill, grade-2 represents on level ground, I walk slower than people of my age because of breathlessness, grade- 3 `stop for breath after walking about 100 yards or after a few minutes on level ground, grade-4 represents too breathless to leave the house or I am breathless when dressing / undressing.

**Procedure**

Thirty respondents were chosen for the convenient sampling technique, based on the inclusion and exclusion criteria. After receiving more information about the study, all individuals provided written informed consent before beginning the study. Dyspnea scale and Post-COVID functional scale (PCFS) were used to evaluate the pre-test and post-test. Using the closed-envelope method, participants were randomly assigned to one of two groups.

Diaphragmatic strength training exercise were performed in the strength training group. Thoracic mobility exercises with diaphragmatic breathing exercise were performed in the conventional group.

- Strength training group:

  Participants were given diaphragmatic strength training exercise.

**Exercise 1:**

- Patient was asked to be in supine position
- Patient was asked to keep one hand on the upper chest and half kg sand bag was placed on the upper abdomen.
- Patient was asked to breathe in slowly through their nose, letting the air in deeply, towards the chest. The hand on the chest should remain still, while the lower chest expands gradually.
- Patient asked to tighten the abdominal muscles and let them fall inwards as they exhale. And they feel the resistance during inspiration.
- Patient is asked to repeat the procedure for 15reps/2sets/day.
- For a total period of 5days a week for 4weeks.

**Exercise 2:**

- Resistance training was prescribed with weights based on an individual, personal strength assessment basis. A 10-repetition maximum is the greatest amount of weight that a participant can lift through the range of motion for 10 times. Each group of muscles was trained for 10 repetitions for three sets with a rest period of 60 seconds. The resistance was increased gradually as per the individual requirements and the training was given four days a week, for eight weeks. This training was conducted by a trained physiotherapist on an individual basis at the physiotherapy department.

**Upper limb exercises:**

- **Shoulder front raise** with weight Patient was asked to hold 1kg dumbbell in hands in erect standing posture. Then asked to raise the hands in front of thighs with palms in a neutral position, without bending elbows with co-ordinate breathing exercise. (i.e., inspiration during lifting up the hand and expiration during lowering the hand down) and then lower the weights.
- **Shoulder lateral raise** with weight Patient was asked to hold 1kg dumbbell in hands in erect standing posture.

  Then asked to raise the hands in front of thighs with the top of each weight pointed away, and then lift arms up by sides without bending elbows with co-ordinate breathing exercise. (i.e., inspiration during lifting up the hand and expiration during lowering the hand down), then lower the arms.

- **External rotators** with weight Patient should be positioned in supine lying by holding 1kg dumbbell with the shoulder abducted to

900 and the elbow bent to 900 , so the hand points to the roof, patient should rotate the shoulder joint externally so that the hand moves backwards and the palm faces the roof along with co-ordinate breathing exercise.

- **Internal rotators** with weight Patient should be positioned in supine lying by holding1kg dumbbell with the shoulder abducted to 900 and the elbow bent to 900, so the hand points to the roof. Patient should rotate the shoulder joint internally so that the hand moves forwards and the palm faces the floor along with coordinate breathing exercise.

**Treatment Protocol:**

- Resistance\weight - 1 kg dumbbell
- Frequency-5days per week for a period of 4 weeks
- 1 session per day
- 10 to 15repetitions \ 2 sets

Conventional group:

Participants received thoracic mobility exercise and diaphragmatic breathing exercise.

**Thoracic mobility exercise:**

**Sitting position:**

The patient should exhale while bending forward to touch the floor with arms crossed at the feet then the patient should extend up while taking a deep inspiration and lift the arm up with a frequency of 5 days per week and 2 sets of 10 repetitions.

**Standing Procedure:**

The patient should stand with his knees straight, the patient instructed to exhale while bending forward to touch the floor with arms; then the patient should extend up by lifting his hands simultaneously taking a deep inspiration. 10 repetitions/set–2sets with a frequency of 5 days per week.

**Diaphragmatic breathing exercise:**

**Sitting Position:**

- Sit up straight in a chair lengthen the distance between your navel and sternum. Keep shoulders relax. Keep the pelvis in neutral position (Sit on sitting bones). Place your hands at either side of your lower ribs.
- Breath in slowly through nose. As you inhale feel the ribs expanding outwards and upwards. During inhalation is generated expansion of the trunk in three directions front, sides and back. Breath out from your nose. As you exhale feel the lower ribs moving inwards.

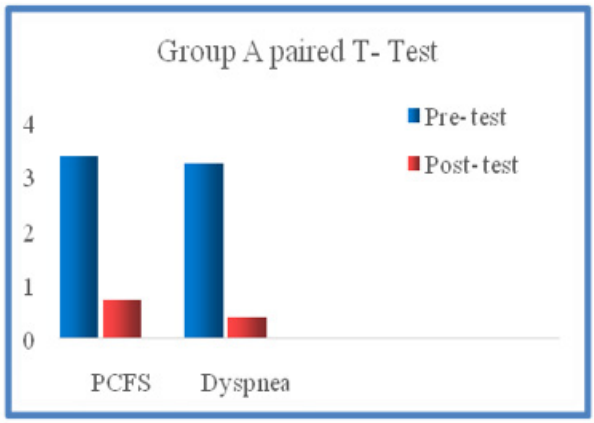
**Standing position:**

- Lie on the back on a flat surface (or in bed) with the knees bent. You can use a pillow under head and knees for support if that's more comfortable. Place one hand on the upper chest and the other on the belly, just below your rib cage. Breathe in slowly through the nose, letting the air in deeply, towards the lower belly. The hand on the chest should remain still, while the one on the belly should rise. Tighten the abdominal muscles and let them fall inward as you exhale through pursed lips. The hand on the belly should move down to its original position.

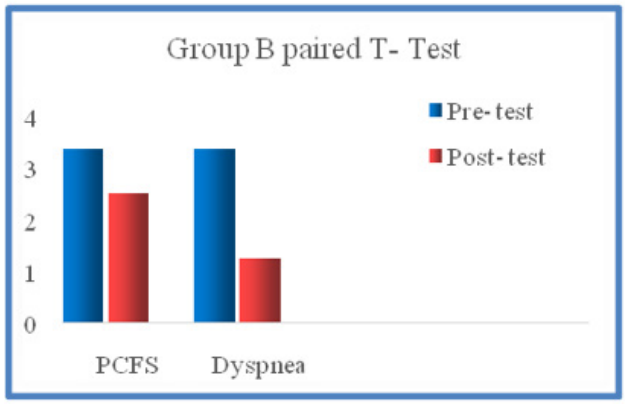
*3.5.2. Treatment protocol:*

- Duration of the session: 30-40 minutes
- Frequency: Single session per day / 4 weeks
- Sets: 2 sets
- Repetitions: 10-15 repetitions
- Rest: 2-3 minutes break between sets.

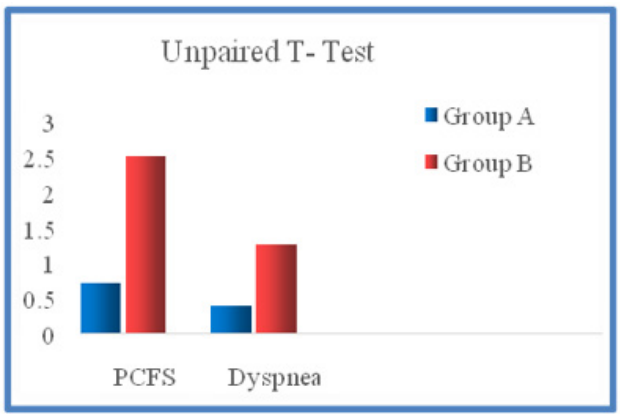
**Data analysis**




**INTERPRETATION: Fig. 1 shows that the values are extremely statistically significant.**




**INTERPRETATION: Fig. 2 shows that the values are extremely statistically significant.**




**INTERPRETATION: Fig. 3 shows that the values are extremely statistically significant.**

## Result

- The study was conducted on 30 subjects. Both the group has 15 subjects each.
- The mean for PCFS was 0.7300for group A, and 2.5300 for group B with p value= <0.0001 and t value was 10.0414 indicating that the results were extremely statistically significant.
- The mean for dyspnoea was 0.4000 for Group A and 1.2700 for Group B, with p value =<0.0001 and t value was 4..9060 indicating that the results were extremely statistically significant.

## Discussion

The purpose of this study was to determine the effectiveness of strength training exercise on functional recovery in patients with post COVID. The study involved 30 people 25 to 45years. Random group allocation separated the groupings in half. The experimental group did strength training exercise and while the control group did thoracic mobility exercise. The trial lasted 5 weeks, and workouts were given 5 days each week. During the treatment, there is no drop-out.

When data from the experimental group, which received diaphragmatic breathing and strengthening exercise, were analysed using paired t-tests within the study population for MRC dyspnoea scale, PCFS scale, there was a statistical difference in these two measures of outcome, namely breathlessness, function, and strength. High levels of impairments in the physical, cognitive, and psychosocial domains are possible. Providers of rehabilitation services will be a crucial link in the continuum of care, assisting in the transition of patients from acute care facilities to eventual community discharge. Rehabilitation is a complex intervention and a longitudinal process with the goals of minimizing the impact of an individual's impairments on daily functioning, promoting and optimizing functional independence in daily living activities, and maximizing opportunities to participate meaningfully in society on the basis of any new functional baseline. In order to support bio-psycho-social functioning, rehabilitation is best provided by specialists working in multidisciplinary teams[9].

The present results confirm the hypothesis that the PCFS Scale can be used to measure the impact of symptoms on the functional status of subjects after COVID-19, especially in slight to severe categories. It is believed that COVID-19 may significantly affect patients with moderate illness presentations in terms of their physical, cognitive, mental, and social health status. The proposed "Post-COVID-19 Functional Status (PCFS) scale" could be assessed upon discharge from the hospital, at 4 and 8 weeks post-discharge to monitor direct recovery, and at 6 months to assess functional squeal[10].

When pre- test and post- test analysis was done for experimental group for which resistance exercise and diaphragmatic breathing exercise was given, data was analysed using paired t- test within the group for PCFS scale and dyspnea score showed statistical difference in the two outcome measures that is functional activities, breathing capacity.

After COVID-19, dyspnea is the most often reported respiratory complaint. A prevalence of persistent dyspnea following hospitalisation and in non-hospitalized patients with moderate COVID-19 ranges from 5% to 81%, according to studies reporting respiratory symptoms from 1 to 12 months after COVID-19. Breathing exercise includes exercise to improve a good inspiration marked by deep and long inspiration[11].

Although exercise capacity increased in the majority of patients during this time, we discovered indications of long-lasting physiological and radiographic alterations in a subgroup of individuals. Finally, prior to COVID-19, we lacked the pulmonary function, exercise capacity, or CT results necessary to determine COVID-19's effects over time. Dyspnoea is a symptom limiting exercise and ADL; therefore, we searched the literature also for papers reporting this symptom. The severity of dyspnoea cannot be predicted from lung function; therefore, dyspnoea must be assessed specifically. Pranayama has been used as a exercise strategy to cope up the stress ,anxiety and fatigue in covid 19 individuals[12].

This finding demonstrates that strength decreases in patients with post COVID. Statistical analysis revealed higher strength[13].

Several instruments are commonly used to measure different domains of dyspnoea such as sensory-perceptual experience, affective distress, symptom impact or burden. We found twelve studies investigating dyspnoea during physical activity with various scales. Some studies have investigated that only breathing and strengthening exercise does not improve the quality of life in post COVID-19 individuals, also it needs some of the pharmacological support. In this study there is improvement in quality of life to the individuals participated.

As a result, the purpose of this study is to look into the effectiveness of combining strengthening exercise and diaphragmatic breathing exercise for people with post COVID, which could lead to better treatment outcomes and overall patient outcomes. This conclude that post COVID affects the functional activities and respiratory system. Hereby we conclude that Diaphragmatic strength training exercise was more effective than the conventional group.

## Conclusion

All outcome indicators in both groups showed significant improvement. Somewhat more improvement in strength training group and is statistically significant for PCFS(post COVID functional scale) and dyspnea scale.

Post COVID affects the functional activities and respiratory system. Diaphragmatic strength training has a better effect in improving muscle strength and breathing capacity among post COVID-19. This study shows improvement in post COVID functional scale as well as reducing dyspnea level. Hereby we conclude that Diaphragmatic strength training exercise was more effective than the conventional group.

**Ethical clearance:** The study was approved by the committee of institutional scientific review board. All study participants were informed about the study objectives, and those who agreed to Participate signed informed consent forms.

**Funding:** None

**Conflicts of interest:** The authors declare that they have no conflicts of interest.

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Original Article

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# The Effects of Early Mobilization Protocol on Pre and Post Operative Functional Performance for Individuals with Post Abdominal Surgery

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**Abstract**

**Background:** The post surgical period of abdominal incision was accompanied with respiratory muscle dysfunction and diminished physical capability. Limited upright mobilisation, exhaustion, and restricted lung abnormalities, among other functional issues, are linked to the early postoperative days. Improving pre-operative levels of physical functioning in individuals might be beneficial for post operative outcome.

**Aim:** Aim of the study was to find out on which post-operative day the abdominal surgery participants get to the same functional status as pre-operative status.

**Method:** 40 Individuals hospitalized for abdominal surgery at Saveetha Medical College and Hospital were chosen for the study based on the inclusion and exclusion criteria. The selected participants were treated with diaphragmatic breathing exercise, Incentive spirometry, thoracic expansion exercise, splinted coughing technique, active range of motion exercise for upper extremity and lower extremity for pre-operative abdominal surgery participants. Post operative participants were treated with physiotherapy from POD 1 till the time their functional status become same as the pre-operative status. Six- minute walk test, hospital anxiety and depression scale were used in this study. Their scores were calculated and analysed.

**Result:** Similar pre-operative mean (365.25±25.92) was attained at POD-7 (350.75±25.46). Day of POD-5, the HADS score was normal (0 to7) in depression.

**Conclusion:** This study shows the post-operative status is attained back on POD-7 with using 6MWT. Depression was relieved at POD-5 with a value of mean and standard deviation in HADS.

**Key Words:** Abdominal surgery, Functional status, Six- minute walk test.

## Introduction

Gastric incision can involve disparate approaches contingent on the organ that needs an incision, such as the liver, stomach, or kidneys. Gastric surgery is consistently suggested for sufferers who have conditions that impact the countless organs in the gastric cavity. The causes are inexplicable abdominal bleeding, appendix inflammation, fetal demise or miscarriage, and inexplicable gastric symptoms. The adjusted intra-abdominal incision assess was 43.8% in mortal over the age of 60, With the exception of the age group 21 -40. The presence of pre-surgical issues

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such as agedness, emitting fumes, malnourishment, being overweight, respiratory diseases, and ailment is linked to the presence of Post surgical Pulmonary Complications in these people. Indignation and tenderness produced by injury from manipulation close to the diaphragm, instinctive suppression of afferent gastric receptors, and post surgical discomfort are all possible causes of diaphragmatic dysfunction.[1] Preoperative aerobic fitness programmes have been investigated as a possible technique for preventing postoperative functional impairment.[3] Postoperative complications and certain pre-operative therapies may also have an impact (eg, opioid analgesia). Participants who are recuperating withdraw from domestic, recreational, and economic activities and frequently need support.[2] Postoperative abdominal surgery is linked to respiratory muscle dysfunction and decreased physical capability, both of which are linked to the development of postoperative pulmonary problems.[3] The severity of initial postoperative pain has been associated with chronic pain development.[4] Utilization of mechanical hand-held breathing device for decreasing the occurence of postoperative pulmonary complications further on cardiac or upper abdominal incision, even though there may be some advantages of pre-surgical deep breathing exercises, respiratory physiotherapy, and mechanical hand-held breathing device in fall off postsurgical pulmonary complications further on major gastric incision.[5] The necessity for mobilisation programmes with a multidisciplinary team and the most efficient way to undertake early mobilisation programmes in critical care units. It has been demonstrated that early ambulation, a crucial component of the Enhanced Recovery After Surgery protocol, reduces the length of critical care and hospital stays.[6] In this study we are going to find out on which post operative day abdominal surgery participants who achieve the same functional status as before surgery.

## AIM

Aim of the study was to find out on which post-operative day the abdominal surgery participants get to the same functional status as pre-operative status.

## Materials and Method

The Quasi experimental study was conducted on 40 in-patients who underwent abdominal surgery at Saveetha Medical College And Hospital, Thandalam. Participants were chosen according to the inclusion and exclusion criteria. Simple random sampling technique was used in this study. This study was conducted between August 2022 to November 2022.

**Inclusion criteria**:

- Both genders were included.
- Age – 30 to 55 years.
- Participants planned for abdominal surgery and underwent abdominal surgery for the causes of appendicitis,cholecystitis, recurrent incisional hernia, carcinoma of pancreas.
- Participants with stable vitals.

**Exclusion criteria**:

- Individuals with cardio- vascular conditions
- Individuals associated with any kind of orthopedic surgery.
- Individuals immobile due to any prior loco-motor or neurological conditions.
- Individuals undergoing gynecologic surgery.

**Outcome Measures:**

The assessment was performed on pre-surgery and post- surgery days 1,3,5,7

- Six-minute walk test
- Hospital Anxiety and Depression scale.

**Study Procedure**

A total of 40 samples were selected based on specific inclusion and exclusion criteria. Prior to the intervention, it was essential to obtain written consent from the participants for both pre-operative and post-operative treatment. Written consent ensures that the patient is fully informed about the procedure, its potential risks and benefits, and any alternative options available. The pre-operative phase involved administering various exercises to the participants, specifically targeting the upper extremities and lower extremities with active range of motion exercises. In addition, participants were guided through incentive spirometry exercises, thoracic expansion exercises, diaphragmatic breathing exercises, and the splinted coughing technique. These exercises were tailored specifically for participants scheduled to undergo abdominal surgery.

Following the surgical procedure, post-operative participants received physiotherapy starting from Postoperative Day 1 until their functional status matched that of the pre-operative period. The aim was to restore their functional capabilities to the same level as before the surgery.

In this study, two specific assessment tools were utilized: the Six-Minute Walk Test and the Hospital Anxiety and Depression Scale. The Six-Minute Walk Test was employed to evaluate the functional capacity of the participants. This test measures the distance an individual can walk in six minutes, serving as an indicator of their overall physical endurance and cardiovascular fitness.

On the other hand, the Hospital Anxiety and Depression Scale was used to assess the participants' levels of depression. This scale is a standardized questionnaire consisting of several items that evaluate symptoms of anxiety and depression.

Both the six-minute walk test and the Hospital Anxiety and Depression Scale were administered to the participants on various days throughout the study, including pre-surgical and post-surgical days 1, 3, 5, and 7. These assessments enabled data gathering at different stages of the surgical and recovery process.

All the collected data was carefully recorded, tabulated, and analysed.

**Treatment Protocol**

**Pre- Operative Therapy**

- Patient education ( explained about the importance of exercise).
- Diaphragmatic breathing exercise- 10 repetitions of three sets of deep breaths each, with a three-second hold on the inhalation and a pursed lip exhalation, thrice a day.
- Thoracic expansion exercise (5 reps of 2 sets, thrice a day.
- Incentive spirometry- 10reps – three sets/ session, 3 sessions/day.
- Splinted huffing and coughing technique encouraged by the patient.
- Active range of motion exercise for bilateral upper extremity and lower extremity (ankle pumps, ankle toe movements, heel sliding, finger , elbow and shoulder range of motion exercise) – Five sets of five repetitions , thrice a day.
- Ambulate the patient out of bed ( 10 to 15 minutes, thrice a day).

**Post Operative Therapy**

**POD 1**

- Diaphragmatic breathing exercise – four sets of five deep breaths each, with a three-second hold on the inhalation and a calm expiration from POD-1, ( twice a day).
- Incentive spirometry – 10reps – three sets/ session, 3sessions/day.
- Splinted huffing and coughing from POD 1 ( twice a day).
- Active range of motion exercise for upper extremity and lower extremity (ankle pumps, ankle toe movements, heel sliding, finger , elbow and shoulder range of motion exercise - three sets of five repetitions from POD 1 ( twice a day).
- Ambulate the patient out of bed with maximal support for 5 to 10 feets (twice a day).

**POD 2**

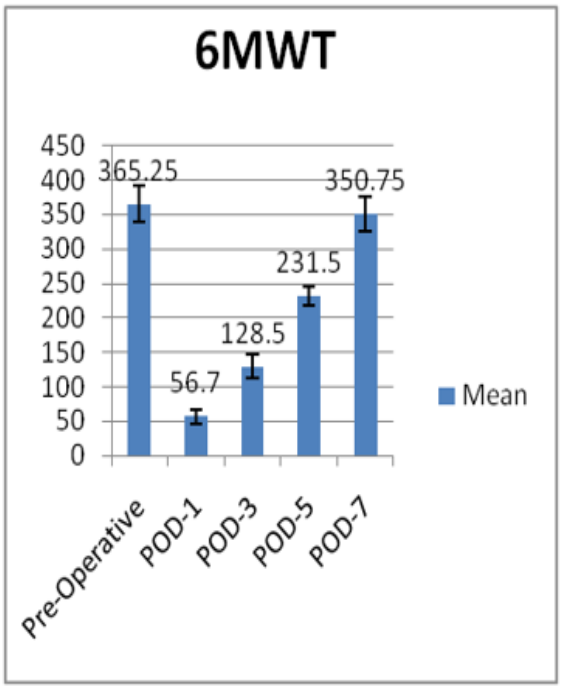
- Same exercise of POD 1.
- knee rolling ( 5 reps of 3 sets, twice a day).
- Thoracic expansion exercise (5 reps of 3 sets, twice a day ).
- Shoulder bracing exercise (5 reps of 3 sets, twice a day).
- Shoulder shrugging (5 reps of 3 sets, twice a day).
- Walking without support from POD2.

**POD 3**

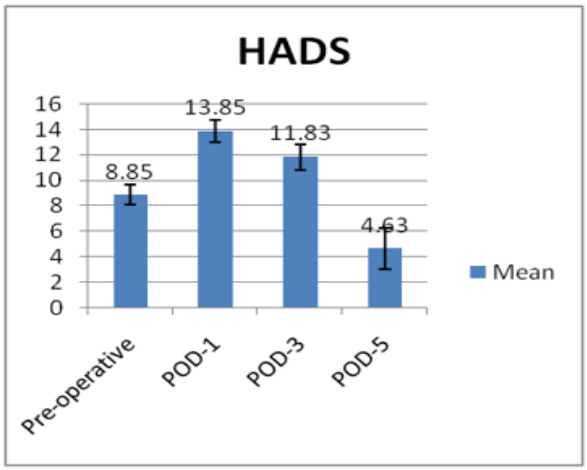
- Same exercise of POD 1 and POD 2
- Resisted exercise for bilateral upper extremity and lower extremity(1RM, 5 reps of 3 sets per day).

From POD 4 to until the day the post functional status same as pre functional status same exercise followed.

**Data Analysis**




**Graph 1: Shows 6MWT values in pre and Post-Operative abdominal surgery participants.**




**Graph 2: Shows depression scores in Pre and Post- Operative abdominal surgery participants.**

## Result

Total of 40 abdominal surgery participants were assessed and data was calculated and tabulated. Mean±SD age of the participants was 42.8±6.9years. Mean±SD BMI of the participants was 23.5±1.5kg/ $m^2$.In 6MWT, the Pre- operative abdominal surgery participants Mean±SD was 365.25±25.92 meters. On the day of POD-1 Mean±SD was 56.7±0.97meters. Day of POD-3 Mean±SD was 128.50±17.18meters. Day of POD-5 Mean±SD was 231.50±13.88meters. Day of POD-7 Mean±SD was 350.75±25.46meters. The distance they were covered in 6MWT at Pre-surgical and post surgical days- 1,3,5,7 were presented in Graph-1.Similar pre-operative Mean (365.25±25.92) was attained at POD-7 (350.75±25.46).

According to HADS, Pre-operative abdominal surgery participants, mean±SD depression score was 8.85±0.80. Day of POD-1 mean±SD depression score was 13.85±0.86. Day of POD-3 Mean±SD depression score was 11.83±1.03. Day of pod-5 Mean±SD depression score was 4.63±1.58. On pre-operative HADS scores was in borderline abnormal (8to10) in depression because of operative procedure. Day of post- operative 1 and 3 it was abnormal score (10to13) in depression. Day of POD-5, the HADS score was normal (0 to7) in depression. The values of depression scores in HADS at Pre-surgical and post surgical days- 1,3,5,7 were presented in Graph-2.

## Discussion

The current study utilized quasi- experimental study to find out the effect of early mobilization protocol in pre and post operative functional performance in participants who were planned and underwent abdominal surgery. This study ensured that all participants provided with written informed consent before their inclusion in the study.

The both male and female participants who were scheduled for abdominal surgery between the ages of 30 to 55 years were included. The scheduled for abdominal surgery due to conditions such as appendicitis, cholecystitis, recurrent incisional hernia, and carcinoma of the pancreas. Participants with stable vitals were included, while those undergoing cardiac or orthopedic surgery, Participants with immobility due to prior locomotor or neurological conditions, and Participants undergoing gynecologic surgery were excluded from the study.

The treatment protocol involved pre-operative and post-operative physiotherapy interventions. Pre-operative therapy included exercises such as diaphragmatic breathing exercises- 10 repetition of five sets for thrice a day, incentive spirometry-10reps – three sets/session, splinted coughing and

huffing technique was taught to the patient, active range of motion (AROM) for the upper and lower extremities (ankle pumps, ankle toe movements, heel sliding, finger , elbow and shoulder range of motion exercise) - five sets of five repetitions for thrice a day, 3sessions/day, and ambulation for 10 to 15 minutes -thrice a day.

Post-operative therapy started from post-operative day 1 (POD 1) and included activities such as diaphragmatic breathing exercises- four sets of five repetition for twice a day, incentive spirometry-10reps – three sets/session, 3 sessions/day, splinted huffing and coughing were encouraged for twice a day, AROM exercises for the upper and lower extremities (ankle pumps, ankle toe movements, heel sliding, finger , elbow and shoulder range of motion exercise) - three sets of five repetition for twice a day, ambulate the patient out of bed with walking with support for twice a day. The same exercise of POD-1 followed and walking without support from POD-2. Additional exercises such as knee rolling- five reps of three sets for twice a day, thoracic expansion exercises- five reps of three sets for twice a day, shoulder bracing exercises- five reps of three sets for twice a day, and shoulder shrugging- five reps of three sets for twice a day. The post-operative exercises were gradually increased in intensity and complexity as the patient progressed, and resistance exercises for upper extremity and lower extremity- 1 RM, five repetition of three sets per day were introduced from POD 3 onwards. From POD-4 to until the day post functional status same as pre functional status same exercise followed.

The study utilized two outcome measures to assess the effects of the intervention. The first outcome measure was the 6-Minute Walk Test (6MWT), which evaluated the functional performance of the participants through sub-maximal exercise. The second outcome measure used in the study was the Hospital Anxiety and Depression Scale (HADS), which assessed the levels of anxiety and depression in the Participants. The HADS consists of 14 items, with 7 items each for anxiety and depression.

Another study by fadime koyuncu RN et al., (2021) examined the effects of mobilization programme schedule on mobilisation starting time, maintenance of mobilisation and Participants care outcomes in individuals who underwent major gastric incision. The results demonstrated that the early mobilization significantly decreased the length of critical care and hospital stays and mobilization protocol has a good impact on early mobilization and participant care outcomes.[6]

Another study by I Boden et al., (2021) explored the Effects of Pre-surgical education and breathing exercise training by a therapist minimizes respiratory problems after abdominal incision. The results demonstrated that the likelihood of a Post-surgery respiratory problems following major abdominal incision is cut in half by the single preoperative physical therapy session. Preoperative physical therapy reduces the signs and symptoms of lung collapse/consolidation,air-passage infection, and post-surgery pulmonary problems.[7]

Furthermore a systematic review and meta analysis by Jonathan Moran BS et al., (2016) examined to assess the ability of prehabilitation to influence post-surgical outcome after intra-gastric incisions. The review encompassed various types of physiotherapy intervention, including inspiratory muscle training, aerobic exercise, and/or resistance training. The findings suggested that prehabilitation appears to be helpful in reducing the incidence of post-surgical problems. Our meta-analysis did not reveal whether prehabilitation can reduce post-surgical length of stay since there were few studies that looked at length of stay. No post surgical mortality was reported in any study.[8]

Although the current study did not specifically measure post- surgical problems, other studies have reported that the deep breathing exercise and coughing exercises with physiotherapist-supervised program of early mobilisation did not significantly decrease the incidence of clinically significant postsurgical respiratory problems in high risk open gastric incision participants (Margaret R Mackay et al., 2005).[9]

Hence, the current study adds to the existing body of literature by demonstrating the potential benefits of pre and post operative exercise in improving functional performance and the participants got to the same functional status as pre-operative status on POD-7 and relieving depression status in participants underwent abdominal surgery on POD-5.

## Conclusion

The conclusion of this study was that cardio-pulmonary exercise has a better impact in increasing functional capacity of participants who underwent abdominal surgery. This study shows the post-operative status is attained back on POD-7. Depression was relieved at POD-5 with a value of mean and standard deviation in HADS. Hereby we states that pre-operative assessment of the participant and early post operative rehabilitation helps in planning the physiotherapy management for abdominal surgery participants.

**Ethical Clearance:** Taken from the Institutional Science Review Board.

**Funding:** Self.

**Conflict of Interest:** There is no funding source.

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Original Article

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# Effects of Pulmonary Rehabilitation and Respiratory Muscle Training in Individuals with Acute Respiratory Distress

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**Abstract**

**Background:** Acute Respiratory Distress Syndrome (ARDS) arises from accumulation of fluid in the tiny, flexible air sacs of the lungs. Individuals with ARDS may experience muscle weakness, due to a condition known as intensive care unit acquired weakness, resulting in impaired physical function. To mitigate potential complications namely muscle weakness and joint contractures, and to assist with weaning from mechanical breathing and enhance the overall quality of life for individuals with ARDS, early rehabilitation is strongly advised.

**Purpose:** To compare the effectiveness of pulmonary rehabilitation and respiratory muscle training against conventional care among individuals with ARDS.

**Materials and Methods:** 30 subjects diagnosed with ARDS were randomly selected from the intensive care unit or patient ward of Saveetha Hospital following certain inclusion and exclusion criteria. The subjects were allocated into pulmonary rehabilitation with respiratory muscle training group (n=15) and conventional care group (n=15). The effectiveness of the treatments was assessed at the end of 4 weeks using a 30 seconds sit-to-stand test and St. George's Respiratory Questionnaire.

**Results:** Descriptive and inferential statistics were used to examine the data collected. All parameters underwent analysis employing mean and standard deviation. To analyze significant differences, pre-test and post-test measures, a paired t-test was performed. P values < 0.0001 were deemed statistically significant.

**Conclusion:** The combination of pulmonary rehabilitation and respiratory muscle training offered an adjunctive treatment option for patients with ARDS, providing quality of life, and improving strength of the muscle activities compared to conventional care alone.

**Key Word:** Acute distress respiratory syndrome, Pulmonary rehabilitation, Dyspnoea, Physical performance test, Quality of life

## Introduction

Acute Respiratory Distress Syndrome is a progressive type of respiratory failure that involves extreme hypoxia and non-hydrostatic pulmonary edema[1]. Pathologically, diffuse alveolar injury, alveolar capillary leakage and the emergence of protein-rich pulmonary edema are the characteristic features of ARDS. All these factors adhere to the emergence of clinical manifestations such as dyspnea,

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decreased lung adherence, severe hypoxemia, and widespread bilateral infiltrates on chest radiographs[2]. A prevalence investigation was carried out over four weeks in 459 ICUs in fifty nations. Twenty-three percent of mechanically ventilated patients and ten percent of all ICU patients met the necessary standards, and the incidence of ARDS in the ICU was 5.5 million cases per ICU bed per year. Sepsis, pneumonia, aspiration of gastric contents, severe trauma, and numerous transfusions account for a significant number of instances of ARDS development among the various causes that have been identified[3].

Refinements in mechanical ventilator support have been provided recently in the treatment of ARDS, alongside a focus on protective lung ventilation approaches that use minimal minute ventilation, increased Positive End Expiratory Pressure (PEEP), and recruitment techniques to reopen collapsed lung alveoli[4]. Physical therapy for ARDS patients attempts to lessen their reliance on ventilators, improve their remaining lung function, regain their physical independence, limit complications, and improve their quality of life[5]. Chest manipulations, such as vibration, percussion, and suctioning (both open and closed procedures), have been included in basic physiotherapy interventions. Additionally, positioning is used to increase ventilation-perfusion mismatch, enhance ventilation-associated pneumonia incidence, and maximize oxygenation. In addition, active or passive mobilization is used to stop deconditioning[6]. Therefore, this study has been proposed to improve the quality of life and muscle strength in individuals with ARDS.

## Aim

To compare the effectiveness of pulmonary rehabilitation and respiratory muscle training against conventional care among individuals with ARDS.

## Material and Method

30 subjects with acute respiratory distress syndrome between the ages of 40 to 60 years were randomly selected from Saveetha Medical College and Hospital, Chennai to participate in an experimental study conducted to evaluate the effectiveness of pulmonary rehabilitation and respiratory muscle training compared to conventional care.

**Inclusion Criteria:**

- Both genders – Male and Female
- Age – 40 to 60 years
- Stable medical condition with a stable respiratory status, allowing for active participation in a rehabilitation program
- Patients diagnosed with moderate ARDS. (100mmHg < $Pao_2/Fio_2$ ratio ≤ 200 mmHg with PEEP ≥ 5cm $H_2O$)
- Sufficient cognitive and psychological ability to comprehend and actively engage in the rehabilitation process.

**Exclusion Criteria:**

- Unstable medical conditions, such as active infection or unstable respiratory status.
- Severe comorbidities or medical conditions.
- Cognitive impairment or psychological conditions.
- Cardiovascular instability, such as severe heart failure or unstable angina.
- Unwillingness or inability to comply with the requirements of a pulmonary rehabilitation program.

**Outcome Measure**

Assessments were done before and after the 4-week trial period.

- Physical performance: 30 seconds sit-to-stand test.
- Dyspnea- NYHA Classification
- Health related quality of life questionnaire: St. George's Respiratory Questionnaire (SGRQ)

**Procedure**

30 individuals diagnosed with ARDS were randomly selected from the intensive care unit or patient ward of Saveetha Hospital following certain inclusion and exclusion criteria. Study procedure was explained in detail to the participants and their willingness to participate was obtained by informed consent which was signed by the individual or their attender. The subjects were split into two groups and those assigned to the control group received conventional (standard) care while the subjects in the experimental group received pulmonary

rehabilitation and respiratory muscle training. The groups were treated according to the treatment protocol, which was followed for 4 weeks on 5 days/ week for 45 minutes per session.

**Pulmonary Rehabilitation and Respiratory Muscle Training Group**

- Step up, Step down holding two, 2kg dumbbell (10 rep's x 2 sets)
- Wall squats holding two, 2kg dumbbell (10 rep's x 2 sets)
- Calf raise down holding two, 2kg dumbbell (10 rep's x 2 sets)
- Leg lifts with two, 2kg weight cuffs (10 rep's x 2 sets)
- Shoulder press holding two, 2kg dumbbells (10 rep's x 2 sets)
- Chest press holding two, 2kg dumbbells (10 rep's x 2 sets)
- Elbow flexion and extension holding two, 2kg dumbbells (10 rep's x 2 sets)
- Walk short repetitive distance (50 meters' x 5 rounds)
- Positive expiratory pressure breathing technique (10 rep's x 2 sets)
- Pursed lip breathing technique (10 rep's x 2 sets)
- Coughing techniques- huffing and autogenic drainage (10 rep's x 2 sets)

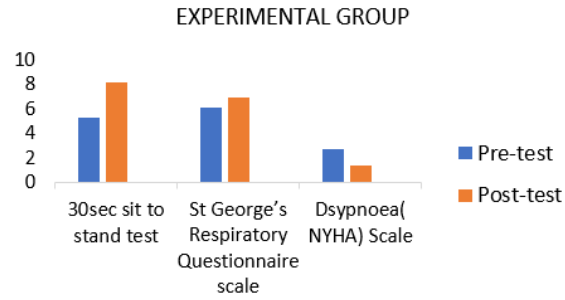
**Conventional Care Group**

- Deep breathing exercise (10 rep's x 2 sets)
- Hip flexion and extension with two, 2kg weight cuffs (10 rep's x 2 sets)
- Hip abduction and adduction with two, 2 kg weight cuffs (10 rep's x 2 sets)
- Knee flexion and extension with two, 2 kg weight cuffs (10 rep's x 2 sets)
- Ankle dorsiflexion and plantar flexion with two, 1kg weight cuffs (10 rep's x 2 sets)
- Shoulder flexion and extension with two, 2 kg dumbbells (10 rep's x 2 sets)
- Shoulder flexion and abduction with two, 2 kg dumbbells (10 rep's x 2 sets)
- Elbow flexion and extension with two, 2 kg dumbbells (10 rep's x 2 sets)
- Wrist flexion and extension with two, 1kg dumbbells (10rep's x 2 sets)
- Walking short repetitive distance (50 meters' x 5 rounds)

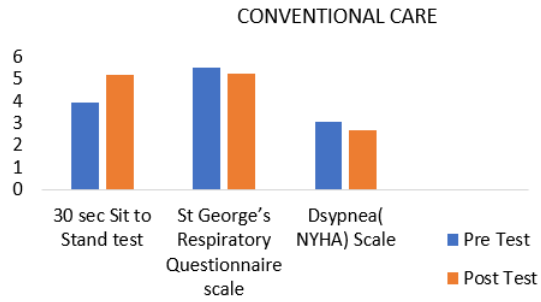
**Treatment protocol**

- Duration of the session: 45 minutes
- Frequency: 5 days a week / 4 weeks
- Sets: 2 sets
- Repetitions: 10 repetitions
- Rest: 1 min break between sets

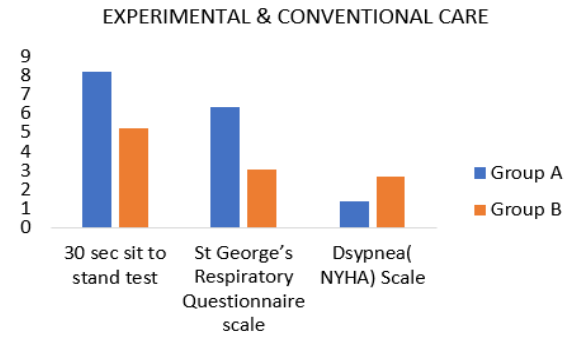
**Data analysis**




**INTERPRETATION: Graph 1: Pre-test and Post-test values within the Experimental group**




**INTERPRETATION: Graph 2: Pre-test and Post-test values within the Conventional care group**




**INTERPRETATION: Graph 3: Comparison of Post-test Values between Experimental and Conventional care group.**

## Result

- The Experimental group's 30-second Sit-to-Stand test had pre-test mean values of 5.33 and post-test mean values of 8.20, with a P value of <0.0001. The St. George's Respiratory Questionnaire scale's pre-test mean value for the Experimental group was 6.133; the post-test mean value was 6.927. As a result, the results were revised and given a P-value of <0.0001 to reflect their statistical significance. The pre-test mean value of the dyspnea (NYHA) scale in the experimental group is 2.73, while the post-test mean value is 1.40. Therefore, with a P value of <0.0001, the findings were considered statistically significant.
- The Conventional Care Group's Sit-to-Stand test had pre-test mean values of 3.93 which increased to 5.20 in post-test with a P value of <0.0001. The pre-test mean value of St George's Respiratory Questionnaire scale in the Conventional Care group was 5.523 which decreased to 5.232 in post-test. Therefore, the findings are considered statistically significant with a p-value <0.0005. The pre-test mean value of the dyspnea (NYHA) scale in the experimental group is 3.07, while the post-test mean value is 2.67. With a P value of 0.0086, the findings were therefore considered statistically significant.
- With a P value of <0.0001 the post-test mean value of 30 sec sit to stand test in conventional care Group was 5.20 which is increased to 8.20 in Experimental group. The post-test mean value of St George's Respiratory Questionnaire scale in the conventional care group is 5.123 which is increased to 6.322 in the Experimental Group with the P value of <0.0001. In the Experimental group, the post-test mean value of the dyspnea (NYHA) scale is 1.40, and in the Conventional care group, the value is 2.67. With a P value of <0.0001, the results are therefore considered statistically significant.

## Discussion

ARDS is a severe lung condition that affects both gas exchange and lung compliance. It is characterized by acute lung injury leading to respiratory failure, which requires mechanical ventilation in most cases. Conventional care for ARDS patients typically involves mechanical ventilation and supportive care, such as fluid management and nutrition.

Siddiq MA et.al, have explored the potential benefits of adding pulmonary rehabilitation (PR) and respiratory muscle training (RMT) to conventional care for ARDS patients[7]. Likewise, in this study Pulmonary rehabilitation helped enhance physical function by incorporating exercises that promote muscle strength, endurance, and overall physical conditioning. McNarry MA, Berg RM et.al, found, when compared to conventional treatments alone, pulmonary rehabilitation therapy with respiratory muscle exercise improved physical performance, decreased dyspnea, and enhanced quality of living in patients with post-ARDS[8]. Magadle R,et. al, results suggest that pulmonary rehabilitation with respiratory muscle training may be a valuable addition to conventional care in this patient population. However, in further studies techniques such as energy conservation strategies, and pacing techniques should be included to help alleviate dyspnea and reduce fatigue, allowing patients to perform daily activities with greater ease. According to Asadi-Lari et.al, the current objective for patients is not just to ensure their survival but also to achieve an optimal quality of life outcome[10]. For a patient, six weeks after being discharged, the improvement in exercise capacity may have been influenced, at least in part, by participating in a pulmonary rehabilitation program. The findings indicate a rapid recovery of exercise capacity during the early stage following hospital discharge in ARDS survivors. Impaired quality of life and exercise capacity were significantly associated with reduced pulmonary function. Among people who had recovered from ARDS, the anomalies in pulmonary function were associated with a deterioration in health-related aspects of life, particularly in areas pertaining to physical well-being.

Schelling et.al, found that patients with greater abnormalities on pulmonary function tests experienced the lowest health-related quality of life[11]. Additionally, Vinan-Vega et al. reported that pulmonary rehabilitation has the potential to enhance exercise capacity, sleep quality, alleviate depression, and promote healthy lifestyle[12]. Ramírez-Sarmiento

A et.al, demonstrated the advantages of respiratory muscle conditioning and pulmonary rehabilitation in patients with COPD and other respiratory illnesses[13]. However, this study is one of the first to specifically examine the effects of pulmonary rehabilitation with respiratory muscle training in patients post-ARDS. The improvement in physical performance and reduction in dyspnea observed in this study can be attributed to the strengthening of respiratory muscles and improvement in lung function that occurs with pulmonary rehabilitation and respiratory muscle training[14].

Eades M, Murphy J,et.al, the improvement in quality of life may be related to the reduction in dyspnea and improvement in physical function, as well as the psychological benefits of rehabilitation[15]. The study had several limitations, including a small sample size, a brief study period, and limited generalizability of the findings. The results of this study need to be confirmed by other research with larger sample numbers and longer follow-up timeframes. Candan SA, et.al, suggests that pulmonary rehabilitation with respiratory muscle training may be a valuable addition to conventional care in patients with post-ARDS[16]. This intervention may improve physical performance, reduce dyspnea, and improve the patient's level of well-being in this population. The implications of these findings hold significance in the clinical management of individuals after experiencing ARDS[17]. This study suggests that pulmonary rehabilitation with respiratory muscle training is effective in improving physical performance, reducing dyspnea, and improving quality of life in patients with ARDS. This suggests that these findings significantly impact the clinical management of ARDS as compared to conventional therapy alone. These findings warrant further research since they have major implications for the beneficial management of ARDS.

## Conclusion

The combination of pulmonary rehabilitation and respiratory muscle training offered an adjunctive treatment option for patients with ARDS, providing improved lung function, quality of life, strength of the muscle activities compared to conventional care alone. Significant improvement was seen in the intra-group comparison of both groups from baseline to post 4-weeks intervention, as measured by 30 sec sit to stand test, St George's Respiratory Questionnaire scale and dyspnoea (NYHA) scale. The important aspect being any form of intervention is more necessary for an ARDS patient than no intervention at all. Further research needs to be done to determine the effectiveness as well as the safety of the following combination in the management of ARDS.

**Ethical clearance:** The study was approved by the committee of institutional scientific review board. All study participants were informed about the study objectives, and those who agreed to Participate signed informed consent forms.

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**Conflicts of interest:** The authors declare that they have no conflicts of interest.

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Original Article

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# Effects of Early Mobilisation on Post Operative Pulmonary Complication in Patients with Open Abdominal Surgery

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**Abstract**

**Background:** Patients undergoing open abdominal surgery are the focus of this research, namely the effect of early mobilisation on postoperative pulmonary problems. Early mobilization is proposed as a potential intervention to enhance respiratory function and reduce the risk of PPCs.

**Purpose:** The purpose of this study is to evaluate the impact of pre-operative mobilisation on the incidence of pulmonary complications in patients undergoing open abdominal surgery.

**Materials and Methods:** This quasi-experimental study included 50 subjects who underwent open abdominal surgery at Saveetha Medical Hospital, SIMTS. Convenient sampling was used to select the participants. Measures of oxygen saturation (SPO2) and pulmonary function (FEV1) from a spirometer were employed as functional outcome indicators. After two weeks, participants were given a post-test to record their progress.

**Results:** Data collected before and after early mobilisation exercise were analysed using a paired t-test. The experimental group showed significant improvements in SPO2, FIM, and FEV1 ($P<0.0001$), indicating higher values post-intervention. Post-test demonstrated higher statistical significance compared to pre-test.

**Conclusion:** As a result, it was shown that early mobilisation Exercise is beneficial for reducing pulmonary complications after surgery.

**Key Word:** Functional Independence Measure Scale (FIM), Spirometer (FEV1), Early Mobilisation Exercise (EMT), SPO2, and Open Abdominal Surgery.

## Introduction

Post-operative pulmonary complications (PPCs) following open abdominal surgery are a possibility. The most frequent type of surgery is abdominal surgery, which can involve a wide range of important internal bodily organs and tissues, such as the gallbladder, oesophagus, kidneys, and liver.[1]

A cut above or reaching out over the umbilicus is referred to as upper abdominal surgery (UAS). An incision below the umbilicus is referred to as lower abdominal surgery (LAS). Open abdominal surgery is an option if the incision is longer than 5 cm. Laparoscopic procedures were first often used for several reduced risk abdominal surgeries. Compared to open abdominal procedures, these were typically

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associated with less discomfort, quicker healing times, shorter hospital stays, and lower complication rates.[2]

Notwithstanding, and whether they adhere to the most recent best evidence recommendations are currently unknown. It is appropriate to examine whether and how the advancements in surgical methods have affected the use of physiotherapy in this populace. Accordingly, the motivation behind this study was to decide how patients having various types of abdominal surgery and surgical techniques are now managed during their preoperative and postoperative physical therapy sessions in New Zealand's public hospital surgical units.[3]

As surgical practises and after care have advanced, so too have patient outcomes following open abdominal surgery. Pulmonary complications after surgery (PPCs) continue to be a key cause for concern. The wide variety of respiratory illnesses that are classified as PPCs includes atelectasis, pneumonia, and respiratory failure. These illnesses may lead to more serious outcomes, longer hospital stays, and greater medical costs. There has been growing interest in early mobilisation as a preventative strategy for reducing PPCs and speeding up recoveries in recent years.[4]

In this introductory section, we will discuss how early mobilisation affects pulmonary difficulties for patients . The significance of early assembly, alongside the physiological advantages and supporting proof, will be emphasized. It will also be obvious what challenges and barriers medical practitioners face while using early mobilization techniques.[10]

Pulmonary complications after abdominal surgery are a major concern since they affect as many as half of all patients. In the first thirty days after surgery, any pathological changes or abnormalities in the respiratory system are classified as postoperative complications.[8] It is important not to downplay the impact of PPCs on patient outcomes, which may vary from relatively minor respiratory difficulties to life-threatening infections.

Consequences and difficulties caused by PPCs: PPCs have a major effect on postoperative mortality and morbidity. They may cause patients to need more medical treatment, including admission to the intensive care unit (ICU) and readmission to the hospital. Due to the high costs of Hospitalization, diagnostic testing, and subsequent treatments, PPCs may put a substantial burden on healthcare budgets.[4]

The benefits of early mobilisation in avoiding the complications of prolonged bed rest and immobility provide compelling justification for the practice. weaker respiratory muscles, lower lung capacity, poor gas exchange, and decreased cough efficiency are only some of the physiological changes that may occur after surgery and prolonged periods of inactivity. By beginning early mobilisation, lung function, pulmonary secretion clearance, and respiratory outcomes may all be improved, mitigating some of the un favourable effects.[9]

**The Physiological Advantages of an Early Deployment**

Better Airflow and Gas Transfer in the Lungs Inhibiting the progression of atelectasis with early mobilisation has been shown to increase lung ventilation. By encouraging a more upright posture, this device helps increase oxygen intake. Deeper breathing, facilitated by mobilisation, aids in secretion clearance and improves gas exchange. Movement, particularly walking and upper-limb movements, performed early on may strengthen respiratory muscles and improve the effectiveness of a cough, so facilitating the early clearance of respiratory secretions.[5]

**Venous thromboembolism Prevention**

Early mobility is related with a diminished risk of creating venous thromboembolism (VTE), a potentially fatal complication of surgery. Increasing blood flow early on decreases the likelihood of developing pulmonary embolisms and deep vein thrombosis.[6]

Early mobilisation after open abdominal surgery has been studied extensively for its potential benefits in reducing postoperative pulmonary complications. The results of these investigations have been uniformly good, with fewer cases of PPC, shorter hospital stays, and faster recoveries.[5] Standardised early mobilisation tactics are still difficult to implement due to a variety of barriers, such as patient-specific limits, attitudes among healthcare practitioners, and resource constraints.[12]

As a result, patients having open abdominal surgery might greatly benefit from early mobilisation, which has been shown to enhance outcomes and decrease the incidence of postoperative pulmonary problems. The physiological benefits of early activation, for example, expanded hack viability, higher lung capability, and VTE counteraction, highlight the need of including it into perioperative remedial regimens. To overcome these barriers and make the most of early mobilisation approaches in clinical practise, more study and effort are required. Patients undergoing open stomach a medical procedure might recuperate all the more rapidly, with less issues, and have better resides in the event that medical services suppliers put an accentuation on right on time mobilisation.[7]

## AIM

The purpose of this research was to determine whether early mobilisation reduced the risk of pulmonary complications in patients who had gone through open stomach a medical procedure. The motivation behind this examination was to decide the impacts of early postoperative mobilisation on oxygen saturation (SPO2), pulmonary function (FEV1), and functional outcome assessments in individuals who had undergone abdominal surgery.

## Material and Methods

This quasi-experimental study concentrates on 50 subjects who went through open abdominal surgery at Saveetha Medical Hospital, SIMTS. Convenient sampling was used to select the participants. SPO2 levels, spirometer (FEV1) readings, and functional outcome measures were utilised to determine success. The post-test findings were obtained and analysed following the 2-week intervention.

**Materials required**: pulse,oximetry,chair, Dumbbell,ball,walker, incentive spirometry.

**Selection criteria**

**Inclusion criteria:**

- Patients with open abdominal surgery with pulmonary complication.
- Both genders.
- Age groups 30-65 years.
- Patients only taken from the Saveetha Medical college and Hospitals

**Exclusion criteria:**

- Individuals who have Recurrent abdominal surgeries.
- Medical conditions that would limit their participation in the training program.
- Those in the past who left too early for the Mobilis efforts.
- Able to walk alone following surgery

**Outcome measure:**

- **SPO2 level –** Pulse oximeter readings
- **Functional Independence Measure Scale (FIM)** - As a means of evaluating practical competence
- **Pulmonary function** - Measured using Spirometer (FEV1)

**Procedure**

Fifty people who have had open abdominal surgery will be selected at random from those who meet the inclusion and exclusion criteria. Participants will be briefed and supervised by the treatment teacher before the trial begins.

Each person who took part in the study was picked using a systematic, random, and efficient method. The patient was instructed to take a seat and given some background information before the therapy session began, and then shown how to do the necessary movements by the therapist.

Measurements of SPO2, the Practical Freedom Measure Scale, and pneumonic capability utilizing a spirometer (FEV1) will be taken before and after the subject receives treatment for 5 weeks, with the same protocol being used for both sets of measurements.

**Early Mobilisation Protocol**

**1. Ankle toe Pumps 10 reps per hour**

Ask the individuals to sit and make their ankle going up on toe and down on toe.

**2. Active/assisted Mobility exercises:** make the individual sit on bed or chair move the upper limb backward

**3. Deep Breathing Exercise:**

make the individual inhale through nose while abdomen should comes out while aling through mouth abdomen should goes in

**4. Airway clearance technique (ACT):**

- Therapist should give percussion, vibration and shaking to the individual.
- Sit up straight take a deep breath to fill lungs three quarters full hold two or three seconds exhale forcefully, in a continues exhalation to move mucus form the smaller to the larger airway
- Train the individual ACBT and Autogenic drainage

**5. Incentive Spirometry:**

using incentive spirometry make the individual inhale and exhale.

**6. Upper limb and lower limb Strengthening Exercise**

using 0.5 kg and 1 kg dumbbell wrist curl and biceps curl on chair or bed.

**7. Walking:**

make the individual walk slowly with or without walker

**Data analysis**

Descriptive and inferential statistics were used to tabulate and analyse the gathered data. The mean and standard deviation (SD) were applied to all boundaries. The massive contrasts between the pre- and post-test scores were dissected utilizing a paired t-test. Statistical significance was found at the (p0.05) level.

| outcome | Early Mobilization | | | | Std. err | 't' test | P Value |
|---|---|---|---|---|---|---|---|
| | Pre-Test | | Post-Test | | | | |
| | Mean | SD | Mean | SD | | | |
| SPO2 | 84.2% | 2.3 | 96.4% | 1.8 | 0.39 | 30.6 | <0.0001 |
| FIM Score | 43.82 | .56 | 93.36 | 3.02 | 0.55 | 89.99 | <0.0001 |
| (FEV1) | 71.44% | 1.83 | 90.34% | 4.87 | 0.72 | 26.16 | <0.0001 |

## Results

This study examined the effectiveness of early mobilization exercise in reducing post-operative pulmonary complications, improving pulmonary volume, and functional independence in patients who have undergone open abdominal surgery. The study involved an unknown number of participants who received early mobilization exercise for two weeks. Data was collected before and after the program and analyzed using descriptive and inferential statistics. The results showed a statistically significant improvement in SPO2, FIM, and FEV1 after the early mobilization exercise. These findings suggest that early mobilization exercise may improve lung function and overall recovery for patients who have undergone open abdominal surgery. However, the study's limitations and individual differences among participants should be considered when interpreting the results.

## Discussion

This research set out to see whether post-op patients benefited from early mobilisation exercises after undergoing open abdominal surgery. The reason for this study was to inspect the impacts of early mobilisation on lung volume and functional activities in patients who had just had thoracic surgery, with the hope of determining whether or not this strategy may lower the risk of pulmonary problems.[1,6]

The research included 50 people who had just recovered from open abdominal surgery. The researchers have predetermined inclusion and exclusion criteria in place to keep the sample representative. Prior to the start of the trial, all participants received the same pre-defined instructions for the early mobilisation exercise therapy.[13]

Subjects participated in a two-week, supervised exercise programme as part of the early mobilisation

intervention. Researchers followed study subjects very carefully and gathered data to assess the effect of the intervention during this time.

The researchers observed that patients who participated in early mobilisation exercise had fewer pulmonary problems after surgery. As a result of this discovery, it seems that the intervention may have a beneficial impact on the respiratory system, which might result in fewer breathing-related issues after surgery.[8]

Measurements were also taken to assess the individuals' lung volume and the functional activities they engaged in. Results from a test measuring lung capacity, called the Forced Expiratory Volume in 1 Second (FEV1), were significantly higher after treatment than they had been before. It seems that individuals who have had open abdominal surgery benefit from early mobilisation because of improved lung function.[2]

The Functional Independence Measure Scale (FIM) was used to evaluate functional activities, and it, too, revealed a considerable uptick after the early mobilisation intervention lasting only two weeks. It's possible that the exercise programme may help these individuals become more independent in their daily lives and boost their physical abilities as a whole.

A thorough examination of the data showed no statistically significant relationships between the investigated factors. It appears to be that the enhancements in post-usable aspiratory issues, lung volume, and practical exercises were inferable straightforwardly to the early preparation mediation, since both the bias and independent factors were shown to be negligible.[11,15]

Patient care after open abdominal surgery may benefit from early mobilisation exercise, according to the study's results. Early mobilisation may improve recovery results and patient well-being by lowering the risk of post-operative pulmonary problems, increasing lung volume, and fostering functional independence.

However, it is critical to note that the research includes several caveats. For example, the sample size was on the smaller side, and the intervention period was just two weeks long. The findings may not be applicable to a wider population or longer time frame if these limitations are taken into account. In order to confirm and broaden these results, further study is required, ideally with bigger samples and longer follow-up periods.[5,14]

In sum, the findings provide light on the potential advantages of early mobilisation exercise for patients recovering from open abdominal surgery.[7] More examination is expected to affirm these discoveries and investigate different parts of the mediation's effect on post-usable recuperation, yet the outcomes propose positive results concerning decreased post-employable pneumonic inconveniences, worked on aspiratory volume, and improved utilitarian exercises. The data presented here may help medical practitioners evaluate the feasibility of introducing early mobilisation exercise into the treatment regimens of patients after open abdominal surgery, with any necessary modifications made to account for the specific characteristics of each patient.[4,9]

## Conclusion

The goal of this study was to determine whether patients who had open abdominal surgery benefited from early mobilisation as a post-operative intervention to reduce their risk of pulmonary complications. The research found that early mobilisation helped patients recover more quickly because it increased lung volume and enhanced functional activities.

The term "early mobilisation" is used here to describe the practise of beginning exercise and other forms of physical activity soon after surgery.

**Ethical clearance:** The Institutional Review Board (IRB) of a private hospital and institution in Chennai has given its approval for human research to be conducted in accordance with all relevant local, state, and federal laws and regulations. (Application Number 03/029/2022/ISRB/SR/SCPT).

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**Conflict of interest:** According to the authors, there is no bias.

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Original Article

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# Effectiveness of Aerobic Training on Lung Volume, Exercise Capacity and Gait Speed in Individuals with Chronic Kidney Disease

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**Abstract**

**Background:** Kidney disease (CKD) is a disorder in which the kidneys have been damaged and are unable to filter blood as effectively as they should. As a result, extra fluid and waste from the circulation linger in the body, potentially leading to various health issues like heart disease and stroke. This also causes swelling in the lower limb causing reduced mobility and altered lung volume. This reduction in mobility can be improved with exercise. Aerobic training has been proved to be one of the most effective treatments for improving lung volume capacity. Aerobic training using cycling exercise can improve both lung volume capacity and mobility together.

**Purpose:** To analyze the Effect of Aerobic training and lung volume and gait speed capacity in individuals with chronic kidney disease.

**Materials and Methods:** Sixty individuals with chronic kidney disease were selected according to inclusion and exclusion criteria in which 48 individuals completed the study and 12 quit. These individuals were treated with bed side cycling and spirometry for 8 weeks, 1 session per day. Their Pretreatment Gait speed test scoring, 3-minute walk test, were recorded. After the treatment duration the same test was repeated.

**Results:** There is an Improvement in Gait speed and 3-minute walk test after giving incentive spirometry stage of CKD Individuals. No adverse events were observed during and after the treatment.

**Conclusion:** Individuals with CKD need aerobic training to improve their lung volume capacity. The current study concludes that there is an improvement in Gait speed and 3-minute walk test after the treatment session of incentive spirometry and Bedside cycle ergometer.

**Clinical Significance:** This study's clinical significance lies in assessing how aerobic training impacts lung volume capacity in chronic kidney disease patients. Improved lung function may lead to better cardiovascular health, enhanced quality of life, and reduced complications. These findings could support tailored exercise programs to improve the well-being and overall health of individuals with chronic kidney disease.

**Key Words:** Gait speed test scoring, 3-minute walk test, CKD, Aerobic training, Bed side cycling, Incentive Spirometry.

## Introduction

Chronic kidney disease (CKD) is a global health concern, and its classification and assessment have evolved over the years. Various terms, such as "chronic renal failure," "chronic renal insufficiency," "pre-dialysis," and "pre-end-stage renal disease,"

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have been used to describe different stages of CKD based on underlying causes. However, there is a growing need for standardized terminology and a comprehensive approach to understanding and managing CKD. The National Kidney Foundation (NKF) established clinical practice guidelines in 2002, which have been crucial in the analysis, classification, and evaluation of CKD. Nowadays, CKD encompasses the entire spectrum from early stages to end-stage renal disease (ESRD), highlighting the importance of early detection, risk assessment, and appropriate interventions to slow disease progression and prevent complications. To address the rising health burden of CKD, guidelines and frameworks have been developed to assist healthcare professionals in evaluating, classifying, and stratifying CKD. By implementing evidence-based interventions, these resources aim to improve individual outcomes and reduce the global impact of CKD [1]. CKD has complex interactions with various bodily systems, leading to significant physiological changes affecting individuals' health and well-being. Gastrointestinal problems, skin changes, and persistent itching are among the issues associated with CKD. Furthermore, CKD Individuals are at an increased risk of developing cardiovascular disease, emphasizing the importance of exercise training as a preventive measure. Muscle loss, decreased strength, impaired physical function, and reduced cardiorespiratory fitness are common in CKD, increasing cardiovascular risk and potential complications. Individuals undergoing haemodialys is often face limitations in their daily activities, leading to physical deconditioning and reduced exercise tolerance [2][3][4]. Exercise interventions have been studied extensively for CKD Individuals and have shown positive impacts on health and quality of life. Engaging in aerobic exercise can improve aerobic capacity, aerobic fitness, muscle strength, and mass. Exercise can be assessed using maximal graded tests like the incremental shuttle walking test or submaximal tests like the 3-minute walk test [14]. However, despite the benefits of exercise, its widespread incorporation into standard practice has been hindered by limited duration, small sample sizes, and methodological limitations of previous studies [8]. Bedside cycling is a practical and accessible form of exercise for individuals with restricted mobility or those unable to engage in conventional exercises. It provides cardiovascular and respiratory benefits and is adaptable to various medical settings. As healthcare professionals recognize its importance, bedside cycling is becoming a critical component of physical therapy and rehabilitation programs, enabling individuals to actively participate in their recovery process [6]. Incentive spirometry (IS) is a useful technique for practicing deep breathing exercises and enhancing lung health. It allows individuals to independently perform deep breathing exercises while receiving visual feedback on their inspiratory effort. After surgery, using an incentive spirometer can help maintain lung health and prevent congestion. Inspiratory muscle training involves stretching and exercising the lungs, promoting active lung involvement during the recovery phase after surgery [7]. A peak flow meter is a compact and portable device used to assess an individual's peak expiratory flow rate (PEFR). It is frequently employed in monitoring and controlling respiratory disorders like asthma. PEFR measures the highest velocity at which a person can forcefully exhale air after a deep inhalation. Monitoring changes in PEFR can help assess the effectiveness of cardio physiotherapy interventions, including exercise programs and breathing exercises, allowing the cardio physiotherapist to tailor the treatment plan and track progress [17]. CKD is a significant global health issue, and its understanding and management have evolved over time. Standardized terminology and comprehensive approaches have become essential to address this growing health burden effectively. Exercise interventions have shown promise in improving the health and quality of life of CKD Individuals. Bedside cycling, incentive spirometry, and peak flow meters are valuable tools in promoting cardiovascular and respiratory health and aiding in the rehabilitation process. By recognizing the importance of these interventions and conducting further research, healthcare professionals can enhance the care and well-being of CKD Individuals worldwide.

## AIM

To analyze the Effects of Aerobic training on lung volume,exercise capacity and gait speed in Individuals with CKD.

## Materials and Methods

60 individuals with chronic kidney disease were selected according to inclusion and exclusion criteria. These individuals were treated with bed side cycling and spirometry for 2 weeks, 1 session per day. Their Pretreatment Gait speed test scoring, 3-minute walk test, were recorded. After the treatment duration the same test was repeated.

**Study Period:** June2023 - July2023

**Inclusion criteria:**

- Both male and female
- Age group- 20-60 years
- Individuals with CKD without Back pain
- Individuals with Chronic Kidney Conditions GFR values of 15-90 mL.

**Exclusion criteria:**

- Individuals with cardiopulmonary infections
- Individuals with Back pain
- uncontrolled low or high blood pressure
- Physical impairment sufficient to prevent undertaking the intervention.
- Recent myocardial infarction
- Upper limb and lower limb amputated Individuals
- Unstable chronic conditions
- Daily dialysis Individual

**Outcome Measure**

To determine the effectiveness of aerobic exercise on Peak expiratory flow rate using peak flow meter, the effectiveness of cardiovascular endurance by 3-minute walk test, the effectiveness on gait speed using gait speed test.

**Procedure**

The study was conducted at Saveetha College and Hospital, involving 60 individuals with CKD who were under dialysis (CKD stage 1-5). The participants were selected based on specific inclusion and exclusion criteria. Each individual was thoroughly explained about the procedure, and informed consent was obtained from all of them. In which 12 didn't complete the study and 48 individuals completed the study successfully. Prior to the treatment, all necessary arrangements were made. First the pre-tests were taken before the treatment. The following are the procedure for pre and post test

**3-Minute Walk Test:**

The subject's vitals were taken before the test. A cone with a beginning and ending point was used to indicate a 10-meter stretch of ground. The person was given instructions to walk the 10 meters for three minutes while having their vital signs monitored.

**Gait Speed Test**

A distance of 8 metres, split into 2+4+2 metres, was indicated on the floor. The person was instructed to walk the distance, and the moment their leg touched the line at the third metre was timed. When their final leg reached the sixth metre, the test was declared over. The results of this exam were recorded after it was conducted twice.

**Peak Expiratory Flow Rate:**

The person received a peak expiratory flow rate device. They were instructed to adopt a comfortable posture when standing or sitting, securely grip the mouthpiece to prevent air from escaping, and forcefully exhale. The best result was recorded when this method was done three to four times. Pre-vitals were noted during the course of the therapy.

After the pretest the Treatment is preceded by

**Treatment Protocol**

Treatment Duration: 45 minutes.

Incentive spirometry: Inspiration 20 reps ,1 set per day and Expiration 20 reps 1 set per day. (10 minutes)

Cycle Ergometry:

Warm up period B/L AROM 10 reps 1 set per day (5 minutes)

Stretches: Upper and Lower limb stretches (5 minutes )

Cycling: 3 minutes cycling in Clockwise direction, 2 minutes rest, 3 minutes cycling in Clockwise direction (10 minutes)

Cool Down: 2 minute rest , Upper and Lower limb Stretches (5 minutes).

**Incentive Spirometry:**

The process was first explained to the patient. The patient is asked to hold the device in an upright position and they are told to close the mouthpiece with their mouth and do a forceful inspiration via mouth and expiration via nose and then hold the device in upside down position and do forceful expiration via mouth and inspiration through nose.

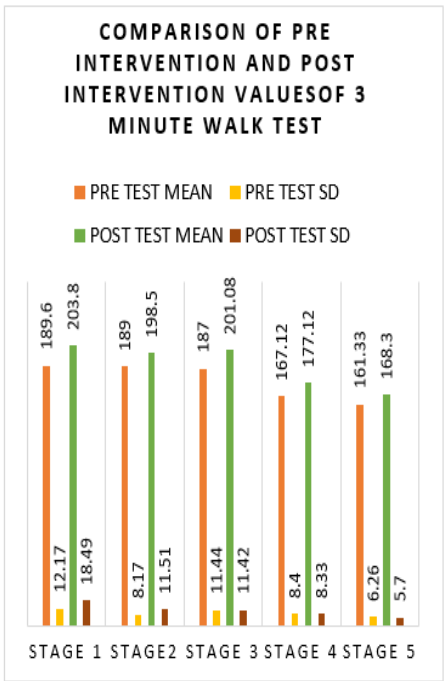
**Bed Side Cycling:**

There were instructions for a warm-up that included bilateral upper- and lower-limb arm exercises. Then, either while sitting up or lying down, bedside cycling was carried out. The patient's comfort was taken into consideration when setting up the cycle ergometer. After cycling for 3 minutes in a clockwise manner, the patient had a 2-minute break before cycling for 3 minutes in the opposite way. After a three-minute period of rest, post-vitals were taken to make sure the patient was in good health.

After every session the post vitals are checked, in the same way the treatment was repeated for alternate days for 8 weeks resulting in a total of 28 sessions.

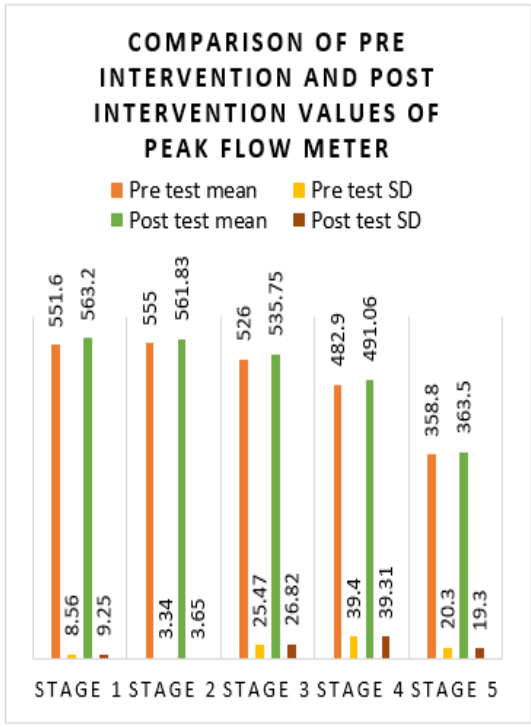
And the post tests of all sessions were tabulated and carefully recorded and analysed.

**Data Analysis**



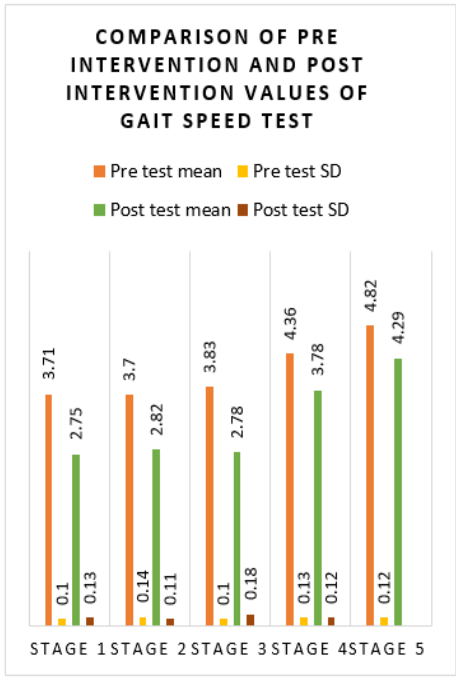

**Graph 1:**

**INTERPRETATION: Graph 1 shows that the values are statistically significant**




**Graph 2:**

**INTERPRETATION: Graph 2 shows that the values are statistically significant**




**Graph 3:**

**INTERPRETATION: Graph 3 shows that the values are statistically not significant**

## Results

A total of 48 Individuals were included in the study out of them stage I stage II stage III stage IV stage V. Mean age of the Individual with standard deviation was 34.2, 2.6 years respectively. The pre intervention and post intervention Mean and standard deviation were mentioned in following tables 1,2,3. Stage I, II, III, IV, shows statistically improvement with the p value <0.05 whereas stage V was not significant. Twelve individuals were excluded from the study due to various reasons: three of them had deceased, four individuals experienced an increase in blood pressure and four with low back ache and cramps, and the remaining one individual were shifted to daily dialysis due to changes in their glomerular filtration rate (GFR). Aerobic exercise is necessary for Individuals with Chronic Kidney Disease (CKD) to improve their lung volume capacity. The results of this study show that bedside cycle ergometer use and incentive spirometry led to substantial gains in gait speed and the 3-minute walk test. The study's goal was to examine the possible advantages of aerobic exercise in enhancing respiratory function in people with CKD. The use of incentive spirometry and bedside cycle ergometer sessions were two particular therapies. Through slow, deliberate inhalations into a mouthpiece, Individuals are urged to attain a target volume depending on their capacity during incentive spirometry. Following a maximum inhalation, individuals were advised to hold their breath for a brief interval before repeating the cycle ten times. The goal was to exhale quietly and slowly, without closing the mouth around the mouthpiece. The need of proper breathing techniques was highlighted, notably the importance of extending the lower rib cage during maximal intake rather than depending only on accessory muscles. Individuals were positioned in a supine reclining posture with the head end of the bed elevated to 30° for the second intervention, the bedside cycle ergometer. The lower limbs underwent an active range of motion activities throughout the 10-minute warm-up period. Individuals' feet were firmly fastened to the pedals of the cycle ergometer, which was placed at the foot of the bed. They were told to bike for 6 minutes in a clockwise manner, stop for 3 MINUTEs, and then cycle for another 6 minutes in an anticlockwise direction. This treatment plan was followed for 8 weeks on alternate days with no resistance being imposed. The researchers assessed the individuals' improvements in the 3-minute walk test and gait speed after the intervention period. Results showed a considerable improvement in both metrics, demonstrating the effectiveness of aerobic exercise in enhancing Individuals' functional mobility and walking ability. This study adds to the expanding body of research that shows how crucial aerobic exercise is for those with CKD. The bedside cycle ergometer sessions and incentive spirometry therapies have shown potential in improving gait speed and the 3-minute walk test. These gains represent the potential advantages of such therapies in enhancing the pulmonary function and general wellbeing of CKD Individuals. However, the full research report must be read in order to fully comprehend the study's findings and implications since it may offer more information on the methodology, data analysis, and other study limitations. Additional investigation in this field may help create aerobic training programmes for CKD Individuals that are more focused and effective, thereby enhancing their quality of life and functional capabilities.

## Discussion

Chronic kidney disease (CKD) is a condition characterized by kidney damage that reduces blood filtration efficiency, leading to fluid and waste accumulation in the body. This can result in various health issues, including heart disease and mobility problems. To address these challenges, a stationary bedside cycle ergometer has been utilized to facilitate arm and leg cycling movements for CKD Individuals, improving their physical strength and functional recovery. Additionally, exercise has shown potential anti-inflammatory effects and benefits in lipid profile and dialysis adequacy in CKD patients. Recent studies emphasize the importance of early detection and appropriate interventions to slow disease progression and enhance individual outcomes. A pilot study with CKD children and adolescents demonstrated promising anti-inflammatory effects of exercise, while a randomized controlled trial combining functional training and intradialytic cycling resulted in improved lipid profiles and dialysis adequacy[12]. However, further research is needed to validate these findings and explore the potential benefits of exercise

in CKD care. A study conducted at SAVEETHA HOSPITAL in Chennai with 60 CKD Individuals from stages 1 to 5 showed significant improvements in stages I, II, III, and IV, while stage V did not exhibit significant improvement after the treatment.

## Conclusion

Chronic kidney disease (CKD) is characterized by kidney damage leading to impaired blood filtration, causing fluid and waste buildup and various health problems. To address this, a stationary bedside cycle ergometer aids CKD Individuals by improving physical strength and functional recovery. Exercise has shown potential anti-inflammatory effects and benefits in lipid profile and dialysis adequacy. Early detection and appropriate interventions are crucial for better outcomes. Studies on CKD children and adults demonstrated promising results, while a randomized controlled trial combining functional training and intradialytic cycling showed positive effects. A study at SAVEETHA HOSPITAL with 60 CKD Individuals showed significant improvements in stages I-IV, except for stage V.

**Ethical Clearance**: Taken from institutional ethical committee

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Effects of the Pole Striding Intervention Program on Cardiovascular Fitness among Bronchial Asthma Patients

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**Abstract**

**Background:** Chronic inflammatory illnesses of the airways, such as bronchial hyper-reactivity and varying degrees of airway blockage, are known as bronchial asthma. Pole walking is a low-impact fitness walking using specially designed, light weighted pole. Nordic walking is a common outdoor physical activity.So in this study we are going to find out the effectiveness of pole striding in bronchial asthma.

**Aim:** The aim of the analysis is to appraise the impact of the pole striding intervention program on bronchial asthma, with regard to the potential improvements in cardiovascular fitness.

**Method:** 40 Individuals who were admitted in IP for bronchial asthma and got discharged were selected randomly based on inclusion and exclusion criteria from Saveetha Medical College And Hospital. The selected participants were allocated into 2 groups. Pole striding group was treated with routine treatment along with pole striding. Calisthenic exercise group was treated with only routine treatment. Treatments were given to the groups according to the treatment protocol after discharge as home care therapy. Six-Minute Walk Test, Pulmonary Function Test were the outcome measures used in this study.

**Result:** The improvement was seen in both groups though statistically pole striding group was more significant than calisthenic exercise group in 6 minute walk test and forced expiratory volume in one second (FEV1) with mean difference of 28.5m, 0.24L, respectively. P- value is <0.0001.

**Conclusion:** Hereby, This study concludes that Pole-striding approach has a better effect in improving in Cardiovascular fitness among Bronchial asthma.

**Keywords**: Physical Activity, pole striding, Six minute walk test, Pulmonary Function Test.

## Introduction

Chronic bronchial asthma is characterised by mucus overproduction, airway hyper-responsiveness, reversible airway blockage, and airway inflammation.[1] Asthma prevalence in the US is 2.05%, according to Epidemiology of Asthma, Respiratory Symptoms, and Chronic Bronchitis in Adults (INSEARCH). Affecting 17.23 million people. Overall, 34.3 million individuals in India have asthma, which accounts for 13.09% of the global burden.[2]

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3.23 million people died from chronic obstructive pulmonary illness, the third most common cause of dying in the world in 2019. LMIC account for about 90% of casualities from Chronic Obstructive lung illness in those under the age of 70. Tobacco smoking accounts for over 70% of COPD cases in high-income countries. The aetiology of bronchial asthma (BA), a chronic inflammatory illness of the respiratory system, involves inflammatory cells and mediators that are, in part, influenced by hereditary factors. It has airflow blockage and bronchial hyper reactivity, which may be fully or partially reversible. These three processes—bronchial inflammation, allergies, and bronchial hyper-reactivity—have an impact on the pathophysiology of this illness. Inflammatory cells, which can result in oedema and broncho-constriction, are implicated in bronchial inflammation.[3] The effect of car emissions on the timing of chronic lung illness attacks and the incidence of chronic lung illness in universal, however, is difficult to assess. An augmented immediate reaction to hay fever and heightened pneumonitis may be responsible for the rising incidence of allergic rhinitis allergies.[4] At any stage of COPD, lung dynamic hyperinflation can be seen in addition to or independently of static hyperinflation.[5] Nordic walking (pole walking) originated in Scandinavia and was introduced to Central Europe about 20 years back. It immediately became popular among people of various ages. Nordic walking has shown to be a simple and practical type of exercise that can be done by practically anybody, anywhere, and at any time.[6] The modern lifestyle puts people at risk for chronic illness together with diabetes, fatness, high blood pressure, and ischemic heart diseases since it discourages regular physical activity and exercise training. It is a type of walking that incorporates handheld poles and is employed in contrast to lower extremity mobility. It has low-collision, judicious-potency features similar to walking.[7] Expanded foot step length, accelerated pelvis range of travel, and a clutch/release fist clasp method are all key aspects of the Nordic walking method. A additional usual walk, a excessive forelimb posture, and a constant fist grasp are all key aspects of the Exerstriding style.[7] Participants who reported developing asthma throughout the observation period had a greater incidence of FEV1 reduction. Contrary to the results of two earlier trials, however.[8] So in this study we are going to found out the effectiveness of pole striding in bronchial asthma.

## AIM

The aim of the analysis is to appraise the impact of the pole striding intervention program on bronchial asthma, with regard to the potential improvements in cardiovascular fitness.

## Methods

The Experimental study was conducted on 40 participants with bronchial asthma were selected as samples' from Saveetha Medical College And Hospital, Thandalam according to the inclusion and exclusion criteria. Simple random sampling technique was used in this study. This study was conducted between July 2022 to December 2022.

**Inclusion criteria:**

- Both gender.
- Age – 40 to 55 years.
- Participants with bronchial asthma ( stage I and II ).( COPD Assessment Test)
- Participants having grade I and II Dyspnea (Modified Medical Research Council).
- Participants with stable vitals.

**Exclusion criteria:**

- Participants immobile due to any previous musculoskeletal or neurological conditions.
- Participants having peripheral vascular disease
- Obese individuals were excluded.

**Outcome Measures:**

The initial assessment was conducted at the outset of the study, serving as a baseline measurement before of treatment was administered. Subsequently, the participants underwent the designated treatment for a duration of four weeks. At the end of this four-week treatment phase, post-assessment was performed to evaluate the effects and progress resulting from the administered treatment.

- Six-minute walk test
- Pulmonary function test (FEV1).

**Study Procedure**

The process began by applying inclusion criteria to identify a suitable sample size, resulting in the selection of 40 participants for the study. Prior to the intervention, it was essential to obtain written consent from the patient. Written consent ensures that the patient is fully informed about the procedure, its potential risks and benefits, and any alternative options available. Obtaining written consent helps protect the participant's rights and ensures a transparent and ethical approach to their medical care. These participants were then divided into two distinct groups. The first group, referred to as the pole striding group, received a combination of conventional therapy and pole striding. On the other hand, the second group, known as the calisthenic exercise group, solely underwent conventional therapy.

Once the participants were assigned to their respective groups, treatment was administered to both groups following the established treatment protocol. This treatment took place after the participants were discharged, and it was implemented as part of the home care therapy they received.

In this study, two outcome measures were utilized: the Six-Minute Walk Test (6MWT) and the Pulmonary Function Test. The Six-Minute Walk Test was employed to evaluate the participants' aerobic capacity, providing valuable insights into their functional endurance and cardiovascular fitness. This test involved measuring the distance participants could walk within a duration of six minutes, serving as an indicator of their overall physical performance.

On the other hand, the Pulmonary Function Test was employed to assess various lung volumes and capacities, including the Forced Expiratory Volume in one second (FEV1), which is a critical measure of lung function and airway obstruction. By utilizing these comprehensive outcome measures were able to gather a comprehensive understanding of both the participants' exercise capacity and pulmonary health.

All the collected data were carefully recorded, tabulated, and analysed.

**Treatment protocol**

**Pole striding group**

- Pursed lip breathing exercise - 5 reps of 5 set, thrice a day.
- Diaphragmatic breathing exercise - 5reps of 5 set, thrice a day.
- Huffing and coughing technique – thrice a day.
- Pole striding – 3 to 5 times/ week, 30 minutes/ day for 4 weeks.

**Calisthenic exercise group**

- Pursed lip breathing exercise- 5reps of 5 set, thrice a day.
- Diaphragmatic breathing exercise – 5 reps of 5 set, thrice a day.
- Huffing and coughing technique – thrice a day.
- Calisthenic exercise (wall push- ups, wall-squats) – 3 to 5 times/week, 30 minutes every day for 4 weeks.

**Data Analysis**

**Table 1: Shows 6MWT values in Pole striding and Calisthenic exercise Groups**

| **6MWT** | **Pre-test (M)** | **Post- test (M)** | |
|---|---|---|---|
| **Study group** | **Mean±SD** | **Mean±SD** | **P- value** |
| Pole striding group | 264±13.92 | 351.50±13.09 | p>0.0001 |
| Calisthenic exercise group | 262.50±15.52 | 323±15.93 | p>0.0001 |

**Table 2: Shows Forced expiratory volume in one second (FEV1) values in Pole striding and Calisthenic exercise Groups**

| Pulmonary function test | Pre-test (Liters) | Post –test (Liters) | |
|---|---|---|---|
| Study group | Mean±SD | Mean±SD | P-value |
| Pole striding group | 1.790±0.085 | 2.580±0.185 | P>0.0001 |
| Calisthenic exercise group | 1.785±0.081 | 2.340±0.105 | P>0.0001 |

## Result

Total of 40 asthmatic participants were included in this study. All the participants were continued the study as per the allocation. At the end of 4th week post test values of 6MWT and Forced expiratory volume in one second (FEV1) were presented in Table1 and 2. The pole striding group Pre-test Mean±SD was 264±13.92meters. Post- test Mean±SD was 351.50±13.09meters. The Calisthenic exercise group Pre-test Mean±SD was 262.50±15.52meters. Post-test Mean±SD was 323±15.93meters. p- value is < 0.0001 hence, statistically significant. The improvement was seen in both groups though statistically pole striding group was more significant than calisthenic exercise group with mean difference of 28.5m in 6 minute walk test.

The pole striding group Pre-test Mean±SD was 1.790±0.085 liters. Post –test Mean±SD was 2.580±0.185 liters. The calisthenic exercise group Pre-test Mean±SD was 1.785±0.081 liters. post-test Mean±SD was 2.340±0.105 liters. Both groups p-value was <0.000 hence, statistically significant. The improvement was seen in both groups though statistically pole striding group was more significant than calisthenic exercise group with mean difference 0.24L of in pulmonary function test.

## Discussion

In this study the individuals with bronchial asthma were included. Bronchial asthma exacerbates according to the climatic changes mainly in the winter seasons the episodes of dyspnea is more common. Individuals with bronchial asthma were treated with pole striding exercises and calisthenic exercises in this study. Bronchial asthma participants need regular exercises to manage the sudden episodes of dyspnea. Hence all the participants were explained about the risks and benefits of the procedure and Before being included in the study, written informed permission was taken from every participant.

In this study, 40 participants were selected based on predefined inclusion and exclusion criteria, and their scores were subsequently calculated and analyzed.

The study utilized two outcome measures to assess the effects of the intervention. The first outcome measure was the 6-Minute Walk Test (6MWT), which evaluated the functional performance of the participants through sub-maximal exercise. The distance traveled by the participants in a 6-minute period was measured and used as an indicator of aerobic capacity and endurance. Cones and red color cello tape were used to mark a 30-meter stretch pathway for conducting the 6MWT.

The second outcome measure used in the study was the pulmonary function test (PFT), pulmonary function tests, are used to assess how well the lungs work. They control the amount of air that enters and exits the lungs, the amount of air that enters the blood, and how well the lungs work while you exercise. The forced expiratory volume in 1 second (FEV1) is the most air that a person can violently expel in the instant after their maximum inhalation. In this study, PFT is used to evaluate FEV1.

Another study by Katarzyna Sko´rkowska-Telichowska et al.,(2016) explored the Review of research on pole striding efficacy and safety in therapeutic rehabilitation in individuals of an advanced age. The results concluded that the pole striding training was a feasible, simple, and effective physical training modality in elderly individuals with Chronic obstructive with respiratory illness. Pole striding has proven to good effect on the routine physical performance pattern of Chronic obstructive with respiratory illness participants compared to a

COPD group that received no exercise intervention across the course of short- and long-term observation.[9]

Furthermore, study by María Vilanova-Pereira el al., (2023), examined the effect of pole striding in asthma participants. The results concluded that the due of its affordability and viability, pole striding may represent a new, community-based therapy strategy for people with asthma. Combining pole striding with education and standard medical therapy may increase exercise tolerance and other asthma-related outcomes.[10]

Another study by v srinivasan et al., (2021) examined the purpose of effect of pursed lip breathing with brashtika pranayama vs incentive spirometry in rehabilitating post covid 19 follow up. The results concluded that patients not only have respiratory complaints but also other issues in order to prevent re-hospitilisation.[11]

Another study by Marcus Tschentcher et al.,(2013) examined the purpose of this study is to compare Nordic walking (walking with poles) to brisk walking and jogging and to systematically summarise, analyse, and interpret the health advantages of each. The review encompassed Nordic walking shows favourable benefits on resting heart rate, blood pressure, exercise capability, maximum oxygen consumption, and quality of life in participants with different conditions and can thus be advised to a wide variety of individuals as primordial, subordinate prophylaxis.[12]

In this study, improvement was observed in both groups; however, statistically, the pole striding group showed a more significant improvement compared to the calisthenic exercise group, with a mean difference of 28.5 meters in the 6-minute walk test. Similarly, in the pulmonary function test, the improvement was evident in both groups, but the pole striding group exhibited a more significant improvement with a mean difference of 0.24 liters, and the p-value was <0.0001.

While the current study provided valuable insights into the effects of the pole striding intervention program on cardiovascular fitness among bronchial asthma participants, there are certain limitations to consider. Firstly, the study employed a experimental design, which may limit the ability to establish causality between the intervention and outcomes. Additionally, The results may not be generalizable to other contexts and demographics because the sample size was very small and the study was carried out at a single institution.

In conclusion, the present study adds to the existing body of literature by demonstrating the potential benefits of pole striding exercise in improving cardio-vascular fitness and pole striding is a useful technique for increasing both aerobic capacity and physical activity. Hereby, This study concludes that Pole-striding approach has a better effect. However, further study using bigger sample sizes and systematic reviews are warranted to validate and generalize these findings across different populations and settings.

## Conclusion

Participants with asthma who began Pole striding had significant improvements in their cardiovascular fitness level. This study shows improvement in the FEV1 levels and functional capacity in asthmatic participants. Pole striding is a useful technique for increasing both aerobic capacity and physical activity. Hereby, this study concludes that Pole-striding approach has a better effect.

**Ethical Clearance:** Taken from the Institutional Science Review Board.

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Original Article

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# Effect of Hockey Specific Training Program on Strength, Speed and Agility in Collegiate Hockey Players

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**Abstract**

**Background:** Hockey is a fast-paced and high-intensity sport that requires players to possess various physical attributes, including strength, power, agility, and endurance. It requires explosive movements, quick changes in direction, and constant upper and lower body coordination

**Purpose:** There are a number of training programs that are focused on improving strength, speed, and agility. There is less data available on hockey-specific training for field hockey players. Thus, the need for this study is to investigate the effect of a hockey-specific training program on strength, speed, and agility.

**Materials and Methods:** Total of thirty collegiate hockey players who are continually playing hockey for more than 3 to 4 years, the age between 18-25 were selected from SIMATS, Chennai. Strength, Speed and agility were measured using 1RM squat for lower limb, 1 RM bench press for upper limb, 10 meter DASH run test and Illinois agility test respectively. The players were randomly allocated into two groups, one group received hockey specific training program 4 days per week for 8 weeks. Another group perform regular training program.

**Results:** A t test analysis was used to compare the effectiveness of hockey specific training programme and regular training programme, which shows statistically significant improvement in hockey specific training programme group with a p value of< 0.0001

**Conclusion:** Here by we concluded that hockey specific training program will improve the strength, speed and agility in collegiate hockey players.

**Key Word:** Speed, Agility, strength, Hockey specific training program, 1 RM Squat, Bench press, 10 meter DASH run test, Illinois agility test.

## Introduction

Field hockey is a sport with unique demands that requires players to possess a combination of physical attributes like agility, speed, strength, and endurance and specific skills like dribbling, passing, and shooting accurately. To achieve a high level of performance in this sport, players must engage in a specific training program that improves their fitness level and skills while minimizing the risk of injury[1]. Players need to have the ability to move quickly, have strength to tackle opponents, and agility to avoid defenders. Therefore, it is essential to understand

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the importance of these attributes for field hockey players and their performance[2].

Speed is a crucial element in field hockey, especially while attacking and defending. Speed helps players to run faster, reach the ball quicker, and ultimately make more successful plays. This is particularly important when defending penalty corners, where the player needs to run quickly to the goalpost and cover it[3].

Agility is the ability to change direction quickly while maintaining balance and control. In field hockey, agility is vital when dribbling past defenders or avoiding tackles[4].

Strength is fundamental in optimizing a field hockey player's ball control and shooting power. A stronger physique allows players to exert more force when striking the ball, resulting in more powerful shots. Strength training exercises focusing on the upper body, especially the core and upper arm, can enhance a player's ability to accurately and forcefully strike the ball[5].

Hockey-specific strength training emphasizes compound exercises that engage multiple muscle groups, functional movements that mirror on-field action, and exercises that improve core strength. Enhanced strength empowers players to exhibit more powerful shots, execute decisive tackles, and maintain an advantage in physical contests[6].

Optimizing performance gains necessitates the implementation of periodization and progressive overload within a training program. Periodization refers to organizing training into specific cycles, each with its own goals and training intensities[7]. Progressive overload involves gradually increasing the demands placed on the body to elicit continued adaptation. This can be achieved through manipulating variables such as intensity, volume, and exercise selection throughout the training program[8].

On the other hand, regular exercise programs can help improve the general fitness level of players. Such programs focus on improving cardio-respiratory and muscular endurance, strength, and flexibility[9].

Regular exercise programs usually consist of cardiovascular training, weight training, and flexibility exercises. Although regular exercise programs can improve the overall fitness of field hockey players, they may not necessarily be sufficient to address the specific needs required for playing hockey[10].

## Aim

The purpose of this study is to compare the effect of a Regular Training Program with a Hockey-Specific Training Program on collegiate hockey players' strength, speed, and agility.

## Materials and Methodology

A total of thirty subjects were selected from Saveetha Institute of Medical and Technical Science; Informed consent was obtained from the subjects. A Random sampling method was used to gather the sample. The period of study was from July 2022 to December 2022.

**Inclusion criteria**:

- Subjects who were continually playing hockey more than 3 to 4 years
- Age between 18-25 years
- Only male players

**Exclusion criteria:**

- Players who are injured recently
- Players who are in recovery states

**Outcome Measures**

1. RM squat, bench press, Illinois agility test, 10 meter DASH run test were used as outcome measure which measures lower limb muscle strength upper limb muscle strength, agility and speed respectively

**Procedure**

Written informed consent was obtained from the participants who met a pre defined inclusion and exclusion criteria. Players were randomly allocated into hockey specific training program group (15 members) and regular training program group (15 members). Lottery method was used for random allocation. Pre test values for speed, agility and strength was measured using10 meter dash run test, Illinois agility test, 1RM squat for lower limb and bench press for upper limb respectively. Selected Participants were trained for hockey specific training

program for 8 weeks period of time, 4 days per week, in that strength training was given on Monday and Thursday, speed and agility training were given on Tuesday and Friday, Wednesday is considered as off. Subjects in regular training group perform structured regular exercise training. Post test values of strength, speed and agility are taken at the end of the 8 th week and documented for statistical analysis

**Intervention Protocol:**

**Hockey Specific Training Programme**

Strength

(Week 1to 4)

- Hang clean
- Dead lift
- Reverse lunge
- Split squat
- Shoulder press
- Plank rocks
- Hip thrust

(Week 4to8)

- Hang clean
- Dead lift
- Reverse lunge
- Split squat
- Shoulder press
- Plank rocks
- Hip thrust
- Abdominal drawing and crunch
- Banded adduction

SETS AND REPETITION

- WEEK (1-2) 2×10
- WEEK (3-4) 3 ×8
- WEEK (4-6) 3 ×10
- WEEK (7-8) 4 ×8

SPEED

(WEEK 1-8)

- 20m sprinting drills
- High knee
- Shuttle run
- High step jogging
- Double switch
- Triple swith
- Box jump

WEEK (1-4) 2 Circuits

WEEK (5-8)3 Circuits

AGILITY

(WEEK 1-8)

- Side shuttle run
- T drills
- Corico sideways jump
- Zig Zag drills
- Figure 8 cross over

WEEK (1-4) 2 Circuits

WEEK (5-8)3 Circuits

**Regular Training Program**

STRENGTH

- Squat
- Lunge
- Calf raise
- Hamstring curl
- Bench press
- Push up
- Pull up
- Overhead press

SPEED

- High step walking
- Run shuffle
- Run speed
- Skipping
- Triple jump
- Lateral low hurdle run
- Split jump

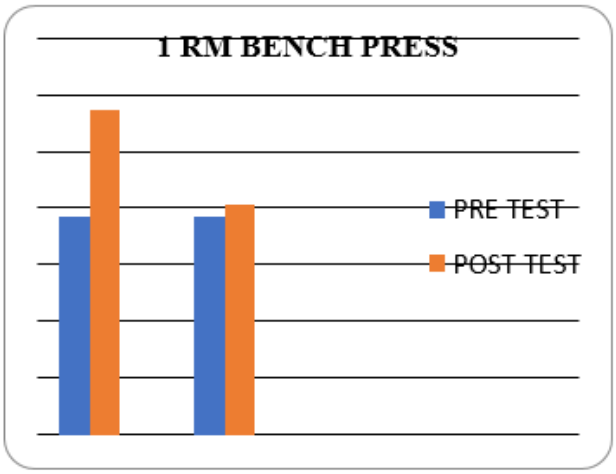
AGILITY

- 3 Cone drills
- L Drills
- Tuck jump

- Deceleration drills
- Lateral plyometric jump
- Laterals drills

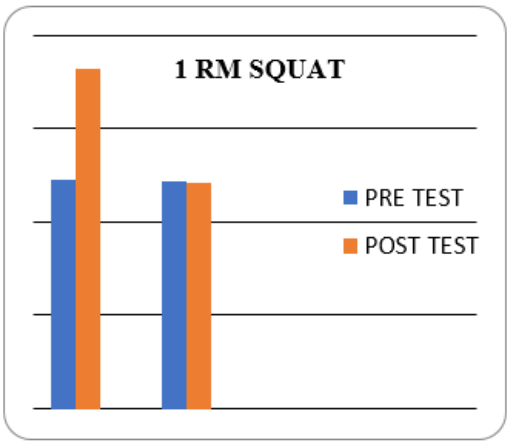
**Data Analysis**

The Pre and Post test values of strength (1 RM bench press & Squat) , agility ( Illinois agility test) and speed ( 10 meter DASH run test) were mentioned in graph 1,2,3 and 4.



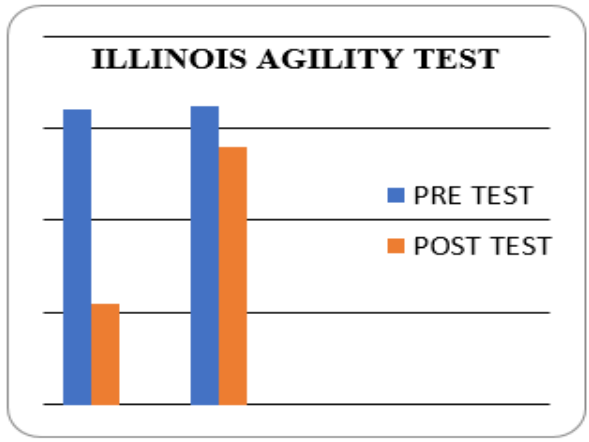

**Graph No: 1**

INTERPRETATION: Graph No: 1 shows hockey specific training group is effective than regular training group in terms of upper limb strength ( 1RM bench press)



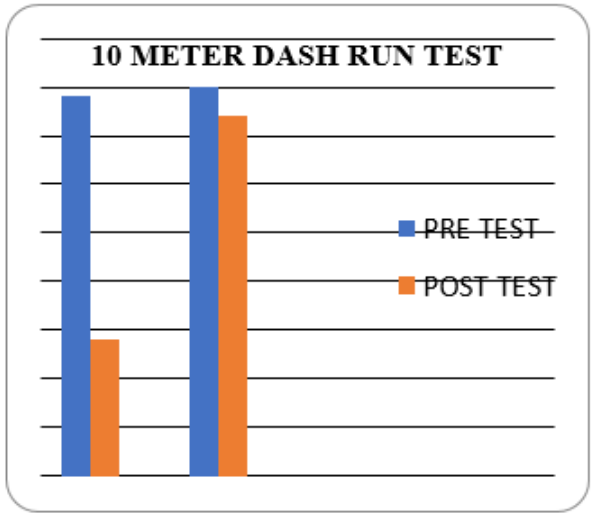

**Graph No: 2**

INTERPRETATION: Graph No: 2 shows hockey specific training group is effective than regular training group in terms of lower limb strength ( 1RM Squat)




**Graph No: 3**

INTERPRETATION: Graph No: 3 shows hockey specific training group is effective than regular training group in terms of Agility ( Illinois agility test)




**Graph No: 4**

INTERPRETATION: Graph No: 4 shows hockey specific training group is effective than regular training group in terms of speed (10 m DASH run test)

## Result

In hockey specific training programme group the Mean value of 1RM bench press and 1RM squat in before intervention values were 77.20 ± 3.55 & 122.53 ± 6.95 and after intervention values were 114.60 ± 7.19 &181.60. In regular training programme group the Mean value of 1RM bench press and 1RM squat in before intervention value was 77.30 ± 4.10 & 121.80

± 7.24 and after intervention value was 181.00 ± 5.71& 121.07. Both groups showed statistically significant improvement in post test values, but compared to regular training programme group hockey specific training group shows better improvement.

The mean value of 10 meter dash run test, for hockey specific training programme was 1.99 ± 0.76 in pre-test and 1.74 in post-test with a p value of < 0.0001 it shows statistically significant improvement when compared to regular training group which has a pre-test value of 2.0 ± 0.83 and post-test value of 1.97 ± 0.05

In hockey specific training programme group the Mean value of Illinois agility test in before intervention values were 17.10 ± 0.59 and after intervention value was 16.05 ± 0.71. In regular training programme group the Mean value of Illinois agility test in before intervention value was 17.12 ± 0.56 and after intervention value was 16.90 ± 0.69.

## Discussion

This study was conducted to assess the effectiveness of a hockey-specific training program on field hockey players' strength, speed, and agility. The study shows a considerable difference following a particular training regimen. Consequently, the players' performance is enhanced.

The study conducted by Neha Ingale Chaudhary on specific speed and agility drills to improve the performance of field hockey players and states that after receiving rigorous Speed and Agility training, the number of slow-twitch muscle fibers increased, allowing for prolonged strength of contraction over several minutes to hours. This directly lowers the risk of injury and improves performance, which makes the player faster

Agility training emphasizes proprioception and kinaesthetic awareness, which allow athletes to have an enhanced sense of body positioning, movement, and limb control. This perceptual ability is vital for responding rapidly to external stimuli and making split-second decisions during play[11].

One key aspect of speed training is the development of muscular power and strength. The ability to produce force quickly and efficiently is vital for speed improvement. Muscular power is a measure of the force generated per unit of time. Speed training not only improves muscular strength but also enhances neural adaptations[12].

The study conducted by sankarmani concluded that pylometrics positively improves the vertical jumping ability and increases the neuromuscular efficiency[13].

Resistance training, a key component of hockey-specific training, involves the use of external loads, such as free weights or resistance machines, to induce muscular adaptations. This method helps increase muscle mass, improves neuromuscular coordination, and enhances force production ability[5].

## Conclusion

Field hockey players require a training program that is tailored to the specific demands of their sport. Hockey-specific training programs are designed to improve the specific skills that are necessary for playing hockey, such as speed, agility, and strength, and have been shown to be more effective in improving hockey-specific skills than regular exercise programs that are more generalized. For field hockey players looking to improve their on-field performance, a hockey-specific training program may be the best solution.

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**Funding**: Nil

**Ethical clearance**: Approved by Institutional Scientific Review Board

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Original Article

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# Effect of Sports Specific Warm-Up Protocol on Injury Prevention among Badminton Players

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**Abstract**

**Background:** Badminton is a sport in which players use a combination of speed, endurance, strength, and coordination over lengthy, high-intensity actions that are broken up by rest breaks. In sports, a warm-up is a pre-exercise session intended to improve performance in competition or training. Training that has been introduced into training programmes involves properly warming up the body before physical exercise. General warm up doesn't help on injury prevention in all games, so there is a need for sports specific warm up programs to promote more flexibility and readiness before the specific strength training and power training.

**Purpose:** To assess the impact of a sports-specific warm-up procedure on badminton players' ability to avoid injuries.

**Materials and Method:** From the SDAT in Chennai, a total of 100 young badminton players were chosen. With a mean age of 22.35 ± 3.23, there were 59 male and 41 female players among them. Injury Rate, Epidemiological Incidence Proportion and Incidence Rate were used as outcome measures. The players were split into two groups, one of which received a sports-specific warm-up procedure and the other of which received a generic warm-up regimen.

**Results:** By the descriptive statistics of the collected data, the Sports Specific Warm-up group showed better improvement in preventing injuries compared to the conventional group.

**Conclusion:** It has been concluded that Sports Specific Warm-up plays a vital role in preventing on-field injuries among badminton players.

**Key Word:** Warm-up, incidence rate, exercise training, performance, athletes.

## Introduction

In India, badminton is a well-liked sport for both competition and recreation. Indian players now have more players than any other country in the top thirty ranks for men's singles, and they have held the top spot for both men's and women's singles in the Badminton World Federation (BWF) ranking. It is thought to be the fastest racquet sport because of how quickly it moves[1]. A rectangular indoor or outdoor court is used for the physical game of badminton, which can be played for fun or at a high level of competition. All ages can maintain

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their fitness levels by playing badminton. There has been a significant growth in the number of female athletes over the past 30 years[2]. Badminton is a sport that involves extended, high-intensity motions (that need speed, endurance, strength, and coordination) interspersed with rest periods. After a century of active development, badminton is currently seeing a tremendous rise in popularity. It is currently one of the most well-liked sports in the globe[3]. Sudden, rapid direction changes and brief bursts of movement are also required in badminton, as well as diving to retrieve the shuttlecock. This puts players at risk for severe non-contact injuries to their joints and muscle-tendon units. Racquet collisions or collisions between doubles players can result in contact injuries such as concussions and eye damage. In order to succeed as a top badminton player, it is essential to avoid injuries and cut down on recovery time.

There are four steps involved in injury prevention in any sport: injury surveillance to assess the problem's breadth, aetiology and mechanism identification, adoption of preventive measures, and evaluation of those measures' efficacy[4]. In the non-contact individual sport of badminton, players must hop, lunge, change directions quickly, and swing their arms quickly from a variety of body postures. Common overuse injuries include those to the back, shoulders, lower legs, and knees. Acute limb injuries are likely to happen frequently in badminton because of the sport's extreme physical demands. Sports injuries in general are thought to make up 1% to 5% of badminton injuries, with male players hurting themselves more frequently than female players[5-7]. Across all age groups, female players had higher injury rates (IR) than male players, which rose dramatically with age. The growth in mechanical stress during matches with increasing competitiveness may be the cause of age-related increases in IR[8]. Lower limbs tend to sustain muscle injuries more frequently than other parts of the body. Sprains were the most prevalent ailment detected (56%), followed by fractures (5%), torn ankle ligaments (10%), and (13%) Achilles tendon ruptures[9]. Players in badminton must quickly adjust their body position in response to the moving shuttlecock. Aerobic endurance, agility, strength, speed, and precision are all required of players. It is a technical activity that calls for extraordinary motor control and mastery of difficult racquet movements. An enormous amount of stress is placed on the upper extremity by repetitive overhead forehand and backhand strokes, deception, and a very short striking technique[10].

Warming up is a term used in sports to describe a time of preparation before engaging in physical activity in order to improve performance in competition or training. Warming up properly prepares the body for more intensive activities, as well as preventing injuries and improving blood flow to the muscles. Stretching exercises improve player performance or flexibility by extending the range of motion of joints and maintaining flexibility. Warming up will stop muscle soreness from happening, which will increase player performance, raise muscle temperature, and reduce the risk of injury. Increased anaerobic performance and improved range of motion are two benefits of warming up; yet, weak or unreliable ROM for a particular joint may result from a lack of warm-up effort. In order to improve performance and reduce injuries, warm up before exercising. The length, intensity, and attitude of the warm-up are all closely related to its benefits. Exercise-specific warm-ups increased body temperature, heart rate, and anaerobic threshold while reducing range of motion in the knee and hip joints.[11]. There are numerous advantages to warming up before exercising with the goal of enhancing performance and preventing injuries, and these advantages are closely associated with the time, intensity, and state of the warm-up. [12]. Warming up helps to avoid muscular soreness, improves player performance, raises muscle temperature, and reduces the risk of injury. To improve performance and prevent injuries, warming up before exercise has a number of benefits, and these benefits are directly related to the length, rigor, and state of the warm-up. Upper and lower extremities together Warming up has the potential to improve performance and prevent injuries, but no studies have been done to see if and how this happens in the upper extremity[13].

## Aim

To assess the impact of a sports-specific warmup strategy on badminton players' ability to avoid injuries.

## Materials and Method

From SDAT, Chennai, a total of 100 young badminton players were chosen. This experimental study was conducted from the month of August to November 2022. With a mean age of 22.35 ± 3.23, there were 59 male players and 41 female players.

**Inclusion criteria:**

- Both genders aged between 18 and 25 years.
- Badminton players who are continuously into the game for more than 2 years.

**Exclusion criteria:**

- Badminton players who have been injured recently.
- Players who are in the off-season.

**Outcome measure:**

- Sports Injury Reporting Form[14].
- Epidemiologic Incidence Proportion (IP)[14].
- Incidence Rate (IR)[14].

**Procedure**

The selected players were clearly explained about the protocols and informed consent was obtained. The participants were divided according to their experience and age. Then they were split into two groups at random, designated as the Specific Warm-up Group (SWG) and the Conventional Warm-up Group (CWG). Baseline measures of Injury Rate, Epidemiological Incidence Proportion and Incidence Rate were calculated. Specific Warm-up Group (SWG) received the experimental protocol of Sports Specific warm-up for 30 minutes before the game. Conventional Warm-up Group (CWG) received the regular Generic warm-up protocols with short runs, active dynamic stretches, push-ups and aerobic exercises for 30 minutes. The duration of this study was for 6 weeks.

**Sports Specific warm up protocol:**

1. **Calf Jumps:** Standing with back straight, core tight and hands over the sides. Forcefully press off the ground with the balls of both the feet. *Repetitions:* 15 times* 3 sets/ sessions for 6 weeks.
2. **Vertical Jumps:** The act of jumping upwards into the air. It is the standard test for measuring athletic performances. *Repetitions:* 15 times* 3 sets/ sessions for 6 weeks.
3. **Drills:** Plain and basic, drill is marching. You "March" and put your left foot in front of and parallel to your right foot by taking a 12-inch step. Lie on both of your feet's balls to evenly distribute your weight. *Repetitions:* 15 times* 3 sets/ sessions for 6 weeks.
4. **T-Run:** T-Run involves forward, lateral and backward movement running over the given T mark. *Repetitions:* 5 times/ session for 6 weeks.
5. **Side Squats:** Start by standing with broader feet than hips, the knees and toes pointed forward. Shift weight into the right heel, push the hip back and bend the knee while leaving the left leg straight. Then, drive through your right foot to reverse the movement. *Repetitions:* 15 times* 3 sets/ sessions for 6 weeks.
6. **Burpees:** Beginning with your straight spine, knees bent, and feet with shoulders wide apart, squat down. Lower hands to floor in front, so they're just inside feet. With weight on hands, kick feet back so on hands and toes and in push-up position. They stand and reach their arms over their heads. Jump quickly into the air and land back. *Repetitions:* 12 times* 2 sets/ sessions for 6 weeks.
7. **Side Lunges:** To begin, place your feet shoulder-width apart while pointing your toes forward. Step out with your right foot as wide as possible. Engage through the right heel as you drop hips down and back while keeping the left leg straight, stretching the groin on the left leg and keeping both soles of the feet on the ground. *Repetitions:* 15 times* 3 sets/ sessions for 6 weeks.
8. **Inch Worm:** Standing erect with your feet shoulder-width apart, stoop down and touch the floor with the palm of your hands, walk hands out as far as while keeping your legs straight and pause. Walk back up to the starting position and repeat until the set is complete. *Repetitions:* 12 times* 3 sets/ sessions for 6 weeks.
9. **Walking Lunges with trunk twist:** Right foot forward, body lowered into a basic lunge position. Twist upper body to the right from midsection. Keep core engaged,

squeeze glutes, and be careful to not rotate your knee. Bring arms back to the centre in a slow, controlled movement. Step the right foot back and return to the starting position. *Repetitions:* 5 rounds/ session for 6 weeks.

10. **Multi Directional Lunges:** Front lunge step forward and back knee should just touch the ground. Front 45 degrees angle lunge step with head and eyes facing forward and pelvis and shoulders square to the front allow the back leg to pivot as the lunge. Lateral lunge steps out to the side as per previous exercise. Back 45 degrees lunge step back and lower the back knee until it touches the ground, back lunge step backwards. *Repetitions:* 10 times* 3 sets/ sessions for 6 weeks.
11. **Squat Jumps:** Standing with your feet shoulder width apart and your knees slightly bent, lower yourself into a full squat. Lift the body off the ground by kicking out the hip and knee. The feet will be a few inches off the ground when the legs are fully extended. To manage the landing, lower yourself, squat, and then lower yourself again for another powerful jump. *Repetitions:* 12 times* 3 sets/ sessions for 6 weeks.



**Fig 1: Inch Worm**



**Fig 2: Burpees**

## Data Analysis

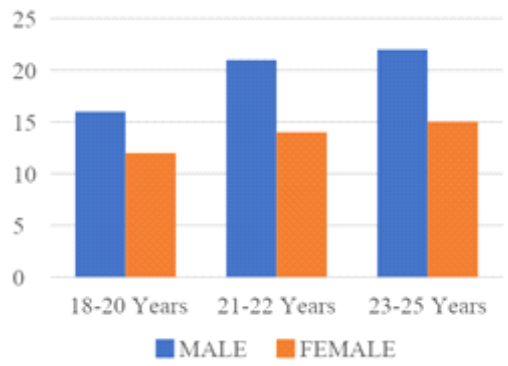
Participants in this study came from a total of 100 badminton players. Injury rate, epidemiological incidence proportion and incidence rate variables had been estimated and tabulated post-intervention. The data that had been gathered was examined using descriptive statistics.

## Result

Incidence of injuries in both previous in-season and post interventional in-season were evaluated and presented in Table-1. Total of 35(70%) out of 50 subjects in SWG were injured in the previous in-season (before intervention) and 19(38%) out of 50 subjects were injured in present in-season (after intervention). Whereas 39(78%) out of 50 subjects in CWG were injured in previous in-season (before intervention) and 26(56%) were injured in present in-season (after intervention). Incidence rate (IR) was 4.5 per 1000 athlete's exposure in previous in-season (before intervention) whereas 3.9 per 1000 athlete's exposure in present in-season (after intervention). Epidemiological Incidence Proportion (IP) of SWG was 0.29 whereas in control group it was of 0.54.

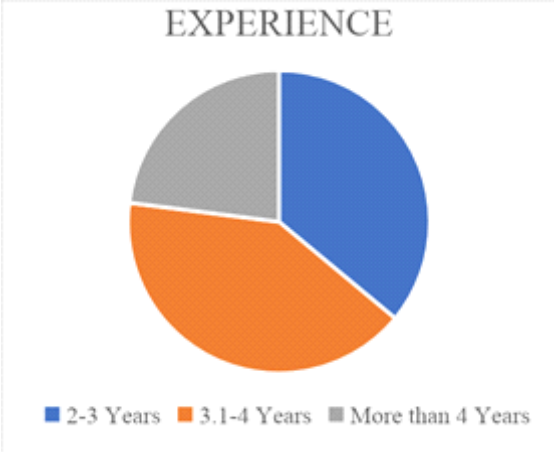
**Table 1: Number of players injured.**

| S No | Type of injury | SWG | | CWG | |
|---|---|---|---|---|---|
| | | Pre-intervention | Post-intervention | Pre-intervention | Post-intervention |
| 1. | Dislocation | 3(6%) | 1(2%) | 4(8%) | 3(6%) |
| 2. | Skin injuries | 6(12%) | 4(8%) | 8(16%) | 6(12%) |
| 3. | Overuse injury | 5(10%) | 2(4%) | 2(4%) | 2(4%) |
| 4. | Respiratory problem | 3(6%) | 1(2%) | 3(6%) | 1(2%) |
| 5. | Sprain | 8(16%) | 5(10%) | 10(20%) | 6(12%) |
| 6. | Strain | 10(20%) | 6(12%) | 12(24%) | 8(16%) |
| | Total | 35(70%) | 19(38%) | 39(78%) | 26(56%) |




**Graph No. 1:**

INTERPRETATION: Graph No.1 shows the age and gender distribution of the sample.




**Graph No. 2:**

INTERPRETATION: Graph No.2 shows that the player's experience is distributed.

## Discussion

The current study's goal was to find out how badminton players' performance was impacted by sports warming up routines. Exercises during the warm-up phase raise body temperature and heart rate, boost productivity, and lower injury risk. The results of past studies that examined how warm-up exercises affected player performance provide evidence in favour of this theory.

A study conducted by Yuksel et.al (2015), stated that the elite and junior level badminton players' strength and endurance can be improved by performing warm-up activities that combine both of these elements. To enhance the fitness indices of badminton players, numerous training regimens with various warm-up exercises have been created[15].

In a study Yaday JS et.al (2017), concluded how specific exercises affected a player's flexibility and coordination in badminton and tennis. The results supported the current study's conclusions, which show that warm-up exercises greatly increase joint flexibility and coordination[16].

Samson et.al (2012), determines how performance is affected by dynamic and static warm-up exercises. Dynamic warm-up techniques result in the highest levels of overall performance when compared to static warm-up protocols. The findings of this study, which demonstrate that dynamic warm-up exercises had the highest overall impact on badminton players' performance, are supported by earlier research[17].

Any physical exercise should be preceded by a warm-up to prepare the body and mind for more demanding activities. It raises the body's internal temperature while also raising the temperature of the muscles. Muscles become supple and elastic as their temperature rises. A brief physical activity should be the main component of the overall warm up. Exercises like jogging, easy swimming, riding a stationary bike, skipping, or light aerobics. Sports specific warm-up is a phase of the warm-up when the athlete precisely gets the body ready for the demands of his or her particular sport. This phase of the warm-up involves more strenuous activities. The exercises should mimic the kinds of actions and movements that would be needed during the sporting event. Warm-up activities enhance player's coordination, strength, flexibility, and endurance while also having a positive impact on their performance in badminton. The health of players is improved by warm up exercises. Sports and physical activity help athletes build confidence and mentally prepare for competition.

## Conclusion

A player's physical health plays a crucial role in their ability to perform well in sports. Despite being a non-contact sport, badminton nevertheless carries a sizable risk of injury. The current study's conclusion elaborates that, when compared to a conventional warm-up, a sports-specific warm-up has greater outcome in reducing injuries among badminton

players. In a sports-specific warm-up routine, we prefer to place greater emphasis on warm-up exercises that will enhance the performance of badminton players as well as exercises that will assist increase coordination, strength, flexibility, endurance, and sports activities.

**ISRB approval:** This research work has been approved by the ISRB committee.

**Source of Funding:** Self

**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# Effect of Sport Specific Strength and Conditioning Training on Strength and Power among Mixed Martial Arts Athletes

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**Abstract**

**Background:** MMA is an intermittent sport with short, intense phases of activity repeated for 3-5 rounds of 5 minutes each, separated by 1-minute breaks. This complexity demands diverse physical skills (power, strength, speed, endurance) and metabolic processes (anaerobic, aerobic) in practice and competition.

**Purpose:** To determine the impact of a sports-specific strength and conditioning (S&C) training regimen on MMA competitors' performance.

**Materials and Methods:** A total of 30 MMA athletes were selected. 1RM strength test, medicine ball throw and vertical jump test were used as outcome measures.30 players were divided into two groups. Sports Specific S&C protocol (S&C group) and general strength training (conventional group) for a period of 8 weeks.

**Results:** Post mean and standard deviation of 1RM (bench press, squat), Medicine Ball throw and vertical jump test of S&C and conventional group were 108.3 ± 3.68, 99.93 ± 5.22, 11.80 ± 0.41, 46.27 ± 2.22 and 99.87 ± 2.77 , 93.0 ± 4.71, 10.1 ± 0.78, 42.87 ± 3.34 respectively. The S&C group were more significant than the conventional group with p value < 0.001.

**Conclusion:** It has been concluded that the sports-specific S&C training had a positive impact on performance among MMA athletes.

**Key Word:** High intensity training, performance, MMA athletes, competitive training.

## Introduction

MMA has gained a great deal of attention recently, which has sparked a lot of interest in physical fitness assessment and training for this athletic discipline. Due to the challenge of enhancing both offensive and defensive tactical skills, as well as speed, strength, and endurance, the periodization of the MMA training technique is unique[1]. MMA may be considered a sport that is intermittent with minute-long breaks in between each round and bursts of high speed and power effort occurring every 3 to 5 minutes. Consequently, MMA is an extremely physically demanding sport that requires a wide range of physical skills (such as speed, power, strength and muscular endurance) as well as metabolic processes (both anaerobic and aerobic) during training and competition. In addition to having high levels of power, speed, strength, aerobic fitness, and anaerobic

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power, MMA competitors must use and combine multiple different fighting styles in order to survive the 3-5 rounds. Due to their extreme physical and technical requirements, these athletes require unique strength and conditioning training regimens [2, 3].

Combinations of high-intensity, swift-moving activities, such as striking and grappling, have been used to define MMA. These motions demonstrated how the upper and lower extremities needed to have strong dynamic and isometric muscles as well as substantial amounts of endurance in both aerobic and muscular activities [4, 5]. MMA has a variety of physical requirements that must be met in order to be successful. Upper and lower extremities power and strength are combined during hitting and wrestling in a variety of movement planes and along both open & closed kinetic chains. For resisting an opponent over short distances (1-2 m), agility is essential, as is moving closer to them and preparing an attack. Good footwork and the ability to strike effectively depend on limb speed. Due to the requirement to maintain a physique category that is appropriate for their size, relative strength, and functional skills, hypertrophy is less important than the ability to operate against a competitor's mass [6]. For effective hitting and a capacity to influence a competitor's posture, power is a crucial quality. Force transfer through the transverse plane is necessary for impact [7].

Power can also be thought of as the speed at which work is performed. In athletics, the term "power" refers to the combination of force and speed. Maximum power, commonly referred to as peak power, is the amount of work a muscle can accomplish in a specific length of time [8]. High force rates result in very low velocity, while low force levels result in high velocity . It has been shown that a variety of loads may be used by an athlete to train with in order to increase their muscle power in a variety of activities.

This is because everything below the curve represents the amount of power that is available for a given force and velocity. These loads range from 10 to 70% of the most that can be lifted in a single repetition. In other words, it is possible to measure the peak power in multi-joint movements using a wide variety of different percentages. These loads determine the amount of force and speed needed to complete a movement, which yields a particular amount of power. A well-established S&C programme for MMA participants seeks to increase each athlete's force velocity curve by enhancing speed and force.

Strength is yet another crucial element of MMA training regimens. Strength is the ability of a muscle or set of muscles to generate muscular force under specific conditions. It is the outcome of electrical activities in the body's neurological system controlling and initiating muscular activity. According to biology, strength is mostly a result of a suitable muscle being effectively stimulated by the nervous system to contract vigorously. As a reaction to neuromuscular stimulation, the nervous system has two main adaptive and interconnected effects on the body. Hypertrophy and functional muscle activity are these outcomes. Strengthening is a second, equally important goal of the MMA S&C programme so that the athlete can use more force and, ultimately, more power when performing techniques [9].

Effective MMA athletes must obviously have a broad skill and knowledge base in a range of martial arts techniques. An effective S&C programme to improve overall fitness is essential for these athletes to maintain their high levels of performance. The key benefits of the S&C programme are injury prevention and performance enhancement [10].

The intention of this study was to evaluate the effect of a regular, 8-week programme based on circuit training involving strength as well as power training with specific to a sport power and strength exercises, i.e., exercises that are biomechanically like movements performed during MMA, such as medicinal ball throws simulating a punch. Despite its lower volume and perceived effort, it was predicted that the later regimen would produce superior gains in performance parameters important for MMA.

## AIM

To determine the effect of sport-specific S&C training regimen on performance in MMA athletes.

## Materials and Method

In the experimental study, a total of 30 young athletes were chosen from Saveetha School of Physical Education, Chennai. The subjects were between the

age groups of 18 and 25, comprising 12 female players and 18 male players. The subjects were selected using a random sampling method.

The study was conducted from September to December 2022 at Saveetha School of Physical Education, Chennai.

**Inclusion criteria**

- MMA athletes between the age groups of 18 and 25 years old.
- Both male and female MMA athletes were included in the study.
- MMA athletes who have been actively participating in the sport for a minimum of 2 years.
- Athletes who were available and willing to participate in the study during the designated period.

**Exclusion criteria**

- MMA athletes who have recently suffered an injury that may impact their physical performance or ability to engage in the study.
- Athletes with a history of surgical procedures on their spine or extremities that may affect their physical capabilities.
- Athletes who are currently in the off-season, as their training and performance levels may differ from those in the competitive season.

**Outcome measures**

- 1 RM Strength Test (bench press and squat)
- Medicine ball throw
- Vertical jump test

Each test had a scheduled warm-up and cool-down period, and that was conducted under the supervision of the qualified professional. All tests were performed according to standard protocols; the participants were allocated with three trials, with the average of all three being used as one data item.

**Procedure**

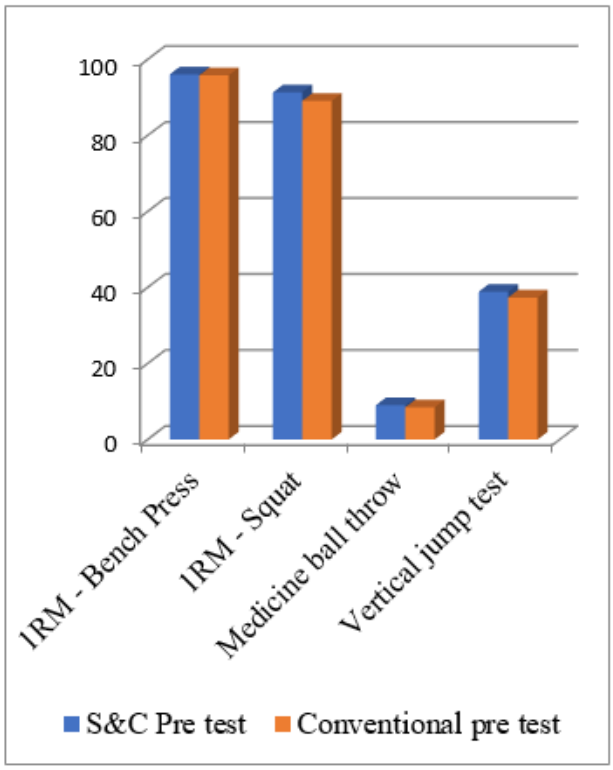
The objectives of the study were explained to everyone, and written informed consent was obtained. Selected participants were randomly allocated into conventional and S&C groups using an opaque enclosed envelope; pre-test values for strength and power were assessed. Upper body Strength of the athletes was measured by bench press and lower body by squat using 2.5% rule; upper body power of the athletes was measured by medicine ball throw and for the lower body by vertical jump test. Participants in the S&C group were trained for high intensity sports specific S&C training for 8 weeks' time duration; conventional group participants were asked to continue with their regular training, and they were asked to maintain an exercise diary for 8 weeks. At the end of 8th week, post-test values were assessed the same as pre-test. All the data were collected.

This eight-week S&C program is designed specifically for MMA athletes who train four days a week on alternate days, with two days dedicated to strength training and two days for power training. Additionally, there are two days dedicated to regular MMA practice, with one day of rest. S&C training starts with 10 minutes warm-up before each session and cool-down afterwards to prevent injuries. Weights and intensity were adjusted based on fitness level.

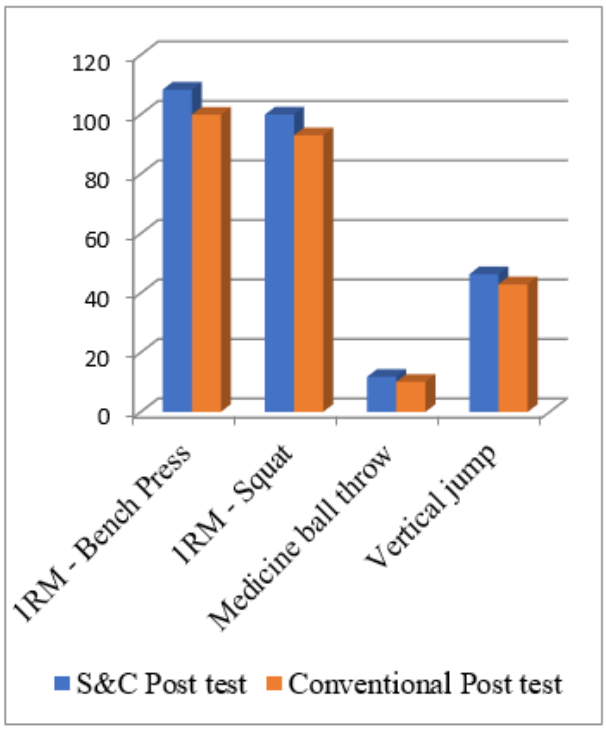
Sports specific S&C exercises for MMA athletes should focus on developing key physical attributes required for the sport, including strength and power. Strength training exercise like push ups with weight, Bench press, Barbell rowing, Overhead press, Deadlift, pull ups, Cable face pull, one arm dumbbell row, Squat, Lunges with weight, Pause SSB squat, Stiff leg deadlift, Bulgarian lunges. Power training exercise like Kettlebell swing, Clean & press, Sumo deadlift high pull, countermovement jump, med ball throw, farmers walk, Lunge jumps, Split squats, Med ball rotational throw, lateral jump, overhead med throw, suitcase farm walk.

## Data Analysis

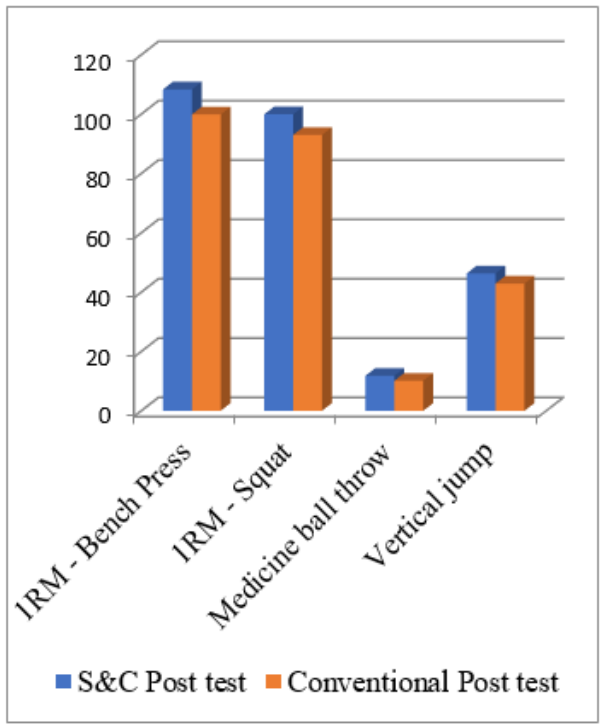
The descriptive statistics, such as mean and standard deviation (SD), were used to analyse the data. The Wilcoxon sign rank test was employed to examine the significant differences between the groups, while the Mann-Whitney U test was used to analyse within-group differences.




**Graph 1 shows the pretest values of S&C and conventional group between the groups**




**Graph 2 shows the post -test values of S&C and conventional group between the groups**




**Graph 3 shows the pre and post -test values of S&C group within the group**

## Results

All 30 subjects successfully completed the study, the mean age of the participant 22.3 with standard deviation of 2.3 years. At the end of 8th week all the athletes were evaluated, and their data were calculated. The pre-test and post-test mean and SD values for 1 RM squat were 91.33±6.04 and 99.93±5.22, respectively. Similarly, the pre-test and post-test mean and SD values for 1 RM bench press were 96.07±3.03 and 108.3±3.68. For the medicine ball throw test, the pre-test and post-test mean and SD values were 9.0±0.85 and 11.80±0.41. Lastly, the pre-test and post-test mean and SD values for the vertical jump test were 38.87±2.17 and 46.27±2.22.

All these improvements were found to be statistically significant with a p-value of less than 0.001.

## Discussion

The main outcome of the present study highlights the effectiveness of a sport-specific S&C training programme in significantly improving the physical fitness of MMA athletes. This specialized training

approach demonstrated superior results compared to a regular circuit training programme. This finding underscores the importance of tailoring training programmes to the specific demands of MMA and the potential benefits of incorporating strength training in enhancing power and overall performance.

Clay Harden Walker et al. found that different variables contributed significantly to the increase in peak power for each MMA technique. Specifically, the deadlift and a combination of deadlift and bench press for strength were identified as responsible for substantial gains in peak power for the cross and knee techniques. This supports the notion that augmented strength variables play a vital role in enhancing peak power in specific techniques[11].

Łukasz Tota et al. conducted a study where they implemented a 14-week periodized training program that focused on various components of strength training. Maximal strength training, with loads ranging from 65% to 100% of 1RM, was integrated into each micro cycle, along with isometric exercises. Additionally, explosive strength training activities such as ballistic training, plyometric, sprinting, and agility exercises were incorporated. The purpose of this periodized training program was to optimize the physical preparedness of MMA athletes. By progressively increasing volume and including specific exercises targeting strength and explosive power, the programme aimed to improve performance outcomes [12]. Moreover, Ioannis N. Kostikiadis et al. 's research comparing two different training programmes (Specific Training Group and Regular Training Group) among experienced MMA fighters reveals that the Specific Training Group, following a sport-specific S&C training programme, displayed substantial improvements in various performance parameters. This further emphasizes the superiority of a tailored training approach over a regular programme for enhancing performance in MMA athletes [13].

Furthermore, the computerized search conducted by Charalampos Spanias et al., provides valuable information on the physiological features of MMA competitors, such as body composition, strength, power, endurance, and aerobic and anaerobic capacity. This information can be utilized by S&C trainers to design tailored training programmes and improve the performance and overall athletic ability of MMA competitors [14].

Additionally, Oliver R. Barley et al.'s research provides valuable information about the training and competing habits of athletes in various combat sports and their potential relationship with competitive level. Understanding such patterns can help coaches, support staff, and regulators design effective training programmes and assess athlete performance [15].

Overall, the collective findings highlight the crucial role of S&C in enhancing the performance of MMA athletes. They underscore the need for tailored and sport-specific training approaches, along with structured strength training programmes, to address the unique demands of MMA. The study also acknowledges the limitations of the current research, including small sample sizes and short intervention periods, and calls for further research with larger sample sizes and longer training interventions to gain a more comprehensive understanding of sports-specific S&C training in MMA.

## Conclusion

In conclusion, the study assessing the impact of sport-specific S&C training on MMA participants found that the athletes' strength and power had significantly increased. The implementation of targeted training protocols tailored to the specific demands of MMA contributed to enhanced muscular strength, allowing athletes to generate greater force and exert more power in their techniques.

Athletes showed greater striking, grappling, and overall athletic ability as a result of their increased strength and power, which right away improved performance outcomes.

**ISRB Approval:** The study was granted by the ethical committee of Saveetha College of Physiotherapy, Tamil Nadu, India.

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**Conflict of Interest:** Nil

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Original Article

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# The Effectiveness of Core Stability Exercise and Plyometrics Balance and Agility in Badminton Players

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**Abstract**

**Background:** Exercises including plyometrics can boost lower extremity strength. According to a different study, teenage badminton players' dynamic balance, endurance, and agility are improved after 6 weeks of core training. The development of core muscles may improve athletic performance.

**Objective:** To evaluate the effectiveness of core stability exercise and plyometrics balance and agility in badminton players in terms of pain using Illinois test and Star Excursion Balance Test.

**Methodology**: It is an experimental study with random sampling technique. Sample size consists of 30 members in total where they are split randomly into 2 groups (15 in each group). Players in Group A received Core strengthening training in addition which includes Leg-up. Similarly Group B received Plyometrics training along with Leg up. Exercises to calm down were performed at the end of the session. Both the groups received intervention for 30 minutes thrice a week for 6 consecutive weeks.

**Results**: According to the intra-group analysis, treatments A and B are equally successful in lowering the Agility Score and raising nearly all of the SEBT scores for the left and right legs, with the exception of the medial and lateral scores for the left leg. The results of the inter-group analysis revealed that Treatment B is more successful than Treatment A in terms of mean Agility Score decrease, whereas Treatment A is more effective than Treatment B in terms of mean Anterior scores for the right Leg improvement. With the exception of Agility and the anterior score for the right leg, both treatments were shown to be equally effective across the board.

**Conclusion:** When compared to Core Stability Exercise, plyometrics help badminton players become more agile and balanced.

**Keywords:** Plyometrics, core stability, Agility, Balance, Illinois test, SEBT

## Introduction

Badminton is a non-contact, solitary activity that calls for leaps, lunges, quick direction changes, and quick leg actions from various postural postures. High-intensity rallies take place on the court frequently throughout a game of badminton. There are 650 teams with more than 170,000 participants total. The strange and perplexing flight path of the shuttle requires exceptional skill to hit the target [1].

Two- or four-player racquet sport called badminton has a temporal structure characterized by bursts of intense action. It is generally accepted

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that success in top badminton requires a combination of mathematical, tactical, anthropometric, physical, and cerebral talent. It is a strenuous physical activity that demands endurance, strong control, and agility when moving fast around the court[2].

Agility and dynamic control are critical motor skills for hitting a shuttlecock in a badminton game[3]. Badminton players must also do repeated motions such as skipping, squatting, and moving positions. The capacity to shift course swiftly and effectively is known as agility[4]. In badminton, players need to move rapidly in all directions to reach the shuttlecock and respond to their opponent's shots effectively[5].

Good agility allows players to cover the court efficiently and be in a better position to make successful shots. Dynamic control involves the ability to maintain body stability and balance during rapid movements. In badminton, players must be able to adjust their body position quickly while hitting shots, especially during lunges, jumps, and overhead strokes[6] .

This skill helps in generating power and accuracy during shots while preventing injuries caused by awkward landings or overexertion. Repetition of Motions: Badminton is a game that demands repetitive actions like skipping, squatting, and frequent changes in positions. These repetitive movements enhance muscle memory and enable players to execute various strokes more effectively. Regular practice of these motions helps players build strength, endurance, and precision in their game[7]. Skipping or jump rope exercises are common in badminton training as they improve footwork, coordination, and cardiovascular fitness. Skipping drills help players develop quick and light foot movements, which are essential for swift court coverage and rapid changes in direction. Squatting: Squatting is crucial for maintaining a low center of gravity, especially during defensive movements and powerful shots[8].

A lower stance allows players to be more stable and agile on the court, enabling them to react faster to the shuttlecock and perform dynamic shots like smashes and drops. Moving Positions: Continuous movement and quick changes in position are fundamental in badminton. Players need to transition smoothly between different areas of the court to anticipate their opponent's shots and create better attacking opportunities [9].

Practicing various footwork patterns helps players become more adept at moving efficiently on the court. Overall, the combination of agility, dynamic control, and repeated motions enhances a badminton player's overall performance and contributes to their success in the game. Training these motor skills regularly can significantly improve a player's on-court capabilities and contribute to their competitive edge. Muscle strength, muscular stamina, capacity, pace, stability, balance, and coordination are all essential factors for badminton players[10] .

There are some crucial factors that contribute to a badminton player's performance and success. Muscle strength is essential for generating power in badminton shots, such as smashes and clears. Strong muscles allow players to hit the shuttlecock with more force, making it challenging for opponents to return the shots. Additionally, strength is crucial for maintaining stability during lunges and other dynamic movements. Muscular Stamina: Badminton matches can be physically demanding, lasting for extended periods with frequent bursts of high-intensity movements[11].

Muscular stamina refers to the ability of muscles to sustain prolonged activity without fatigue. Good muscular stamina ensures that players can maintain their performance level throughout the match. Capacity: Capacity here likely refers to cardiovascular fitness or aerobic capacity. Badminton is an aerobic sport that requires players to have good cardiovascular endurance. A strong cardiovascular system enables players to endure the fast-paced nature of the game and recover quickly between points. Pace: Pace in badminton refers to the speed at which a player can move around the court and react to shots[12]. Plyometric training is a dynamic method of strengthening that involves quick (such as a drop leap) or slow (such as a countermovement jump) actions during the stretch-shortening cycle while doing vertical and horizontal jumps and center-of-gravity displacements[16].

## Aim

The aim of this study is to evaluate the impact of plyometrics and core stability exercises on badminton players' dynamic balance and agility.

## Materials and Methodology

This is a pilot study carried out in a private Sports Academy in Chennai during the period of August 2022 to November 2022. Based on the selection criteria used in this investigation, 30 samples were selected. Following receipt of the patient's consent form, the Illinois and Pre-Star excursion balancing tests were conducted. They were split up into two groups of 15, each with their own members.

The individual's prior consent was obtained. Players were then informed of the process and the significance of the study. The Star Excursion Balance Test (SEBT), which measures balance in four directions (anterior, posterior, medial, and lateral), was used in a previous examination of an individual's agility, along with the Illinois T test. Two groups of participants were randomly assigned. One group does core stability exercises, and the other does plyometric exercises. Exercises were done by both groups for 6 weeks.

**Inclusion criteria:**

Competent amateur badminton players Male players aged 18 to 25 were chosen, and they had to play badminton four days a week without taking part in any regular abdominal or plyometric training.

**Exclusion criteria:**

Players with recent injuries, including lower limb fractures, those who have experienced low back discomfort within the last month, those who have had a lower limb fracture within the past four months, and those who have suffered from chronic ligament sprains are also excluded.

**Outcome Measures**

The study used Illinois Agility Test and Star Excursion Balance Test (SEBT)

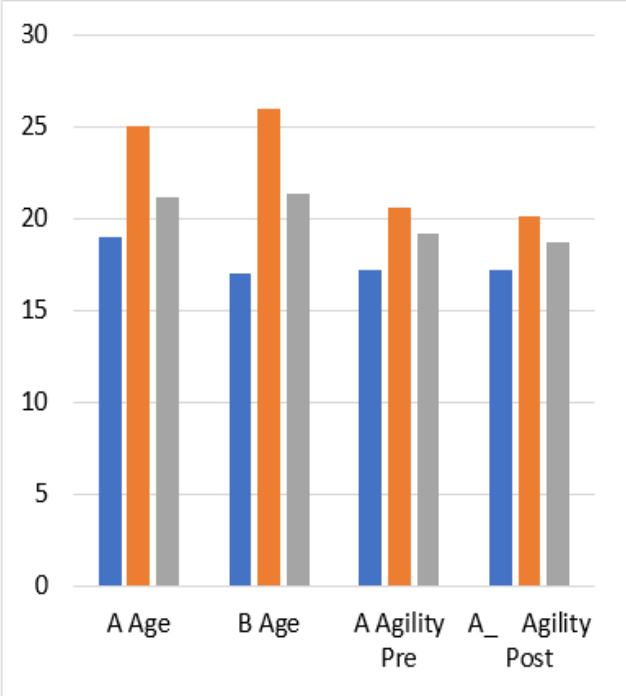
**Procedure**

The Illinois T test was used to evaluate agility performance. Four subjects were positioned in the centre of the 10-by-5-meter test area, spaced 3.3 metres away from one another. The test volunteers were told to complete the course as rapidly as they could. Stopwatch was used to record the value.

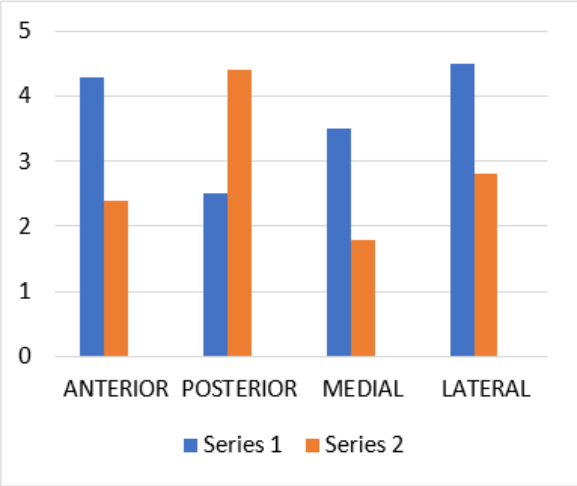
With SEBT, dynamic balance performance was evaluated. The player took the SEBT while standing in the middle of an 8-line, properly measured grid that had been laid out on the ground. The eight lines were labelled Anterior (A), Anterio-Lateral (AL), Antero-Medial (AM), Medial (M), Posterior (P), Postero-Medial (PM), and Lateral (L) depending on the direction of the excursion in relation to the stance leg. The players maintained a single-leg posture while doing the SEBT. A centimeter-long measuring tape was used to calculate the distance from the grid's centre to the point of contact.

Additionally, players in Group A got instruction in Core Stability Exercises, which included Leg-ups. Similar to Group A, Group B also received instruction in Leg up and plyometrics. Cool-down exercises brought the programme to a close. For six weeks straight, both groups got intervention for 60 minutes three times a week.

**Data Analysis**

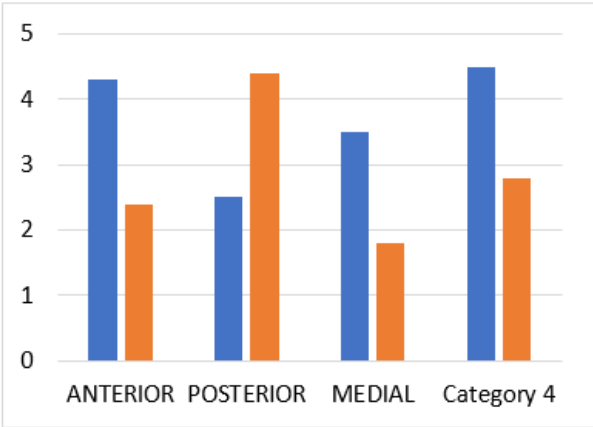



**GRAPH 1: Pre- and Post-test agility.**




**GRAPH 2: Pre- and Post-test for SEBT group**

Treatment A results in a substantial decrease in the Agility score (t = 4.01, p = 0.001 0.05). Additionally, the mean results show that Treatment A caused the mean Agility score to drop from 19.20 (before) to 18.68 (post).




**GRAPH 3: Pre and Post value for SEBT group B**

Treatment B significantly lowers the Agility score (t = 6.08, p = 0.000 to 0.05). Additionally, the mean results show that Treatment B caused the mean Agility score to drop from 19.10 (pre) to 16.98 (post).

## Result

The intra-group analysis revealed that, with the exception of the medial and lateral SEBT scores for the left leg, both treatments A and B are successful in lowering Agility Score and boosting nearly all SEBT scores for left and right.

The results of the inter-group analysis revealed that Treatment B is more successful than Treatment A in terms of mean Agility Score decrease, whereas Treatment A is more effective than Treatment B in terms of mean Anterior scores for the right Leg improvement.

With the exception of Agility and the right leg's anterior score, both treatments were shown to be equally effective across the board.

## Discussion

In this study, the efficiency of plyometrics Group B and Core Stability Exercise Group A in enhancing the dynamic balance and agility of badminton players was compared. This study demonstrates that Group A is more successful than Group B in terms of mean improvement in anterior scores for the right leg, whereas Group B is more effective in terms of mean reduction in Agility Score. The intra-group analysis revealed that, with the exception of Medial and Lateral for the Left Leg, both Groups A and B are successful in lowering Agility Score and raising nearly all SEBT scores for the left and right. In terms of the mean drop in Agility Score, the intergroup analysis reveals that Group B is more effective than Group A. In contrast, Group A outperforms Group B in terms of the average improvement in anterior leg scores for the right leg the same result in their research and hypothesis that plyometric exercises might aid in enhancing agility because they take use of the neuromuscular system's adaptation to the stretch-shortening cycle to strengthen the legs and enhance agility

The study concluded that combined Plyometric Training and weight training significantly enhances hip and thigh power production, as measured by the vertical jump, than weight training program.[13].

By enhancing the dynamic balance and agility of badminton players, the study intended to determine the efficacy of Core Stability Exercise and Plyometrics. Age baselines for the study's participants were available. The findings of this study supported the hypothesis that badminton players had better balance and agility. In terms of motor and action controls, badminton demands a certain level of physical training; key motor demands in this sport are response time, foot striding, and static or dynamic balance[14].

Plyometric exercises include rapidly extending a muscle, which is followed by an action that shortens or constricts the same muscle and connective tissue. The primary goal of the study is to contrast how plyometric and Core Stability Exercise affect badminton players' agility and balance. The majority of research indicates that athletes who participated in plyometric and Core Stability Exercise training programmes showed improvements in their agility and balance. However, there isn't much research that contrasts the benefits of training with plyometric and core stability exercises. However, all of the assessments, with the exception of the anterior score for the right leg, indicated that both treatments were equally beneficial[15].

## Conclusion

This study demonstrates that plyometric training rather than core stability exercises benefits badminton players' agility and balance since it rejects the null hypothesis. With the exception of the anterior score for the right leg, both treatment groups A and B were shown to be equally beneficial across all metrics. As a result, this may be included into a therapeutic plan for more research and injury prevention.

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**Source of funding**: Self.

**Conflicts Of Interest**: No conflict of interest involved during this research.

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Original Article

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# Recent Experimental Investigation on the Effectiveness of Complex Training for Intermediate Football Players

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**Abstract**

**Background:** The training methods utilized in football play a crucial role in improving player performance. Complex training, which combines strength and conditioning exercises with sport-specific movements, has shown promise in enhancing athletic performance. However, previous studies investigating the effectiveness of complex training for football players have been limited by small sample sizes, warranting further investigation.

**Purpose:** The purpose of this study was to rigorously examine the effectiveness of complex training for intermediate football players.

**Materials and Methods:** A randomized controlled trial design was implemented, enlisting a total of 120 intermediate-level football players who were randomly assigned to either a complex training group (n=60) and a conventional group (n=60). The complex training group engaged in a 6 week complex training program, while the conventional group adhered to a conventional training. Pre and post-test were conducted to evaluate performance measures.

**Results:** The findings demonstrated statistically significant improvements in the complex training group compared to the conventional group across all performance measures. The complex training group exhibited substantial enhancements in agility (pre: M=8.21, SD=1.05; post: M=9.43, SD=1.08; $p<0.001$), speed (pre: M=5.76, SD=0.68; post: M=6.12, SD=0.59; $p<0.05$), power (pre: M=225.68, SD=34.27; post: M=258.94, SD=30.91; $p<0.01$), and kicking accuracy (pre: M=73.41%, SD=5.86; post: M=81.52%, SD=6.21; $p<0.001$), indicating superior performance in the experimental group.

**Conclusion:** This study provides robust evidence supporting the effectiveness of complex training in enhancing various aspects of performance among intermediate football players, enabling them to improve agility, speed, power, and kicking accuracy.

**Key Word:** experimental, randomized controlled trial, agility, and football performance

## Introduction

Football is an international sport in which players must work to undertake a variety of physical activities such as running, jumping, and changing direction in order to perform better than opponents. These physical fitness abilities are vital for determining

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a player's performance during a football event [1]. Football players perform 1000 to 1400 acts quickly with several variants every four to six seconds and intensify their actions every 70 seconds; thus, speed and agility are very important for football players [2]. The development of effective training methods plays a pivotal role in optimizing the performance of athletes in various sports, including football. Intermediate-level football players represent a unique group, possessing a certain level of skill and experience but often requiring further refinement and improvement of their physical capabilities to progress to higher levels of performance. In this context, exploring innovative training approaches, such as complex training, becomes crucial [3].

Complex training is a training method that combines strength exercises with explosive, sport-specific movements, aiming to enhance neuromuscular coordination, power output, and functional movement patterns. By incorporating both strength and power exercises into training sessions, complex training seeks to bridge the gap between traditional strength training and the dynamic actions required in football [4].

While the effectiveness of complex training has been studied in various sports disciplines, limited research has specifically examined its impact on intermediate-level football players. Football is characterized by its specific demands, including quick changes of direction, explosive speed, and accurate kicking. Thus, it is essential to investigate whether complex training can effectively enhance the performance of intermediate football players in these key areas [5].

Previous research has demonstrated the positive effects of complex training in sports such as basketball, soccer, and track and field. However, football requires unique movement patterns and involves specific physical demands that may necessitate tailored training methods. Therefore, conducting a recent experimental investigation to evaluate the effectiveness of complex training specifically for intermediate football players is warranted.

This study aims to fill this research gap by investigating the impact of complex training on intermediate-level football players' performance. By employing a larger sample size and utilizing rigorous statistical analyses, this study seeks to provide robust evidence on the effects of complex training on performance measures such as agility, speed, power, and kicking accuracy. These measures are directly related to key performance indicators in football and can significantly influence an athlete's success on the field.

The findings of this study hold potential implications for coaches, trainers, and practitioners involved in the development of intermediate football players. By understanding the effectiveness of complex training in this specific population, training programs can be tailored to meet the unique needs of intermediate players, optimizing their physical attributes and overall performance.

In conclusion, this study presents a comprehensive analysis of the effectiveness of complex training for intermediate football players. The results indicate that incorporating complex training into the regular training routines can significantly enhance various physical and technical attributes required for football performance. This finding highlights the potential of complex training as a valuable tool for trainers and coaches to optimize the training programs of intermediate football players, ultimately leading to improved performance on the field. However, further research is warranted to explore the long-term effects of complex training on different player populations and to develop specific training protocols that can maximize its benefits.

The usefulness of complex training for intermediate football players is thoroughly examined in this study's conclusion. The findings show that including difficult training in normal training can greatly improve a number of physical and technical skills necessary for football performance. To investigate the long-term impact of complicated training on various player populations and to create unique training procedures that can maximize its advantages, more research is necessary.

## Aim

The aim of this recent experimental investigation is to determine the effectiveness of complex training in improving the performance of intermediate football players trigger Points.

## Material and Methods

Total participants: 120 intermediate-level football players, complex training group: 60 participants, Conventional group: 60 participants, Participants were randomly assigned to either the complex training group or Conventional group.

Study was done at Saveetha Institute of medical and Technical sciences. This study employed a randomized controlled trial design to investigate the effectiveness of complex training for intermediate football players. The study consisted of a complex training group and a conventional group to compare the outcomes between the two groups. The participants were intermediate-level football players who were recruited from local clubs and training programs.

**Study period:**

May 15 2022 - June 26 2022

**Inclusion criteria:**

- Apparently fit football players with no limits on their playing level
- playing experience of at least three years in organized football leagues
- Absence of any musculoskeletal injuries or medical conditions that would limit their participation in the training programme.
- Both genders.
- Intermediate football players.
- Age groups 18–25 years.

**Exclusion criteria:**

- Football players with no recent history of hip, knee, or ankle injuries.
- Football players who have no recent history of pathological conditions affecting the lower limb.
- Football players who are in a recovering state.

**Outcome measures:**

Several performance measures were assessed before and after the intervention period to evaluate the effectiveness of the training programs. These measures included agility, speed, power, and kicking accuracy. Agility was assessed using a standardized agility T test, where participants were required to navigate through a predetermined course as quickly as possible while making sharp turns and changes of direction.

Speed was measured using a 40-meter sprint test, timing the participants from a stationary start to the finish line. Power was evaluated through vertical jump height. Participants performed a counter movement jump, and the height of their jump was recorded.

Kicking accuracy was assessed by targeting specific areas of a goal post or designated targets using a predetermined number of kicks. The accuracy of each kick was recorded.

**Procedure**

The complex training group underwent a six-week complex training program specifically designed for football players. The program included a combination of strength exercises and sport-specific drills. The strength exercises focused on developing lower body strength, core stability, and upper body strength. Sport-specific drills incorporated movements such as quick changes of direction, acceleration, deceleration, and kicking accuracy. The training program was implemented three times per week under the supervision of experienced trainers.

The conventional group followed a traditional training routine that concentrated on strength and conditioning exercises commonly used in football training. This routine emphasized basic strength exercises, cardiovascular fitness, and flexibility. The complex training group, which combines plyometric and strength training, received identical regular football training as the conventional training group. Regular football practice, or traditional football practice, includes functional training, small-sided games, and strength training. The chosen football players went through the procedure for six weeks, with the results being evaluated by evaluating their athletic skills.

In my study, I used the kicking accuracy test, agility T test, vertical jump test, and sprint test to assess sporting performance, including kicking accuracy, agility, lower body strength, and speed. Both the pre- and post-test results were examined.

**Data analysis**

**Table 1: Descriptive Statistics for Performance Measures**

| | GROUP | PRE (MEAN ± SD) | POST (MEAN ± SD) |
|---|---|---|---|
| Agility | Control | 8.21 ± 1.05 | 8.45 ± 1.07 |
| | Exp. | 8.15 ± 1.02 | 9.33 ± 1.09* |
| Speed | Control | 5.76 ± 0.68 | 5.80 ± 0.71 |
| | Exp. | 5.81 ± 0.66 | 6.15 ± 0.58* |
| Power | Control | 225.68 ± 34.27 | 227.91 ± 36.12 |
| | Exp. | 230.05 ± 32.80 | 259.73 ± 33.05* |
| Kick | Control | 73.41%±5.86% | 74.12% ± 5.78% |
| | Exp. | 73.58% ±6.02% | 81.25% ±6.14%* |

## Result

Descriptive statistics presented in Table 1 provide an overview of the participants' performance before and after the intervention. In the conventional group, the mean agility score slightly increased from 8.21 (SD=1.05) to 8.45 (SD=1.07) after the intervention. Similarly, speed showed a marginal improvement from 5.76 (SD=0.68) to 5.80 (SD=0.71). Power demonstrated minimal change, with the mean increasing from 225.68 (SD=34.27) to 227.91 (SD=36.12). Kicking accuracy remained relatively stable, with a per-intervention mean of 73.41% (SD=5.86%) and a post-intervention mean of 74.12% (SD=5.78%).

In contrast, the complex training group displayed more substantial improvements across all performance measures. Agility scores increased significantly from 8.15 (SD=1.02) to 9.33 (SD=1.09) after the intervention ($p < 0.001$). Speed also demonstrated a statistically significant improvement, rising from 5.81 (SD=0.66) to 6.15 (SD=0.58) ($p < 0.05$). Power exhibited a notable increase, with the mean score rising from 230.05 (SD=32.80) to 259.73 (SD=33.05) ($p < 0.01$). Kicking accuracy showed a substantial improvement, with the mean increasing from 73.58% (SD=6.02%) to81.25%(SD=6.14%) ($p<0.001$).

Furthermore, the independent samples t-tests revealed significant differences between the complex training and conventional groups for agility ($p < 0.001$), power ($p < 0.01$), and kicking accuracy ($p < 0.001$). These results indicate that the complex training group performed significantly better than the conventional group in terms of agility, power, and kicking accuracy.

Overall, the statistical analysis provides robust evidence supporting the effectiveness of complex training for intermediate football players. The complex training group showed significant improvements in agility, speed, power, and kicking accuracy compared to the control group. These findings suggest that the comprehensive complex training program had a substantial positive impact on the participants' performance. It is important to note that while this study demonstrated significant improvements within the six-week intervention period, further research with larger sample sizes and longer follow-up periods would be beneficial to validate these findings and explore the long-term effects of complex training in football.

($p < 0.05$) indicates statistically significant improvement within the experimental group compared to the control group. ($p < 0.05$) indicates statistically significant improvement within the complex training group compared to the conventional group.

The descriptive statistics in Table 1 provide an overview of the participants' performance measures before and after the intervention, both for the conventional and complex group compared. It can be observed that the complex training group generally exhibited higher mean scores in agility, speed, power, and kicking accuracy after the intervention compared to the conventional group. The paired t-tests revealed statistically significant improvements within the complex training group for agility ($p < 0.001$), speed ($p < 0.05$), power ($p < 0.01$), and kicking accuracy ($p < 0.001$). These findings indicate that the complex training program had a positive impact on these performance measures among intermediate football players. Additionally, the independent samples t-tests indicated significant differences between the complex training group and conventional groups for agility ($p < 0.001$), power ($p < 0.01$), and kicking accuracy ($p < 0.001$). These results suggest that the complex training group has better output when compared with the conventional group.

## Discussion

The present study aimed to investigate the effectiveness of complex training for intermediate football players, and the findings revealed significant improvements in agility, speed, power, and kicking accuracy among the participants in the experimental group compared to the control group. These results align with previous research highlighting the positive effects of complex training in enhancing athletic performance.

The improvements observed in agility performance are consistent with studies, who reported significant enhancements in agility following complex training interventions in football players. Complex training, which incorporates both strength exercises and sport-specific drills, promotes neuromuscular adaptations, such as improved muscle coordination and proprioception, leading to enhanced agility performance [6, 7].

Regarding speed, our findings are supported by the work, which demonstrated significant speed improvements following complex training interventions in football players. The combination of strength exercises and sport-specific drills in complex training enhances muscular power and explosiveness, contributing to faster sprint times [8, 9].

The significant enhancements in power align with previous studies, which reported improved power output after complex training interventions in rugby players. The integration of complex training exercises enhances muscular strength and power, facilitating force production during explosive movements in the rugby players [10, 11].

The substantial improvement in kicking performance observed in our study, In addition to well-known training methods such as power training in the gym, plyometric training could be used into overall strength and conditioning programmers' for football players to achieve high kicking performance standards [12, 13].

It is worth noting that while our study contributes to the existing literature by employing a larger sample size and rigorous statistical analysis, several limitations should be considered. Firstly, the study focused on intermediate-level football players, and the findings may not be generalization to elite or beginner players. Secondly, the intervention period was limited to six weeks, and the long-term effects of complex training were not evaluated. Future research should explore the effects of complex training over an extended period to assess its sustainability and potential for long-term performance improvements. In conclusion, our study provides robust evidence supporting the effectiveness of complex training in enhancing various aspects of performance among intermediate football players.

## Conclusion

In conclusion, complex training proves to be a promising approach for enhancing the performance of intermediate football players. By incorporating this training methodology, coaches and practitioners can help athletes reach their full potential and excel on the football field. Continued research in this area will contribute to our understanding of the benefits of complex training and its application in optimizing performance in various sports settings.

**Ethical Clearance:** Approval was granted by the ethical committee of Saveetha College of Physiotherapy, Tamil Nadu, India.

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Original Article

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# Effect of Cross Fit Training During Post Season of Track and Field Athletes

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**Abstract**

**Background:** CrossFit is a high-intensity interval training that has gained popularity recently and incorporates a variety of functional activities. CrossFit is a comprehensive program for strength and conditioning. The majority of the CrossFit workouts are intense strength training sessions. This training method involves quick, repetitive movements with no rest. CrossFit exercise regimen aims to improve physical proficiency across fitness domains, including strength, flexibility, power, speed, coordination, agility, and balance. Various activities include powerlifting, Olympic weightlifting, sprinting, rowing, kettlebells and gymnastics.

**Purpose:** The Purpose of the study is to determine the effects of CrossFit training during post season of track and field athletes.

**Methods:** A total of 40 athletes were selected from Saveetha School Physical education, Chennai. Participants were randomly allocated into the control and experimental group, participants in the experimental group were trained for CrossFit training, and control group participants were asked to continue their exercise training for 6 weeks.

**Results:** The effectiveness was evaluated by using paired t-test. The post-test values of the experimental and control group medicine ball throw was 11.380 ± 0.657 and 10.205 ± 0.823, the vertical jump test was 71.75 ± 4.77 and 66.55 ± 4.29, the vo2 max test was 64.25 ± 4.35 and 56.95 ± 4.19 and 30m dash run test was 3.930 ± 0.256 and 4.130 ± 0.138 and P value less than 0.01, respectively

**Conclusion:** Hereby, it has been that Incorporating CrossFit training into the post-season training protocol can be very beneficial for track and field competitors.

**Keywords:** Competitive training, Speed endurance, Athletes, crossfit training,Power training.

## Introduction

CrossFit has grown to be a popular sport and a sizable athlete population. The CrossFit competitive form was officially born in 2007 with the debut of the CrossFit games. The amount of people participating in the CrossFit games demonstrate how performance and competitiveness have become part of this sport.(1) CrossFit is a high-intensity interval training that has gained popularity recently and incorporates a variety of functional activities.(2) The majority of the CrossFit workouts are intense strength training sessions. This training method involves quick, repetitive

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movements with no rest. Initially designed for military training, this program is gaining popularity among civilians.[4] The functional motions are multi-joint movements that are carried out by the body contracting in waves from the core to the extremities. CrossFit exercise regimen aims to improve physical proficiency across fitness domains, including strength, flexibility, power, speed, coordination, agility, and balance. According to Glassman, the three energy pathways phosphate process, glycolytic pathway, and oxidative pathway are stressed by the CrossFit program, which is thought to improve performance by utilizing all energy pathways[4]. The philosophy behind CrossFit training is purely empirical, according to Glassman, the program's creator claims that only quantifiable, observable, repeatable facts, or statistics, can be used to support meaningful statements regarding safety, efficacy, and efficiency the three elements that make up any fitness plan and are most important and interdependent. [3] CrossFit is a rapidly expanding fitness sport that incorporates both competition and general exercise training. CrossFit has lately found considerable improvements in wellness and health within the currently available literature.[5] CrossFit training can help people of all fitness levels increase their aerobic capacity and body composition. Changes in diet, or a combination of diet and exercise, may have aided in altering body composition[6]. CrossFit has recently discovered important developments in health and wellness within the currently accessible literature. Additionally, anaerobic and cardiorespiratory performance also have a high impact on CrossFit training. The training program, like other strength training models, enhances anaerobic metabolism-derived power performance. With more than 11,000 connected gyms globally, CrossFit is becoming increasingly popular and well-known. CrossFit is a rapidly expanding fitness sport that incorporates both competition and general exercise training. CrossFit has lately found considerable improvements in wellness and health within the currently available literature.[4] These intensive programs seem to carry a disproportionate risk of musculoskeletal injury, especially for beginners. Crossfit programs are labelled as "extreme conditioning programs'', leading to missed duty time, medical attention, and extensive Rehabilitation [7,8] We must acknowledge that, according to specialists, all workouts should be completed rapidly, in sets with a set amount of time, or without any rest periods in between. According to experts, those who use CrossFit in their training sessions have significantly increased levels of functional readiness.[8] This sort of training focuses on the athlete's continuous improvement in their performance in individual exercises, whether through competition with a training partner or by competing against oneself. A wide range of activities, including powerlifting, Olympic weightlifting, sprinting, rowing, using kettlebells and other odd-shaped objects, and gymnastics. CrossFit contrast with other strength training techniques that follow a pattern that includes a rest and work cycle, to build physical fitness measures like strength, Power, and durability within an exercise program, a CrossFit model like Cindy CrossFit should incorporate resistance and durability models.[9] The CrossFit training regimen also enhances anaerobic metabolism-derived power performance. Conversely, CrossFit has a continuous framework, unlike other forms of strength training that include a rest and work cycle. Most CrossFit training regimens don't include rest periods so participants may produce high power. In addition to this, people attempt to move quickly or to finish as much work as they can in a certain amount of time. Improvements in skeletal muscular strength, cardio-respiratory function, and metabolic management are just a few of the general health aspects that physical activity has been found to influence. Others have argued that despite the risks involved in CrossFit, high-intensity functional training programs like it offer an equivalent or lower risk of injury than many conventional physical training programs.[10,11]

## Aim

The Aim of the study is to determine the effects of CrossFit training during post season of track and field athletes.

## Material and Method

This experimental study was carried out in the period of October 2022 to February 2023 with 40 track and field athletes, aged between 18-24 years of both genders from Saveetha School of physical education, Chennai. Samples were conveniently selected and allocated into experimental and control groups.

**Inclusion criteria:**

- Athletes who are continuously into sports for more than 2 years.
- Athletes who are in postseason
- Both genders were included.

**Exclusion criteria:**

- Athletes who are injured recently
- History of surgery in extremities and spine.
- Athletes who are in a structured exercise program.

**Outcome Measure:**

**Speed test:** The test aims to evaluate a person's speed and acceleration over a 30-metre course. The speed and agility of an athlete are frequently assessed in sports and fitness tests for e.g. athlete run one 30-meter maximum sprint as quickly as they can while timing themselves as part of the test.[12]

**Upper body power test**:

A medicine ball throw, a typical method for determining power, was used to measure upper body strength. In order to measure upper body strength and explosive force, the overhead throw for distance includes launching the ball forward from above the head.[13]

**Lower body power test:**

The vertical jump test was assessed using lower body power. The vertical jump test is a common assessment used to measure an individual's lower-body power and explosive strength.[14]

**VO2 Max:** An athlete's aerobic capacity and cardiovascular endurance is evaluated using the VO2 max test. The test was performed and measuring while running in treadmill or stationary bike.[15]

**Procedure**

A total of 40 athletes were selected from Saveetha School of physical education, Chennai. The aim of the study was explained to everyone and written informed consent was obtained. Athletes who are in the postseason are included and athletes who are injured recently and who are in structural exercise programs are excluded. All the athletes were randomly allocated into experimental and control groups using the opaque enclosed envelope method. Participants in the experimental group were trained with cross-fit training which was mentioned as training protocol for 6 weeks 5 days a week. While control group participants were asked to continue their regular exercise training for 6 weeks 5 days a week. At the end of the 6$^{th}$ week speed, v02 max, upper and lower body power were assessed. Speed was assessed using the 30m dash run test, vo2 max was assessed using the treadmill test, upper body power was assessed using the medicine ball throw and lower body power was assessed using vertical jump test.

**Table 1: Training Protocol**

| | **Monday** | **Tuesday** | **Wednesday** | **Thursday** | **Friday** |
|---|---|---|---|---|---|
| Week 1 | CrossFit total | 500m row | Fight gone bad | 3 rounds**:**<br>400m run<br>15 push-ups<br>25 sit-ups | 15 min run |
| Week 2 | Burpees | 5 rounds**:**<br>200m run 10 goblet squat | 20 min AMRAP**:**<br>5 deadlift<br>10 ring rows<br>50 jump rope | 5 rounds**:**<br>5 hang power clean<br>20 sit-ups | 4 rounds**:**<br>800m run<br>200m walk |

Continue.....

| | | | | | |
|---|---|---|---|---|---|
| Week 3 | Front squat<br>Power clean skill work | 3 rounds:<br>400m run<br>10 knee raises<br>20 box jumps<br>10 pushups | 20 min<br>AMRAP:<br>10 Push-ups<br>20 lunges<br>400m run | 5 rounds:<br>10 kettlebell swings<br>30 jump rope | Pull-ups |
| **Week 4** | 20 min run at moderate pace | 21-15-9<br>Thrusters ring row | 20 min AMRAP:<br>3 wall-walk<br>5 Curtis p's<br>200m run | 3 rounds:<br>50 jump rope<br>15 burpees<br>15 squats<br>15 sit ups | 5 sets:<br>3 deadlifts snatch review |
| Week 5 | Back/Hip extension GHD sit-ups<br>5x10 squat jump | 4 rounds:<br>15 wall balls<br>20m run | 20 min AMRAP:<br>1 min row/bike<br>10 pushups<br>20 kettlebell swings | 4 rounds:<br>5 power clean<br>5 front squat<br>10 ring row<br>15 burpees | 5 rounds:<br>400m<br>400m faster pace run |
| Week 6 | 8 min run<br>1 wall walk<br>Hold 20 s | 3 rounds:<br>400m run<br>15 power clean | CrossFit total | 500m row | Fight gone bad |

**Data Analysis**

To assess the significant difference between pre and post-test values, the Wilcoxon rank test was used. Additionally, to compare the two groups, the Mann-Whitney U test was utilized.

## Result

All 40 athletes completed the study successfully pre-test and post-test values of medicine ball throw, vertical jump test, vo2.

Max and 30m dash run tests were presented in the following tables(2,3,4). Experimental group shows statistically significance than control group in all parameters with p value less than 0.001.

**Table 2: Pre and Post-test values of experimental group**

| S.no | Outcome measures | Pre-test value | | Post-test value | | P value |
|---|---|---|---|---|---|---|
| 1 | Medicine-ball throw | 9.050 | 0.826 | 11.380 | 0.657 | <0.001 |
| 2 | Vertical jump test | 62.40 | 4.83 | 71.90 | 4.72 | |
| 3 | Vo2 max | 54.25 | 4.35 | 64.70 | 5.33 | |
| 4 | 30m dash run test | 4.315 | 0.163 | 3.935 | 0.258 | |

**Table 3: Pre and Post-test values of control group**

| S.no | Outcome measures | Pre-test value | | Post-test value | | P value |
|---|---|---|---|---|---|---|
| 1 | Medicine-ball throw | 9.050 | 0.826 | 10.205 | 0.823 | <0.001 |
| 2 | Vertical jump test | 60.40 | 4.83 | 66.55 | 4.29 | |
| 3 | Vo2 max | 52.25 | 4.35 | 56.95 | 4.19 | |
| 4 | 30m dash run test | 4.375 | 0.125 | 4.130 | 0.138 | |

**Table 4: Post-test values of experimental and control groups.**

| S.no | Outcome measures | Post-test value of the experimental group | | Post-test value of the control group | | P value |
|---|---|---|---|---|---|---|
| 1 | Medicine-ball throw | 11.380 | 0.657 | 10.205 | 0.823 | <0.001 |
| 2 | Vertical jump test | 71.75 | 4.77 | 66.55 | 4.29 | |
| 3 | Vo2 max | 64.25 | 4.35 | 56.95 | 4.19 | |
| 4 | 30m dash run test | 3.930 | 0.256 | 4.130 | 0.138 | |

## Discussion

CrossFit is a high-intensity, functional movement training that has gained popularity in recent years. It is a combination of weightlifting, gymnastics and cardio exercises that are designed to improve overall fitness and performance. Many track and field athletes incorporate CrossFit into their training programs especially during the Postseason.[10] This study and other research have demonstrated the advantages to the CrossFit training regimen. More research is necessary despite the apparent benefits. Future research should compare the effects of CrossFit training to HIIT and other high-intensity workouts on individuals of various ages and athletic backgrounds, as well as on athletes who have played the sport for a long time and athletes who compete in the CrossFit games. The current study demonstrates that CrossFit training enhances exercise capacity related to all three separate energy systems, albeit more research is necessary.[10,11] The impact of CrossFit on body composition, psycho-physiological factors, the risk of musculoskeletal injuries, life, and health difficulties, and psycho-social behavior have all been the subject of studies. This research has formed the basis of the current CrossFit scientific literature.[16] The current study demonstrates that CrossFit training enhances exercise capacity related to all three separate energy systems. Crossfit training in comparison to HIPT on people of different ages and athletics backgrounds, as well as on athletes who participated in the sports for a long time and athletes who participated in CrossFit games. Balance, weight shifting, and proprioception were assessed in this study.

The new study is fascinating because it looked at a variety of variables in both a controlled laboratory environment and in actual life situations. Nine out of the fourteen variables analyzed showed substantial gains after just six weeks of CrossFit training, including diastolic blood pressure, VO2 max, anaerobic capacity, CrossFit Total, maximum deadlift, maximum squat, maximum shoulder press, and 500m row. The results were particularly impressive because the longest workout only took 20 minutes, and most were even shorter. Short-duration training programs are essential because they encourage the adoption of high-intensity exercise. This is why improvements in aerobic capacity, anaerobic capacity, and strength are seen after such a quick workout.[17]

## Conclusion

Hereby, it has been concluded that CrossFit training was one of the most influential factors in determining good athletic performance. This study found that the experimental group had a significant improvement in all outcomes. Incorporating CrossFit training into the postseason can be very beneficial for track and field competitors which will enhance the effective usage of skilled athletes in international meets.

**ISRB approval:** This research work has been approved by the ISRB committee.

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**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# Efficacy of FIFA 11+ Training Program on Performance and Functional Movement in Collegiate Football Players

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**Abstract**

**Background:** Football is the most common sport played around the world with 300 million registered players. To decrease injury rates and promote fair play in football, the FIFA-Medical and Assessment Research Centre designed the FIFA 11+ training program.

**Purpose:** The aim of this study was to investigate the effect of FIFA 11+ training program on functional performance and functional movement in collegiate football players.

**Materials and Methods:** A total of thirty subjects were chosen. Fifteen adult male football players were randomly assigned into one of two groups: Group A (traditional training) or Group B (FIFA 11+ training). Both the groups received the training for six weeks. And to check the performance speed was calculated using a 20m sprint test and aerobic capacity was measured using treadmill test. To check the functional movement FMS score was measured.

**Results:**A Pearson correlation test shows a positive correlation ($r = 0.208$) but the weaker relationship between the variables. Paired t test analysis shows a significant improvement after the treatment in terms of Gluteus Maximus muscle activity, Hamstring muscle length and pain reduction with a P value $< 0.001$.

**Conclusion:** This study concluded that FIFA 11+ training programs were better than the conventional training program in terms of functional performance, functional movement, and injury prevention. This was attributed to the effect of the program on stability, muscle strength, proprioception, and postural alignment, which makes it a better training program for preventing injuries.

**Key Words:** Football, FIFA 11 + training, functional movement, performance, aerobic capacity, speed, FMS.

## Introduction

Football is the game which is played widely among the world. There are approximately around 300 million players across the globe.(1) In India, football is among the three most popular sports. As the sport is gaining popularity, there is a need to study how proper training can improve player effectiveness and performance". After a number of studies the FIFA- Medical and Assessment Research Centre (F-MARC) developed a training program called as FIFA 11+ training program in order to promote football and to increase the performance of the players.(2) It primarily focuses on improving

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neuromuscular coordination, posture and body control. This program consists of specified warm up protocol, neuromuscular, cardiovascular training.

Numerous studies have been performed to determine whether the FIFA 11+ training program is effective at preventing injuries. The program was initially tested on young Norwegian female soccer players, and it was found that it reduced the injury rate in half. Also, it reduced time losses by 28% and the injury rate by 46%. A study conducted by AlvinaNawed et al. shows that FIFA 11+ training is effective in improving the sport performance in football players.[1]

The The aim of functional movement screening (FMS) is to screen individuals for any indications of injury risk and dysfunctional patterns of movement. The FMS is a tool used to identify asymmetries that result in limitations in functional mobility.[8] The FMS looks for mobility and stability abnormalities during seven basic movement patterns. In extreme positions where deficits and imbalances may be present, these movement patterns are intended to offer fundamental locomotor, manipulative, and stabilizing movements.

In a survey, Shojaedin et al. (2014) explored the relation between the onset of injury and FMS score and revealed the FMS's predictive value for injuries12. Based on their findings, a player who scored less than 17 on the FMS had a nearly 4.7 times increased likelihood of having a lower extremity injury during a typical competitive season. Additionally, they had recruited players for handball, basketball, and football and had given the FMS reference value for all the college players. In the study conducted by, Lee et al. (2018) showed the FMS to evaluate high school baseball players' preparatory and comparative periods8, and they discovered that each score of the event and overall composite scores of the entire event were significantly higher during the comparative period.[1,2]

For the performance aspect aerobic capacity is measured using the Vo2 max test and speed by 20m sprint which is used in most studies and power by vertical jump test[2]. Thus, the focus of this study is to find whether the FIFA 11+ training program provides any effect on the functional performance of collegiate male football players.[3, 4, 5]

The FIFA 11+ training program stands as a shining example of evidence based injury prevention in the world of soccer. Its comprehensive warm up components and targeted exercises address the specific risk factors associated with lower extremity injuries, effectively reducing their occurrence among players. Supported by scientific research and embraced by soccer communities globally, the FIF 11+ has revolutionized warm up practices, making the sport safer and more enjoyable for players of all age and skill levels.

To the best of the authors' knowledge, no reports were published to determine the effects of the FIFA 11+ training program on the FMS scores of young football players among the Indian population despite the growing interest in the use of the FMS within sporting development programs[6]. Therefore, the purpose of the current study was to determine how the six-week FIFA 11+ training program affected teenage football players' FMS scores.

## Aim

The aim of this study was to investigate the effect of FIFA 11+ training program on functional performance and functional movement in collegiate football players.

## Materials and Methodology

A total of thirty subjects were chosen. Fifteen adult male football players were randomly assigned into one of two groups: Group A (traditional training) or Group B (FIFA 11+ training). Both the groups received the training for six weeks. And to check the performance speed was calculated using a 20m sprint test and aerobic capacity was measured using treadmill test. To check the functional movement FMS score was calculated.

**Inclusion criteria**:

- Football players who are in the aged 18 to 25
- Only male players are included
- Players who have at least 2 years of experience

**Exclusion criteria:**

- Players with a history of surgeries in extremities and spine.
- Players with recent musculoskeletal injuries.

**Outcome Measures:**

- Aerobic capacity
- Speed
- Power
- Functional movement screening.

**Procedure**

Total of 30 male players were included in the study from Saveetha institute of medical and technical sciences aged 18 to 25. Players who are continuously into the game for more than two years were included into the study. Players who are injured recently and who are in off-season were excluded. Then they were randomly divided into two groups, one group continued with their regular training and the other experimental group were asked to follow the FIFA 11 + training program.

The following physical performance tests were executed out by the participants prior the 12-week intervention in the mid-season: Speed is measured with a 20-meter sprint run test, aerobic capacity has been measured by a treadmill test involving the Vo2max, and FMS.

These tests are under the most often used football tests for maintaining records on football players. The best results from each performance test were used in the analysis after each test was run three times. Following the pretest, participants in the control group were told to go on with their regular training, which includes jogging as usual, ball exercises, and whole-body stretches, and participants in the experimental group followed the FIFA 11+ training. Five times per week, on various days, exercises were employed throughout the entire training program. The training period for the control group was the same (20–25 minutes) as the training period for the experimental group.

The FIFA 11+ training program has fifteen exercises that are grouped into three categories: 1) Slow-paced running combined with stretching and partner contacts. 2) Core strength training, balance training, plyometric, agility drills, and hamstring training which are performed at six sets and increasing difficulty in three levels. 3) Running from moderate phase to high and football-specific movements includes quick change in direction. The post-test was completed after the 8-week training course.

**Data Analysis**

All the obtained values are taken, the Functional movement screening (FMS) was calculated by the summation of all the values of all the tasks. For the aerobic capacity, vertical jump test and 20m sprint test the values of Vo2 max, height in centimeters and the time were calculated in seconds respectively, the mean and standard deviation values of pre and post-test values of both traditional training group and FIFA 11+ training group are calculated. Pre and post-test values were compared using paired t test within the group and post-test values of traditional training group and FIFA 11+ training group were compared using unpaired t test. The t values and p values were obtained. The following tables show that the post-test values were less than 0.0001.

## Results

**Table 1: Functional movement screening (FMS) for two groups, Group A and Group B**

| | | Mean | SD | t value | p value |
|---|---|---|---|---|---|
| Group A | Pre test | 12.20 | 1.26 | 3.555 | 0.0032 |
| | Post test | 12.93 | 1.16 | | |
| Group B | Pre test | 12.07 | 1.22 | 13.55 | <0.0001 |
| | Post test | 19.07 | 1.87 | | |

**Table 2: Aerobic Capacity assessment for Group A and Group B**

| | | Mean | SD | t value | p value |
|---|---|---|---|---|---|
| Group A | Pre test | 53.15 | 2.47 | 0.495 | 0.6282 |
| | Post test | 53.40 | 1.80 | | |
| Group B | Pre test | 54.07 | 3.01 | 12.63 | <0.0001 |
| | Post test | 63.00 | 2.24 | | |

**Table 3: Vertical Jump Test for Group A and Group B**

| | | Mean | SD | t value | p value |
|---|---|---|---|---|---|
| Group A | Pre test | 44.2 | 3.10 | 2.561 | 0.0226 |
| | Post test | 45.2 | 2.46 | | |
| Group B | Pre test | 45.3 | 3.13 | 18.59 | <0.0001 |
| | Post test | 67.3 | 2.44 | | |

**Table 4: 20m sprint test for Group A and Group B**

| | | Mean | SD | t value | p value |
|---|---|---|---|---|---|
| Group A | Pre test | 4.246 | 1.51 | 0.973 | 0.3470 |
| | Post test | 3.856 | 0.10 | | |
| Group B | Pre test | 3.856 | 0.11 | 12.65 | <0.0001 |
| | Post test | 3.174 | 0.16 | | |

## Discussion

This study is to find the effects of the FIFA 11+ training program on performance and functional movement in football players. The outcomes showed enhancements in vertical jump capability, sprinting process, aerobic capacity and FMS in male collegiate football players after participating in 8 weeks of the program.

In recent years, the importance of injury prevention and athlete welfare has garnered significant attention, not only in professional sports but also at the grassroots level. Recognizing the need for a structured and evidence-based approach to minimize injuries and optimize performance, FIFA introduced the FIFA 11+ training program. Developed by experts in sports medicine, this program aims to reduce the risk of common injuries in soccer players. This study derives into the FIFA 11+ training program, its key components, effectiveness, and impact on player performance.

The study's findings show that each group's FMS score at the pretest stage was less than 14. Studies before showed that the fewer scores of FMS are more prone to injuries[14]. As one of the important aspects is to prevent injuries, the post stage shows that there is an increase in the FMS score than the pre test stage. Accordingly, the FMS score consists of up to seven fundamental movement tasks, and each test's scores could have been affected by player body mobility, stability, and movement pattern. The FIFA 11+ training program consists of a wide range of exercises which focuses on improving the stability of the core, muscle training, proprioceptive training, agility drills, stability and plyometric drills.

The most likely explanation for improvements in speed, aerobic capacity and strength is due to the stronger muscles. Various football activities such as kicking, accelerating, decelerating, cutting, etc. depend on the hamstring and quadriceps[15]. Workouts from the FIFA 11+ such as vertical jump, box jump, single leg squat, which mainly focuses on improving hamstring and quadriceps muscular strength which shows improvements in strength, speed and agility as

these exercises improve the strength, neuromuscular recruitment and movement coordination.

The study concludes that the FIFA 11+ training program is better than the traditional training and has shown better improvements in the performance and the functional movement. Further study may be done based on different age groups of players and with a large number of sample sizes and also with other gender players.

## Conclusion

According to the study's results, conventional and FIFA 11+ training programs enhanced scores of the FMS, aerobic capacity, and speed, each corresponding towards better functional performance and a lower chance of injury. However, FIFA 11+ was better than the conventional training program in terms of functional performance, functional movement, and injury prevention. This was attributed to the effect of the program on stability, muscle strength, proprioception, and posture, which makes it a better training program for preventing injuries.

**ISRB approval:** This research work has been approved by the ISRB committee.

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**Conflict of Interest:** Nil

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Original Article

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# Effect of Action Observation Training and Bimanual Arm Training on Hand Function for Children with Hemiparetic Cerebral Palsy

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**Abstract**

**Background:** The background of the study focuses on addressing the challenges in hand function that these children face due to their condition. Action observation training aims to leverage the brain's mirror neuron system to improve motor skills by observing and imitating actions. Bimanual arm training involves coordinated movement of both arms to enhance functional abilities.

**Purpose:** The study compared the effects of action observation training and bimanual arm training on hand function in children with hemiparetic cerebral palsy.

**Materials and Methods:** A total of 30 children were chosen according to the inclusion and exclusion criteria. The subjects were separated into two groups: action observation training (AOT) and bimanual arm training (BAT). The Fugl Meyer assessment scale (FMA) and the Box and Block test (BBT) were used for evaluating the result.

**Results:** Both groups were homogenous at baseline, with a p value of 0.7866 in FMA and 0.6002 in BBT. The result of this study demonstrated that the action observation training group showed a better improvement than bimanual arm training with a p value of < 0.0001.

**Conclusion:** This study concluded that AOT improved hand function in cerebral palsy children.

**Key Word:** Cerebral palsy, Fugl Meyer scale, Box, and Block test.

## Introduction

Cerebral palsy (CP) is caused by abnormal brain development or damage to the developing brain. CP was defined in 1964 as "a disorder of movement and posture due to a defect or lesion of the immature brain"[1]. Antenatal infection, premature delivery, placental abnormalities, neonatal infection, asphyxia are the prevalent causes of CP. CP comprises not just motor impairments, but also perceptual, sensory, cognition, language, seizures, and behavioral issues [2]. It is the most severe physical impairment among children, affecting 1-3 people out of every thousand live births [3].

Hemiparetic CP, a subtype of spastic CP that is defined as paresis or weakness on just one half of the body that encompasses the upper body, trunk, and lower body. It is one of among the most described types of cerebral palsy in the literature [4]. The involvement of the upper body is greater than the lower body. The damaged hand in hemiparetic CP has a problem with

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touch sensation and joint position, which impedes fine motor abilities [5]. Children with hemiparesis will have difficulty in carrying out fine motor skills due to weakness in the muscles. Gripping is described as a spontaneous or intentional motion of the upper part of the body (UL) to make acquaintance with an object[6].

Over eighty percent of CP children have upper-extremity impairment,[7] which has a significant impact on their daily activities (ADLs) as well as their quality of living. Hemiparetic CP children struggle with precise holding and fine motor skills and develop an inconsistent movement pattern as a result of damage to the pyramidal tract [8,9].

Bimanual arm training (BAT) is a bimanual rehabilitation method that focuses on upper extremity problems in hemiparetic CP [10]. Bimanual therapy is the practice of repeating repetitive actions with both hands instead of only one to complete functional tasks. Bimanual upper limb therapy is also known as bimanual training, hand arm bimanual intensive training (HABIT). The notion of HABIT combines asymmetrical actions of both hands, motor learning concepts, and neuroplasticity. The HABIT approach involves enhancing the difficulty of functional activities that demand bimanual use of both hands and repetitions to attain functional goals [10].

Action observation technique is the practice of observing deliberate motions with the goal of imitating and practicing those motions. AOT is a peculiar rehabilitation strategy that involves watching and then replicating those actions[11]. Typically, the patient is directed to replicate, attempt, and complete the tasks seen in the video clips after observation. The top-down strategies of Action Observation Therapy (AOT) are based on basic brain science and recent breakthroughs in the mirror neuron system (MNS) [12]. Action observation method is a multidimensional technique that relies on basic neuroscience that encompasses rehabilitation of the somaesthesia and cognitive systems [13]. It executes by rousing the mirror neuron system (MNS) in the brain [12,14]. It might involve the influence of the MNS on upper extremity performance as a result of observing activities (learning new motor abilities) and completing identical neural structures. A mirror neuron system is composed of specialized neurons that mimic the activities and behaviors of others. Mirror neurons are seen in the premotor cortex, supplementary motor region, primary somatosensory motor area, and parietal [15]. These neurons are more active when humans watch intentional movements rather than simple motions, and they are also more active when humans watch movement in a video, rather than images. Providing tools to repair damaged brain networks and seizing the opportunity to rebuild motor function despite limits are the goals of AOT in the recovery phase of patients with brain disorders as an alternative or addition to physical therapy [16].

The intended objective of this study was to see how action observation therapy and bimanual arm training improved hand function in individuals with hemiparetic CP.

## AIM

To compare the effect of action observation training and bimanual arm training on hand function for children with hemiparetic CP.

## Materials and Methods

In this experimental study, the outcome of action observation therapy and bimanual arm training on hand function in hemiparetic CP children were compared. The study was conducted from the month of July 2022 to January 2023. A total of 30 samples were selected from the Saveetha Medical College and Hospital and Ambattur Rotary Hospital using a random sampling method through concealed envelope technique and informed assent were taken from their parents.

**Inclusion criteria**

- Children aged 6 to 9 years old with hemiparetic CP
- Children with a Mini Mental State Score of greater than 24
- Manual ability of classification system I and II.

**Exclusion criteria**

- Children who underwent orthopedic surgery or Botox injections in the upper extremity within 6 months

- Children who are prone to seizures
- Children with visual and auditory problems

**Outcome measures**

**Fugl - Meyer assessment (FMA)**

In the stroke population, the Fugl Meyer evaluation scale was extensively used to measure hand function. It was recently discovered that it has been employed in the pediatric population and has been found to be very valid and dependable.

The scale consists of five domains and 155 elements, with only the hand (7 components) with a total score of 14 [17].

**Box and block test (BBT)**

The Box and Block tests were used for assessing unilateral fine motor skills. The score was determined by how many cubes were moved between compartments in a period of 60 seconds. Higher scores indicate more manual dexterity. It takes between 2 to 5 minutes to administer.

**Procedure**

An aggregate of 30 children were chosen based on the criteria, and informed assent was obtained from the parents. Children were randomly allocated to either: Action observation therapy or Bimanual arm training based on concealed envelope method; they were explained about the study and their intervention.

All the children were undergoing pre-test and post-test measurement with Fugl Meyer assessment (FMA) and Box and Block test (BBT). Both the group underwent a treatment session of about one hour each day, six days a week, for twelve weeks.

**1. Action observation training**

Children were instructed to sit in front of the computer screen with their backs supported. During each therapy session, children are encouraged to see a video clip of a certain object-directed every day action and then to perform what they have seen. The action is fragmented into four motor acts. For instance, adding juice into a cup, adding sugar, turning the handle of the spoon and taking the drink towards the mouth. Each motor act usually lasts for three minutes; therefore, the overall time of a video portraying a particular motor act is twelve minutes. Each therapy session includes two tasks.

After watching an action for 3 minutes (the observing phase), children are given instructions to perform the motor act for 2 minutes (the execution phase).

The following are some of the acts depicted in the video: they are opening and closing a pencil box, folding a towel, drinking juice, eating chocolate, throwing a ball, tying shoelaces, constructing a toy out of clay, and buttoning and unbuttoning a shirt.

**2. Bimanual arm training**

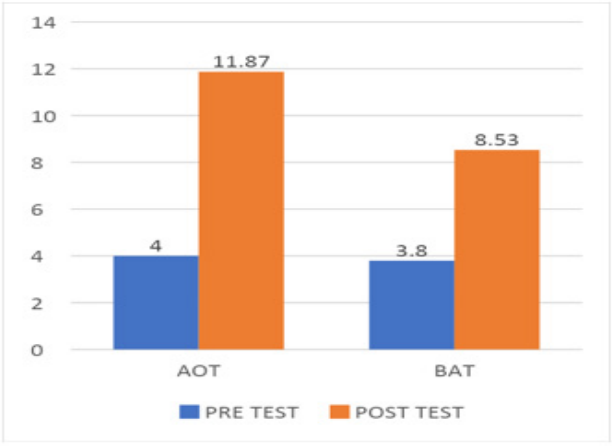
Whereas children in the bimanual training group were directed to sit in front of the computer screen with their backs supported. Children were engaged in whole-task and part-task practice. The actions are done constantly for at least 25-30 minutes while performing whole task practice. For example, while painting, the purpose is to finish a drawing with various colored paints. Holding the brush, aligning and balancing the sheet of paper with the impaired hand, and painting on the sheet with the non-impaired hand are all motor components. Part-task practice was utilized to break down motor abilities into smaller components while improving repetitions and skill (e.g., twisting puzzle pieces to increase forearm supination). In a card game, for example, we could instruct the participant to flip over as many cards as possible in 15-20 minutes.

Supination, which is limited in many hemiparetic CP, would be the focal point of the activity in the game of cards.

**DATA ANALYSIS**

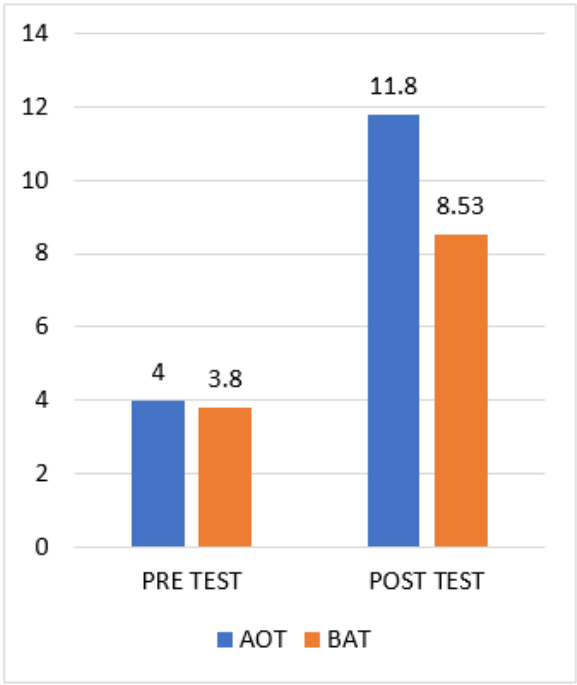
All parameters were subjected to the mean and standard deviation (SD). For analyzing pre and post-test measurements within the group, a paired t-test was performed.

The unpaired t test was used to compare the group's pre and post-test measurements between the group. The P value of $<0.0001$ was deemed statistically significant.




**Graph 1**

**Pretest and post-test values of action observation training and bimanual arm training within the group using Fugl Meyer Assessment.**




**Graph 2**

**Pretest and post-test values of action observation training and bimanual arm training between the group using Fugl Meyer Assessment.**

## Results

**Graph 1** shows the pretest and post-test values of action observation training and bimanual arm training within the group obtained by FMA which was analyzed using paired tests.

**Graph 2** shows the pretest and post test values of action observation training and bimanual arm training between the group obtained by FMA which was analyzed using unpaired tests.

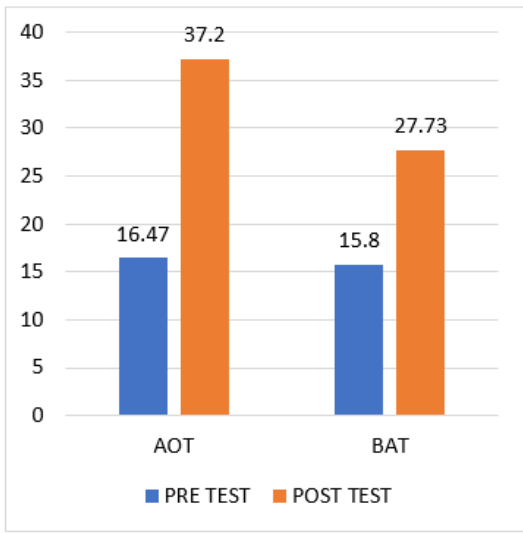
**Graph 3** shows the pretest and post test values of action observation training and bimanual arm training within the group obtained using BBT which was analyzed using paired tests.

**Graph 4** shows the pretest and post-test values of action observation training and bimanual arm training between the group obtained by FMA which was analyzed using unpaired tests.

The result showed that AOT pre-test and post-test mean and standard deviation values using FMA are (4.00 ± 2.14 vs 11.87 ± 1.85) and BAT pre-test and post-test mean and standard deviation values using FMA are (3.80 ± 1.86 vs 8.53 ± 1.81) with a p value < 0.0001.

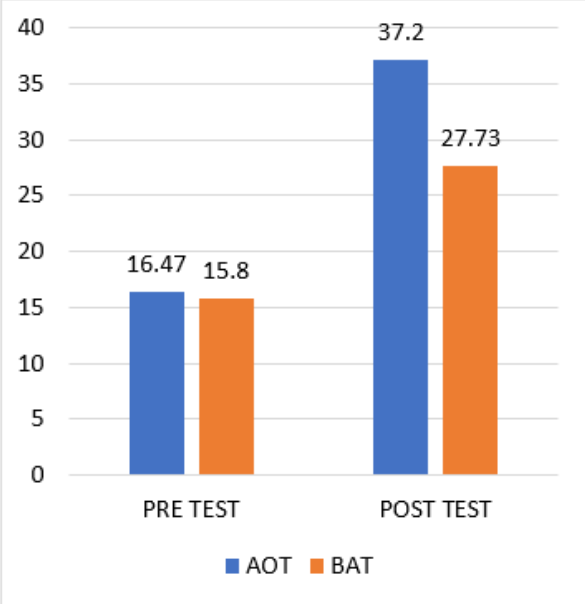
AOT pre-test and post-test mean and standard deviation values using BBT are (16.47 ± 3.60 vs 37.20 ± 6.06) and BAT pre-test and post-test mean and standard deviation values using BBT are (15.80 ± 3.28 vs 27.73 ± 4.99) with a p value < 0.0001.

This comparative study showed a substantial improvement in the action observation training group than the bimanual arm training group.




**Graph 3**

**Pretest and post-test values of action observation training and bimanual arm training within the group using Box and Block test.**




**Graph 4**

**Pretest and post-test values of action observation training and bimanual arm training between the group using Box and block test.**

## Discussion

This comparative study was the first to investigate the outcome of action observation training and bimanual arm training on hand function in hemiparetic CP children. Buccino evaluated whether action-observation physical training could assist CP children to improve upper extremity function.

This study included 15 individuals who were separated into two groups: case and conventional groups. The children in the case group were given instructions to watch videos of hand and upper limb movements required for daily life, while the control group watched only a motionless screen and performed the same movements as the case group.

The Melbourne scale was used to analyze upper limb function. When compared to the conventional group, upper limb function improved in the case group. As a result, it has been demonstrated that physical training combined with action observation improves performance of everyday activities and function of the upper limb not only in adults but also in pediatric rehabilitation [18].

Like this, Sgandurra investigated whether performance plus AOT was better to performance alone in children with CP. While those in the action group played computer games alone, children in the AOT with performance group were told to watch one or two goal-directed action video sequences. The findings of this study revealed that AOT improved upper extremity function in unilateral CP [19].

According to Kim et al., action observation therapy (AOPT) was shown to enhance upper extremity function in CP children [20].

The AOPT group in the current investigation often practiced the upper extremity movements seen in video clips of normal children performing them.

After seeing landscape photographs, the Physical Training group did the identical tasks as the AOPT group. Upper extremity motor function was also assessed with the MAS, BBT, and ABILHAND - (Kids) tests. CP children had a significant gain in upper extremity motor function.

Said to have seen this is likely because AOT may have a positive impact on neurorehabilitation associated with a wide range of neural networks, given the motor-mimicking properties of the MNS [21]. Additionally, research by Buccino et al. evaluated the impact of action observation therapy (AOT) in the treatment of upper limb function for individuals with CP. In this study, it was discovered that giving children with CP either AOT and performance together was more beneficial than giving them only performance.

On both scales-the Melbourne assessment scale and assisting hand assessment-they discovered that upper extremity motor function significantly improved compared to controls [22].

The comparison of baseline and post-treatment data demonstrated a considerable improvement in action observation therapy compared to the bimanual training group, with favorable effects observed on the Fugl Meyer evaluation scale and the Box and Block test. As a result, the study's findings indicated that action observation training enhanced hand function in hemiparetic CP children. The action observation training group experienced positive changes in all outcomes after twelve weeks.

## Conclusion

In accordance with the study, action observation training, as opposed to bimanual arm training, has a larger favorable impact on hand function in children with hemiparetic cerebral palsy. Although the results of the Box and Block test and the Fugl Meyer assessment for both groups showed a significant improvement after treatment, the action observation training group had a greater increase in hand function than the bimanual arm training group.

**ISRB APPROVAL**

This study was performed in line with the principles of Helsinki. Approval was granted by the ethical committee of Saveetha College of Physiotherapy, Tamil Nadu, India.

**(01/044/2022/ISRB/PGSR/SCPT)**

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**Conflict of interest:** Nil

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Original Article

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# Effect of Early Intervention on Post Tracheostomy Infants on Developmental Delay

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**Abstract**

**Background:** In the pediatric population, tracheostomy is most common to provide good ventilator support, and that too is most commonly performed in the infant population. Tracheostomy is frequently associated with devices such as ventilators, which can further interrupt the neck motion and this in turn, may also affect the gross motor development.

**Purpose:** To determine the effectiveness of early intervention in post-tracheostomy infants with developmental delays.

**Materials and Methods:** A randomized control trial was conducted with a total of 20 tracheostomy infants with a mean age of 2 months. Subjects were randomized into the early intervention group (n = 10) and the conventional group (n = 10). Both groups were treated with routine chest care in the Pediatric Intensive Care Unit. In addition, the early intervention group included neck postural and movement activities for 20 minutes per day for 5 days for 4 weeks.

**Results:** One outcome concentrated on neck control by using a clinical rating scale for head control (HCS), and another outcome concentrated on gross motor milestones (lying and rolling components) by using the Gross Motor Functional Measure (GMFM-88). Both groups were similar at baseline, with a p-value of 0.8493 in HCS and 0.56866 in GMFM. Following improvement in head control, the GMFM score improves from 29% to 74% in the conventional group. Early intervention groups progressed from 25% to 89%.

**Conclusion:** Early intervention programs concentrated on post-tracheostomy infants showed significant improvement in the development of neck control and rolling. And organized head movement in space was noted when compared to conventional groups.

**Keywords:** Postural and movement training, Neck control exercises, High-risk infants, Clinical rating scale for head control, GMFM-88.

## Introduction

A tracheostomy is a surgical operation that includes opening the cervical trachea to provide an airway[1]. Pediatric tracheostomies are becoming more prevalent, accounting for nearly 40% of tracheostomy procedures performed on infants under the age of

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12 months[2] . Pediatric tracheostomy, tracheostomy tube selection, and post-surgery rehabilitation in infants and children need specialized and advanced treatments [3].

Infant tracheostomies provide various advantages, including minimizing the need for extended intubation, decreasing the risk of tracheal stenosis, and boosting feeding and development. Tracheostomies help infants to be more comfortable during oral feeds, which can be absorbed, resulting in improved nutrition[4]. While most studies have focused on the impact of tracheostomies on speech, language, and swallowing[5]. Tracheotomy infants, notably develop neck flexor weakness, immobility, and discomfort as a result of the incision site.

Head control is often achieved by infants as their first gross motor milestone. Once they have gained control of their heads, they can go on to other milestones like rolling, sitting, standing, and walking[6]. Adults normally require approximately two weeks to recover from the decannulation phase after the tracheostomy is removed. However, the healing process may differ for infants aged one to five months, when gaining neck control may take longer, potentially resulting in delays in gross motor milestones.

An infant with developmental delay (DD) fails to meet age-appropriate developmental goals in one or more areas, such as gross motor abilities, fine motor skills, language/speech development, and social development[7-9]. Globally, the prevalence of developmental delays ranges from 1.5% to 19.8% of children. The estimated frequency of developmental delays in India is roughly 10%, and it is significantly greater among infants released from neonatal intensive care units (sick newborn units)[10]. For infants with developmental delays, early detection and intervention are critical. Infants have a higher chance of fulfilling their developmental potential if the delay is identified early and proper support and treatments are provided[11].

Gross motor delays (GMD) were found to be most common in children aged 2-4 months (10.3%). Early intervention is critical for infants who are at risk of developmental delays (DD), emphasizing the importance of early childhood development therapies and programs. Motor development in children follows a pattern in which movement ability impacts others[12]. Head control is an important early milestone that should be reached by 3 months of age, and delay in developing head control can have a substantial influence on overall development[13].

The Gross Motor Functional Measure (GMFM-88) is a thorough assessment instrument for assessing gross motor skills. It examines five areas of gross motor function, which are as follows: Rolling, lying, Crawling, kneeling, Sitting, Standing Walking, running, and jumping[14]. Chavan SR developed the clinical rating scale for head control (HCS) in 2008 to assess the postural control necessary for head control in infants with neurological diseases or developmental delays. It rates head control on a 5-point scale (ranging from 0 to 4) in prone and supported sitting postures, and on a 4-point scale (ranging from 0 to 3 in supine). The clinical rating scale is a reliable instrument used to measure the progression of head control in children with cerebral palsy. It was found that there were very substantial positive correlations between the prone ($r = 0.845$), supine ($r = 0.802$), and supported sitting ($r = 0.827$) dimensions[15].

When developmental delays are diagnosed early, suitable treatments to promote the child's development can be undertaken, resulting in improved learning results, improved behavior, and fewer functional difficulties.

Early childhood treatments have been found to have long-term advantages, such as sickness prevention and general health and well-being promotion. Early identification and appropriate intervention can significantly affect an infant's long-term trajectory and enhance developmental results[16]. Early intervention programs take advantage of this neuroplasticity by delivering personalized therapies and activities that encourage the formation of brain connections and pathways. Early intervention is especially critical for post-tracheostomy newborns since they may have special developmental requirements and issues. Infant's head control improves significantly throughout the first few months after birth as part of their motor development. Early intervention plays an important role in improving the general development and well-being

of post-tracheostomy infants by offering tailored therapies and involving families. To determine the effectiveness of the early intervention on post-tracheostomy infants on developmental delay.

## Aim

To determine the effectiveness of the early intervention on post tracheostomy infants on developmental delay.

## Material and Methods

It is an experimental study conducted from June 2022 to Januray 2023 on 20 post tracheostomy infants from Saveetha Institute of medical and technical science (SIMATS). According to the inclusion and exclusion criteria. Concealed envelope sampling technique was used in this study. The infants included in the study were based on the following criteria:

**Inclusion criteria**

- Full term baby
- After the diseases get cured for which the tracheostomy was done
- After 2 weeks from decannulation
- Infant age group (1-4 months)

**Exclusion criteria**

- Once neck control was achieved
- Congenital disorder
- Congenital disabilities
- Prenatal and perinatal complications
- Immediate postnatal complications such as NICU stay, low birth weight, seizure
- Recent surgery to head

**Outcome Measure**

**Clinical rating scale for head control**

The clinical rating scale for head control is used to assess head control in supine, prone, and sitting postures. This scale grades prone and supported sitting positions on a 5-point scale (0–4), whereas the supine position is rated on a 4-point scale (0–3).

**GMFM-88**

The GMFM-88 item assesses the range of gross motor activities in five dimensions. Divided into five dimensions, of which lying and rolling (17 components) were assessed in supine and prone postures with a total score of 51. The scoring of GMFM consents to four-point scoring from 0–3, where 0 does not initiate, 1 initiates, 2 partially completes, and 3 completes.

**Procedure**

A total of 20 infants were randomly selected and divided into an early intervention and conventional group by using concealed envelope method. The study was conducted in Saveetha medical college & hospital. Informed assent was obtained from their parents, and they were also explained the safety and simplicity of the procedure.

***Study Procedure***

***Early intervention group*:** Infants in the early intervention group underwent routine PICU chest care along (conventional treatment) with posture and mobility activities[17] administered by the physical therapist for a period of twenty minutes daily for five days or four consecutive weeks.The training protocol includes

**Exercise 1**: **Tummy time (3 minutes)**

Phase 1: a) Infant is placed on the therapist's chest and abdomen with his or her elbow's weight beard and raised to develop usage of the shoulder and neck muscles while sitting in a reclining position. b) The therapist interacted with the infant to keep the head elevated.

Phase 2: a) Further infant is placed on the floor with his or her tummy while maintaining their elbow's weight, beard and head raised to develop usage of the shoulder and neck muscles.

b) Present a doll in front of the infant and encourage them to focus their attention on it.

c) The doll is then moved from side to side, allowing them to turn their head and follow the toy's movements. Then the toy is placed in front while the infant is in a tummy for as long as possible.

**Exercise 2: Head control against gravity for extensors (3 minutes)**

Infant is placed on the therapist's chest and abdomen (prone) on his or her stomach with the

upper limb extended and supported. The therapist gradually lifted the infant, 12 to 18 inches (30.4 - 45.7 cm) above the chest level. Hold for ten seconds before lowering the tummy gently.

**Exercise 3**: **Head control incline position for flexors (3 minutes)**

The therapist places the infant on bent knees then gently grasps the infant›s shoulders and then pulls up to a sitting posture on a count of three. Interact with the infant to keep his or her head up. This posture was maintained for 10 seconds. While performing this exercise the infant's head tilts back slightly and support to the head is given by placing index fingers on the occiput.

**Exercise 4: Head control on a flat surface for flexors (2 minutes)**

An infant is placed on the floor. The therapist's thumb is placed inside the infant's palms, the hands resting at their sides. Then the infant's hands are brought together and taped over their chest, keeping them as straight as possible. Hold them in this posture for a few seconds, keeping their elbows as straight as possible. Consider singing a song while engaging in this activity to keep entertained.

**Exercise 5**: **Advanced (3 minutes)**

The following task will take place of Exercise 3 once the infant has demonstrated excellent head control in Exercise 3.

The therapist positions the infant on their lap with both knees bent and then proceeds to hold the infant's hands. The infant pulled up to sitting posture on the count of three. While performing this activity the infant is encouraged with attractive lights to maintain their head up. This posture is maintained for 10 seconds. The infant was lowered back to the floor using the same method. A slight head drop noted while lifting to a sitting posture.

Once the infant gains head control while translating from pulling to sitting significantly, then head control in the sitting posture should be encouraged.

**Conventional group*:***

Both groups underwent routine physiotherapy care in the pediatric intensive care unit, such as positioning, vibration, percussion, and suctioning.

## Results

This study involved Twenty infants. The mean age of participants in the conventional group is 2 months with an SD of 0.67, and that of the early intervention group is 2.2 months with an SD of 0.74. Both groups were similar at baseline, with a p-value of 0.8493 in HCS and 0.56866 in GMFM. Wilcoxon signed rank was used to compare pre- and post-values at 4, 5, and 6 months of infant age. Mann-Whitney t test analyzed data between groups by comparing the pretest and post-test at 4,5, and 6 months of age for conventional and early intervention groups. The mean value of both groups is converted into the GMFM percentage calculation.

**Table 1- Mean, SD and P- Value using clinical rating head control scale for conventional group**

| HCS | Mean | SD | p -value |
|---|---|---|---|
| Pretest | 2 | 1.825 | <0.05 |
| Post test at 4 months of age | 3.2 | 1.619 | |
| Post test at 5 months of age | 4.5 | 1.715 | |
| Post test at 6 months of age | 7 | 2.403 | |

**Table 2-Mean, SD, P - Value using clinical rating scale for head control for early intervention group**

| HCS | Mean | SD | p - value |
|---|---|---|---|
| Pretest | 2.2 | 1.873 | <0.05 |
| Post test at 4 months of age | 3.9 | 2.024 | |
| Post test at 5 months of age | 7.2 | 1.316 | |
| Post test at 6 months of age | 9.8 | 1.229 | |

**Table 3- Mean, SD & P- Value using GMFM for conventional group**

| GMFM | Mean | SD | P-value |
|---|---|---|---|
| Pretest | 15.2 | 4.366 | <0.05 |
| Post test at 4 months of age | 19.3 | 3.2676 | |
| Post test at 5 months of age | 27.7 | 8.577 | |
| Post test at 6 months of age | 38.9 | 8.9746 | |

**Table 4- Mean, SD & P - Value GMFM for early intervention group**

| GMFM | Mean | SD | P-value |
|---|---|---|---|
| Pretest | 13.9 | 3.6651 | <0.05 |
| Post test at 4 months of age | 24.4 | 4.7888 | |
| Post test at 5 months of age | 34.4 | 6.008 | |
| Post test at 6 months of age | 45.8 | 5.0946 | |

**Table 5- Comparing the pre-test and post-test between group**

| Test | HCS (P-Value) | GMFM (P-Value) |
|---|---|---|
| Pretest | 0.8493 | 0.56868 |
| Post test At 4 Month of age | <0.05 | <0.05 |
| Post test At 5 Month of age | | |
| Post test At 6 Month of age | | |

**Table 6 -Percentage mean value of GMFM**

| GMFM % | Pretest | Post test at 4 months of age | Post test at 5 months of age | Post test at 6 months of age |
|---|---|---|---|---|
| Conventional group | 29% | 37% | 52% | 74% |
| Early intervention group | 25% | 47% | 66% | 89% |

## Discussion

The purpose of this study is to look at the effects of an early intervention program on post-tracheostomy infants with developmental delay (DD). Infants with developmental delays frequently exhibit obvious functional difficulties as a result of limited access to early intervention treatments and delays in detecting developmental problems[18]. Early detection and intervention for DD improve the activity of the impaired children[19].

The research included infants under the age of four months who underwent tracheostomy and were diagnosed with developmental delay. On the first day of the research, a pediatrician performed a baseline assessment such as the infant's birth records to determine any difficulties during labor, APGAR scores, birth weight, feeding type, and gestational age before beginning the intervention program. A physiotherapist with expertise working with infants evaluated the infant's head control using a clinical rating scale and GMFM-88, especially the lying and rolling component. Pretest was performed two weeks following decannulation. The therapist treated one-month-old infants with great care, notably during the supported sitting component when the therapist's hand softly stabilized the neck to prevent atlantoaxial instability. Between each exercise, appropriate rest intervals are given. Immediate post-treatment results may not indicate substantial treatment benefits until developmental sequences occur, the infants were assessed at 4, 5, and 6 months of age. Following the

intervention, the early intervention group improved significantly on average. However, it was shown that two infants still had developmental delays in the early intervention group. Further study of their medical histories revealed that these two infants had been on ventilator support for an extended period throughout their stay in the Pediatric Intensive Care Unit (PICU).

A recent study has shown that intervention programs are cost-effective and may have long-term effects, and that intervention should start early to maximize developmental accomplishment [20-21].

Nonetheless, some risk factors, like extended ventilator support, can have an impact on the intervention's efficacy and careful assessment of the infant's medical history is critical in establishing suitable intervention strategies.

Hence, Tailored therapy should be given according to the duration of the PICU stay in future practice. In this study, we concentrated on neck control exercises, and future studies should incorporate other components such as sitting, kneeling, crawling, standing, and walking. In the conventional group, six infants were found to have developmental impairments. There are no single dropouts in the study, as we scheduled assessment dates before the study and explained the study procedure to parents. Regular follow-up through telephone calls a day before assessment. Since the sample size is small, we could follow up easily.

## Conclusion

Early intervention training concentrated on neck control for post-tracheostomy infants showed significant improvement in their neck control and rolling. And organized head movement in space was noted when compared to conventional groups. These improvements contribute to the infant's overall motor development and may facilitate their engagement in age-appropriate activities and interactions.

**ISRB approval:** This research work was approved by the ISRB committee.

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**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# Effects of Gluteal Muscle Focused Exercise Regimen on Functional Movement and Posture in Children with Down Syndrome: Pilot Study

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**Abstract**

**Background:** This article emphasizes the importance of the gluteal muscles in children with Down syndrome, revealing their impact on posture and functional movement.

**Purpose:** The motive of this study was to assess the remedial effects of the gluteal muscle exercise regimen as compared to the conventional protocol for Down syndrome and develop the most efficient treatment protocol for children with down syndrome.

**Materials and Methods:** Twelve children with Down syndrome received 8 weeks of continuous therapy, divided into conventional and Gluteal muscle exercise regimen groups using randomization. Pre and post-treatment levels of functional movement and posture were recorded and analyzed using GMFM and Posture Screen Mobile Posture Assessment.

**Results:** The Glutes group showed higher mean GMFM scores and better improvement in posture in 67% of the 6 comparisons, while the remaining subjects didn't show any notable difference.

**Conclusion:** The gluteal muscle exercise regimen group demonstrated more remarkable improvement than the conventional exercise group in both functional movement and posture in children with downs syndrome in a 8 week protocol.

**Keywords:** Rehabilitation, Mobility, Motor Development, Down Syndrome, Gluteal Complex

## Introduction

Down syndrome or Down's Syndrome is associated with intellectual disability and characterized by a variety of additional clinical findings. It is the most common chromosomal condition with these features [1]. Worldwide DS occurs in approximately 1 of 800 births. It has been recognized that the extra copy of chromosome 21 is the root cause of DS[2]. The variations in the clinical manifestations are also seen due to the various genes on chromosome 21 such as the polymorphisms of the Down Syndrome cell-adhesion molecule (DSCAM). Down syndrome is connected with substantial musculoskeletal sequelae, including laxity of the ligaments[3] weakness of the muscles, hypermobility and deformities of the skeletal structure.

These musculoskeletal abnormalities are often debilitating for children with this syndrome[4], and it

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prevents them from having a normal life. Not being able to keep up physically with your counterparts can be very challenging to understand[5].

The gluteal complexes are the most underrated muscles of the human body. The gluteal muscle complex is the powerhouse of the body. Lower extremity injury prevention and rehabilitation programs often target the glutes using exercises of varying difficulty[6] . However, there are many other workouts that can be used for these goals, and there is a dearth of concrete evidence about which exercises work the gluteal muscles the best. The idea that high levels of muscular activity indicated by electromyography (EMG) signal[7] amplitudes result in effects that strengthen muscles is universally accepted by researchers.[8]. The literature on gluteal muscle activity during exercise therapy is limited. Improved glute strength means improved balance[9], and improved balance means improved quality of life even into old age. Strong glutes ensure a strong base in your core[10] and a higher quality of life. This justifies why we need to lay more importance to simulating and strengthening the gluteal complex. The gross motor function measure (GMFM) is a clinical tool that is used in the observation and evaluation of the changes of the child's gross motor function abilities with cerebral palsy. Even though the GMFM 88 was developed for children with CP, advances and deeper research[11] with this scoring system it is now also validated for other populations. These include all the children with acquired brain damage and Downs Syndrome.

The use of mHealth is a priority in healthcare models in countries where life expectancy is increasing and patients require continuous long-term monitoring[12]. Recently mobile posture analyzing applications have gained popularity for their reliability and their ease of use. One such application is PostureScreen. It is one of the most recent and uses relatively advanced technology for its analysis[13]. The posture will be tracked by advanced posture tracking mobile applications. The front, back, and sides of the body will be analyzed using this application[14] .

## Aim

To determine the effectiveness of Gluteal Muscle Focused Exercise Regimen on Functional Movement and Posture in Children with Downs Syndrome

## Materials and method

A randomized clinical trial, by non-probability sampling, with a target population of both male and female children diagnosed with downs syndrome between the age group of 3-7 years.

Opaque Envelope Method was used to randomly allocate the participants into different groups.

Sample Size of 12 was selected for the purpose of this pilot study. There will be 6 respondents in each group and overall sample size will be 12 6x2 for the study based on the probability systematic sampling method. The study was conducted from June 2022 to February 2023.

Inclusion criteria were as follows, Both gender, Ages between 3 and 7 years, Children diagnosed with Down Syndrome, GMFCS Level I, II, III, a score of at least 38-42 in component C in GMFM-88, Mini mental State examination score greater than 24 and stable vital signs. Exclusion criteria were as follows Uncontrollable seizure, had received nerve block or orthopedic surgery, having hip and knee flexion contracture.

**Outcome measures:**

Assessment was performed at baseline (before starting of treatment) and after eight weeks of study.

- Gross Motor Function Scale (GMFM)
- PostureScreen Mobile posture analysis application

**Procedure**

Participants were included considering the inclusion and exclusion criteria. Procedure was explained to the participant & participant's parents after which the participants' parents were asked to sign the consent form. Assessment of all the included participants was done according to the assessment form. Participants were randomly divided into two groups i.e. Glutes group and Conventional group. Assessment was performed at baseline and after 8 weeks of study.

Glute focused exercise: The children in this group were subjected to glute specific exercises along with

core strengthening and the conventional treatment for down syndrome. The exercises were performed on an exercise mat. The instructions were given by the therapist and if necessary, assistance was provided.

| Exercise | Description |
|---|---|
| Glute Bridges | Lie on your back with knees bent, lift hips off the floor, squeezing glutes, and hold for a few seconds before lowering. |
| Clamshells | Lie on your side with knees bent, open and close top knee like a clam, engaging glutes. |
| Lunges | Step forward, bending both knees, lower into a lunge, push back to starting position. |
| Squats | Stand with feet shoulder-width apart, bend knees, lowering into a squat position, rise back up, engaging glutes throughout. |
| Hip Abduction | Use a resistance band, lift leg sideways against band tension, engaging glutes. |
| Standing Glute Kicks | Stand on one leg, kick the other leg backward, engaging glutes, and lower down. |

The intervention was started with stretching and warming up of the muscles[15]. The proposed protocol consisted of Bridging with single leg, squats, lunges, stepping up, clam, prone hip knee extension, Standing Glute kicks[16] and straight leg extension in supine at an angle of about 20-30 degrees. Quadruped kicks, one leg bridge, opposite arm/leg raise, 3- direction leg lift was incorporated into the protocol as the subject progresses. The intervention was administered for 1 hour/day for 6 days a week, along with instructions on home care and maintenance. The intervention was administered for 1 hour/day for 6 days a week, along with instructions on home care and maintenance.

Conventional exercise: The children in this group were subjected to the conventional protocol, the exercises were performed on the exercise mat. The exercises are inspired from the Invited Topical Review titled 'Physiotherapy management of Down syndrome' by Nora Shields, published in the Australian Journal of Physiotherapy. The instructions were given by the therapist with assistance given when necessary. The intervention started with the stretching and warming up of the muscles. The protocol would include aerobic training, massage, progressive resistive training, and balance training[17] . Various evidence-based exercises were incorporated into this protocol, tailored to the needs of the individual subject. Glute focused exercises were avoided until absolutely unavoidable. The intervention was given for 1 hour/day for 6 days a week, along with instructions on home care and maintenance. The intervention was administered for 1 hour/day for 6 days a week, along with instructions on home care and maintenance.

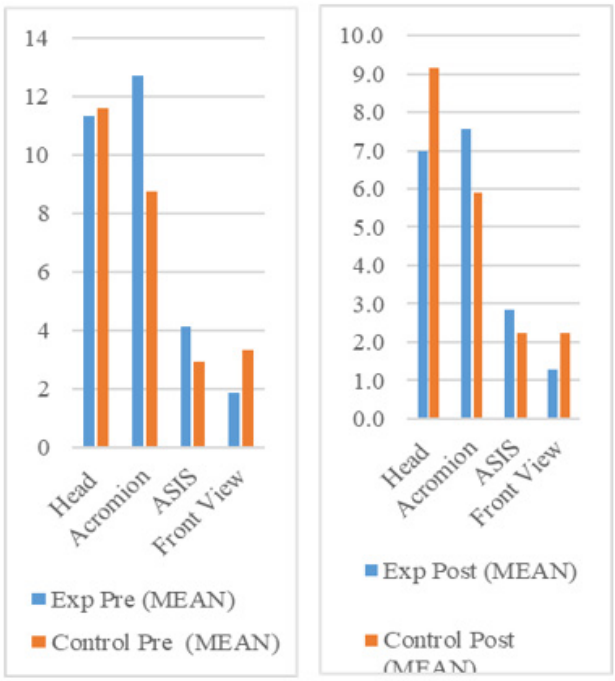
**Data analysis**

The gathered data was entered into an excel spreadsheet, tallied, and statistical analysis was performed on it. The tests of normality were performed and the data set was found to be NOT normally distributed. So, the researcher shall apply a non-parametric test (Wilcoxon test). The 'Mann Whitney' test for paired data was used to test for statistical significance. Other statistical metrics included mean, standard deviation, and others.

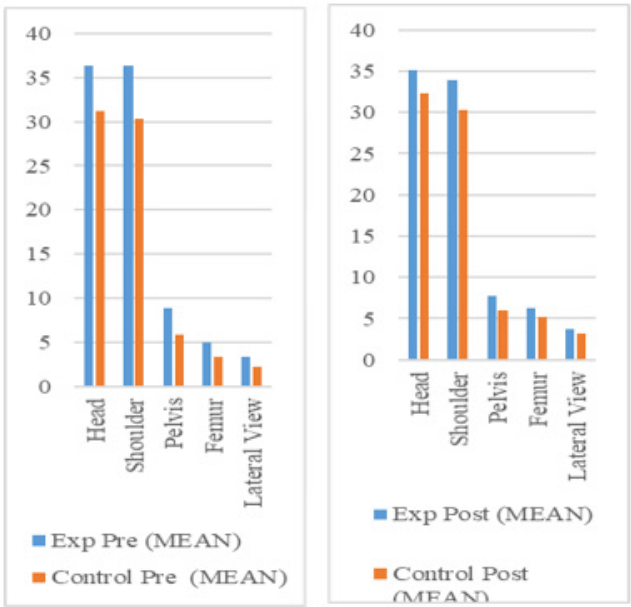
Data was obtained using the outcome measures among both the glutes group and the conventional group, and were analyzed using the Wilcoxon test. Further comparison of pre-post intervention outcomes within the groups were done for all the outcome measures.

## Result

The postural deviations were recorded and compared with the normal values. The normal values for the front view are: Head-0˚, Acromion-0˚, ASIS-0˚, Alignment-0˚ and the normal values for the lateral view are: Head 25˚, Shoulders-15˚, Pelvis-3˚, Femur-4˚, Alignment-0˚.




**Graph 1 Front view Pre Intervention and post intervention postural angles**




**Graph 2 Lateral view pre intervention and post intervention postural angles**

The experimental group showed considerable improvements in head, shoulder, pelvic, and femur locations in the lateral and frontal view. It was found that for GMFM scores and the postural changes showed significant changes in both the groups; but the glutes group was found to be more effective than the conventional group.

The Post Test Dimension E score for the experimental group was 5.15 points higher than the post test dimension E score of the control group.

The postural angles demonstrated in the glutes group were closer to the normal values of posture when compared to the control group.

The GMFM scores and pre and post intervention postural angles comparison is shown in Tables 1 and 2. Figures 1 and 2 show the comparison between the groups before and after the intervention.

## Discussion

In the present study the glutes group showed a statistically greater difference in functional movement through GMFM scores and posture through the Posture Screen application when compared to the conventional group. In the study we demonstrated that gluteal muscle exercises provoked better posture and functional movement than the conventional exercises. The children in the gluteal muscle group also had a visible improvement in balance and speed. This is in line with what Reiman Bolgla and Loudon reported in 2012 where they proved the importance of the gluteal muscle in rehabilitation[10].

Barr and Shields (2021) reported that there are physical barriers in various real life situations in children with down syndrome that need to be addressed[3]. This is in agreement with a study done by Gupta and Kabra (2014) where they also found that the children required assistance in some activities that children of the same age without DS wouldn't have a problem with[11].

In a study done in 2015 by Mourcou et al., the use of mobile posture analysis applications was found to be unreliable[12]. This was contradictory to the findings of Ahmed., Othman, Sabet and Salwa (2021) where they proved that the PostureScreen Mobile application had excellent inter rater and intra rater validity[13]. A study by L Ruiz G., explored the relationship between physical therapy and the potential benefits in children with down syndrome and found that physiotherapy and its interventions have a significant impact in terms of strength and balance. This provides a useful and convenient way to easily monitor changes in posture and functional mobility throughout the course of a workout programme. A mobile posture

analysis tool integrated into the intervention may give healthcare practitioners real-time feedback, enabling customized changes and guaranteeing that the exercises are catered to each child's requirements and ability[2].

During the post test data collection phase, we were able to see that the children looked a lot more toned physically. The body looked firm and aligned and did not look like the usual DS presentation where the children are usually stopped and floppy. It is also to be noted that this was a minimal change and could have only been noted by a keen observer. There was also no significant change in weight.

Additionally, Daly et al.'s (2019) study looks at gluteal muscle activation activities that are useful for children with cerebral palsy, which may be relevant for children with DS given their motor problems[5]. The activities mentioned were similar to the types of exercises used in this study. In Daly's studies these activities were labeled to be useful in the betterment of movement and posture in children with DS. This is in agreement with our study as we found a similar result [9].

In contrast to the current investigation, which seeks to determine the effects of a focused exercise programme on functional movement and posture in the same group, Russell et al. (1998) evaluated the validity of the Gross Motor Function Measure (GMFM) as an evaluation tool for children with DS.

The work by Russell et al. gives us a fundamental knowledge of the validity and precision of the GMFM in evaluating motor function in DS children[18]. Their study adds to the body of knowledge by demonstrating the reliability of the GMFM, which has subsequently gained acceptance as a frequently used and reliable tool for evaluating gross motor function in this group in both clinical and research contexts. This justifies the use of GMFM in our study.

In our study we were able to produce proof that exercise approaches that involve strengthening, postural balance and mobility are able to help in the management of postural imbalances and gait problems.

The gluteal muscle training programme for kids with DS thus offers a potential chance to address their functional mobility and posture difficulties, building on the data and ideas from this research to create efficient and unique exercise programmes. Adopting a carefully planned and scientifically supported exercise programme may improve the general motor function, balance, and physical wellbeing of kids with DS, encouraging more independence and quality of life. However, in order to guarantee that the exercise programme is suitable and safe and to get the best results, it is crucial to take into account each child's particular skills and consult with healthcare specialists. Utilising mobile posture analysis tools to provide real-time feedback and individualised modifications might help therapy sessions be even more successful.

Hence the results of our study are concurrent with the studies mentioned above.

## Conclusion

The current study has provided sufficient evidence that the protocols used have shown a significant improvement in Posture, functional movement and in increasing the strength in subjects with down syndrome. Both the groups had improvement with treatment protocol administered but in this 8-week intervention, we found that the group that had the glute focused exercise had overall better improvement in posture through the assessment application and in the GMFM scores. The subjects in this group were also visually more pleased and relaxed after every treatment session. A deeper study needs to be done into both these methods with a higher sample size and a longer intervention period to provide a better understanding of these methods.

**Ethical Clearance:** Taken from institutional ethical committee.

**(ISRB NO: 01/046/2022/ISRB/PGSR/SCPT)**

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Original Article

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# Effectiveness of Spider Cage Therapy for Balance Control in Spastic Diplegic Cerebral Children: A Pilot Study

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**Abstract**

**Background:** Spastic diplegic cerebral palsy (CP), a neurological disorder that specifically affects the lower extremities, affects mobility and posture. People with spastic diplegia frequently have balance problems, which reduces their functional independence and raises their risk of falling. In order to treat balance impairments in this population.

**Purpose:** The aim of the study is to examine novel and alternative treatment approaches that may possibly enhance the motor function and general quality of life in spastic diplegic cerebral palsy children by examining the efficacy of spider cage therapy for balance control.

**Methods:** 10 children with spastic diplegic cerebral palsy were allocated into developmental and experimental group. The experimental group (n=5) received spider cage therapy and the developmental group (n=5) received conventional physiotherapy.

**Result:** This finding shows that the conventional group pre and post-test values by using GMFM (30.2±1.67, 34.95±1.58) experimental group pre & post value of GMFM (30.55±5.63,36.95±1.64) with p value<0.0001. Conventional group pre & post-test values by using PBS (9.2±3.11,14.95±4.52) and experimental group pre and post-test values of PBS (9.75±1.58,16.7±1.78) with a p value <0.0001.

**Conclusion:** The study's findings suggest that children with spastic diplegia might benefit from balance training in a spider cage.

**Key words:** Spider cage, Exercise, Balance, Suit therapy, Cerebral palsy.

## Introduction

A neurological condition called cerebral palsy (CP) affects how people move and how they stand, which can be quite difficult for those who have it. Spastic diplegic cerebral palsy is one of the several subtypes and is characterized by increased muscle tone, primarily in the lower limbs, which impairs mobility and balance. To improve functional independence and lower the risk of falling, it is essential to treat balance deficiencies in people with spastic diplegic cerebral palsy [(1)]. Although precise figures are unavailable in India, the Indian Paediatric Society estimates that the incidence of cerebral palsy ranges from 2.5 and 3 per 1,000 live births [(2,3)]. It is the

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single most frequent reason for children's mobility problems. Children with CP may experience severe muscle deficits such as stiffness, muscle weakness, and a lack of selective motor function. The link among spasticity, endurance, and functioning in CP patients is the subject of numerous theories. [3] Reduced muscular strength, range of motion, motor control, sensory organization, cognition, multisensory integration, and abnormal muscle tone can all lead to balance disturbances on a variety of levels.[4] Exercise can assist patients with CP live healthier lives by reducing a variety of secondary diseases and enhancing posture, muscular tone, and balance. The main characteristics of CP are aberrant gross and fine motor organization and function, suggesting improper motor control. Loss of selective motor control, aberrant muscle tone, and imbalance in the strength of the muscles that act as agonists and antagonists, and compromised body balancing processes can all lead to diminished muscle elasticity, decreased joint range of motion, and altered bone and joint development. Limits and balance impairment were a result of individual factors relating to the numerous processes involved. Poor control of balance is one of the key causes of movement issues given the importance of steady management in all measures. The visual, proprioceptive, vestibular, and other higher-level premotor systems, which are essential for achieving balance, are influenced by many different body systems. The balance system's functional aims are to support some voluntary acts, such as posture evolution, posture maintenance, such as sitting or standing, and equilibrium restoration following external issues, such as a slip or self-inflicted instability.[5] Exercises like resistance training and aerobics have been demonstrated to reduce HbA1C levels, which help to lessen the signs and symptoms of diabetic neuropathy[6]. The youngster cannot adjust shifting, which limits their capacity to walk freely, increases gait cost efficiency, and results in early fatigue, making it difficult to start an activity.[6] The various interconnected systems at work are tied to specific causes of impairment and balance issues. Insufficiencies in movement range, motor control, strength of muscles, cognition, sensory firmness, sensory integration, and aberrant muscle tone are some of the factors that contribute to balance disorders on different levels.[7] A promising treatment option for balance control issues in people with spastic diplegic cerebral palsy is spider cage therapy, a relatively new therapeutic strategy. In this ground-breaking intervention, people are suspended in a specially made harness that is connected to bungee cords in order to provide dynamic support and facilitate functional motions. Spider Cage Therapy may have the ability to improve proprioceptive feedback and postural changes, hence enhancing balance control in this population by providing an immersive and participatory therapeutic environment. [8] The Advanced Spider Suit is a dynamic orthotic that consists of knee pads, knee shorts, a vest, and elastic band caps. The Advanced Spider Suit's main goal is to create a framework of support that will allow the body to be as aligned to normal as possible. This will allow the wearer to regain optimal postural alignment and weight bearing, which is essential for regaining muscle tone, sensory function, and vestibular function.[9]

## AIM

To determine the effect of spider cage therapy for balance control in spastic diplegic cerebral palsy children.

## Method and Material

The subjects were selected from Saveetha institute of medical and technical sciences (SMCH) with a sample size of 10 and divided in two groups. Informed consent was obtained from parents.The experimental group (n=5) got spider cage therapy and the other group (n=5) received developmental physiotherapy. 10 patients with cerebral palsy among the ages of 4 and 10 were selected and split into the developmental group and the experimental group. All these participants underwent a Gross Motor Function Measure evaluation.

**Study Period:** From June 2021 to June 2022.

**Inclusion criteria**

Selection criteria were

- cerebral palsy has been identified in children.
- The gross motor function of children between the ages of 4 and 10 ranges from Levels III to V.

**Exclusion standards:**

- Hip subluxation or dislocation in excess of 33%.
- Scoliosis of more than 25 degrees.
- uncontrollable seizures, challenging systemic conditions, and high blood pressure.
- injection of botulinum toxin-A within three months of an earlier study.

**Outcome measures:**

**Gross motor function measure scale (GMGM):**

The gross motor function measure scale (GMGM) is numerical gauging of CP from five months to sixteen years old. It has 88 components that quantify five elements of gross motor function. 0 - Does not begin the task, Starts the project (less than 10%), finishes it in part (10–99%), and finishes the assignment (100%). 13 assignments that make up the standing space were evaluated, and the highest score was 39.

**Paediatric balance scale:**

The Paediatric Balance Scale, which was developed by modifying the Berg Balance Scale, is used to gauge balance in children between the ages of 5 and 15 who have motor impairment. Instructions for the exam, the order of the tests, and the amount of time needed to maintain static posture have all changed. There is a maximum score of 56 points[13]. This scale measures how well 14 typical daily tasks—including the capacity to sustain increasingly challenging sitting and standing positions—are performed. In order to evaluate standing balance, progressively smaller BOS were offered. The goal of this test was to examine children with neurological conditions.

**Procedure**

10 cerebral palsy patients between the ages of 4 and 10 were chosen, divided into two, these participants underwent a Gross Motor Function Measure evaluation of developmental group and experimental group. Using an assessment of Gross Motor Function Measure, all of these participants were evaluated. For two months, the patient had two hours of developmental therapy five days a week, this included.

**GROUP A**

- General warm-up exercises for the body,
- Flexibility exercises,
- Resilience exercises and muscle stretches,
- Resistance training with dumbbells and an elastic band,
- Exercises require coordination and balance.

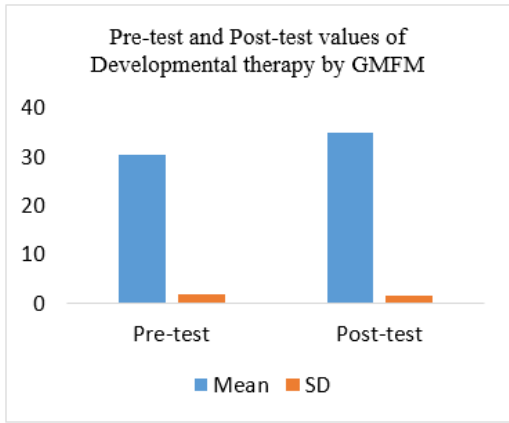
**GROUP B**

- The spider cage therapy that the subjects in this group underwent for two months, lasting two hours per day, five days per week, Spider Cage therapy is used to develop strength by concentrating on one muscle group without using another (weights and pulleys) after a general warm-up and easy stretches.
- A spider cage is used as therapy to help with movements including sit-to-stands, quadrupeds, squats, and jumping, as well as balance and coordination.

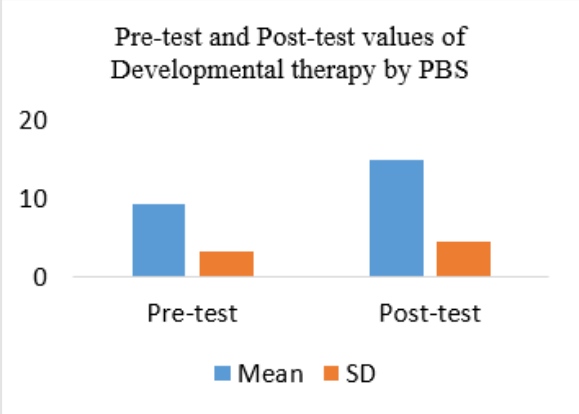
**Data Analysis**

Inferential and descriptive statistics were applied to tabulate and evaluate the collected data. All parameters have been transformed into their mean and standard deviation (SD). A paired t-test was employed to evaluate whether any significant improvement in between pre- and post-test measurements. Statistics were considered significant at P values less than 0.0001.

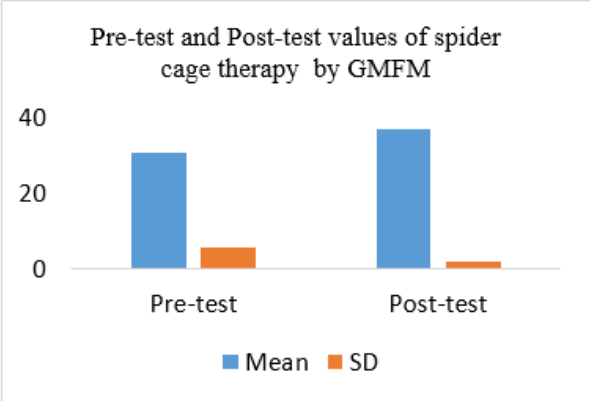
All 10 subjects completed the study successfully; test and post values of GMFM and PBS were presented in following graphs.Statistical analysis shows significant improvement from pre-intervention to post.



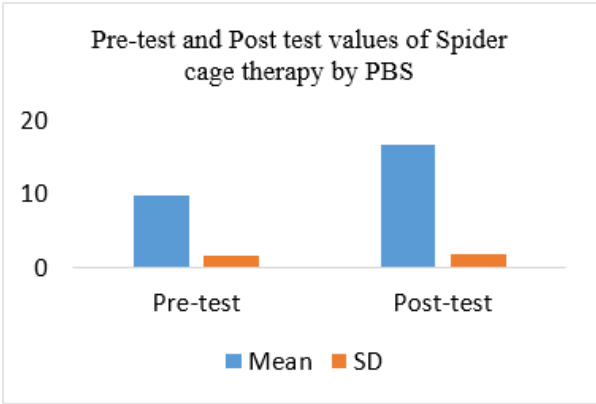

**Graph 1: The pre and post-test values of developmental therapy by GMFM**




**Graph 2: The pre and post-test values of developmental therapy by PBS**




**Graph 3: The values of pre and post-test values of spider cage therapy by GMFM**




**Graph 4: The values of pre and post-test values of spider cage therapy by PBS**

## Result

For the GMFM scores, the developmental therapy group showed an average value of 30.2 in the pre-test and in the post-test. In contrast, the spider cage therapy group had an average value of 30.55±5.63 in the pre-test and 36.95 in the post-test. The p-value of less than 0.0001 for both groups indicates that there was a statistically significant improvement in motor function in both groups after the therapy, with the spider cage therapy group showing a slightly higher improvement compared to the developmental therapy group.

Regarding the PBS scores, the developmental therapy group had an average value of 9.2 in the pre-test and 14.95 in the post-test, while the spider cage therapy group had an average value of 9.75in the pre-test and 16.7 in the post-test. Similar to the GMFM scores, the p-value of less than 0.0001 for both groups indicate a statistically significant improvement in balance control for both groups after the therapy, with the spider cage therapy group again showing a slightly higher improvement to the developmental therapy group.

## Discussion

This study investigated the effects of spider cage therapy on balance in kids with spastic diplegic CP. Children with CP often step incorrectly as a result of balance-related motor impairments. This project aimed to increase balance. The developmental group prior to and following treatment showed a noticeable difference, whereas the study group showed a considerable improvement, according to stance domain results in GMFM. This may be due to the fact that they regularly engaged in physical activities, which are consistent with Mark and Gromley's findings,[10]who found that physical therapy significantly improves selective motor control, leading to improved function.

According to Levinson, spider cage therapy is a cutting-edge and efficient treatment option for children with cerebral palsy that significantly improves balance, body coordination, and performance. It also makes the most of the child's strengths and abilities and can be used in conjunction with the majority of rehabilitation procedures to encourage independence and security while preserving postural stability. Furthermore, it agrees with studies by Haart et al. (9)

A therapy method called "spider therapy" developed by Gamit and Sutaria [12] uses a hanging web-like apparatus to aid and assess the motor skills of people with neurological illnesses. It requires a variety of motions while hung in the device, including reaching, gripping, and weight shifting. This study looked at how balance and motor skills in people with cerebral palsy were affected by spider therapy. The Functional Independence Measure (FIM) and the Gross Motor Function Measure (GMFM), which are standardised assessment methodologies that provide precise assessments of motor skills and functional abilities, were used to study motor functions. To assess equilibrium, we used tests created expressly for that purpose.

The main advantage of suit therapy, according to Alagesan and Shetty, [13] is the considerable increase in sensory proprioceptive feedback, which promotes the growth of cortical regions where embryonic development in children with development was slowed. Suit therapy has benefits such as supporting weak muscles, building endurance in strong muscles to increase power, assisting in the decrease of contractures, enhancing coordination, and offering tactile stimulation. Restoring muscle tone, allowing the body to return to normal, reestablishing gait patterns, and providing tactile feedback are some of the objectives of external stabilization. The study discovered important links between spasticity and other aspects of motor function. Higher spasticity scores, which were correlated with lower GMFM-66 scores, are indicative of poorer gross motor function. As a result of their heightened muscle rigidity and tone, persons with spastic diplegia cerebral palsy may experience functional restrictions. Spastic diplegia is a type of cerebral palsy characterized by rigidity and elevated muscular tone, primarily in the lower extremities. This condition was the focus of the investigation. Spasticity can have major negative consequences on mobility and motor function in CP patients, thus it's crucial to understand how it interacts with other factors when developing a therapy strategy.

## Conclusion

The findings of the study conclude that spider cage therapy has an impressive effect in improving balance in children with cerebral palsy. Treating children who had spastic diplegic cerebral palsy with spider cage therapy along with developmental therapy over a period of 4 consecutive weeks improves their balance control as indicated by improvements in the gross motor functional measure scale (GMFM) and Paediatric balance scale (PBS). As such, there is strong evidence to suggest that the application of spider therapy and developmental therapy in combination with standard care represents a simple, yet highly effective.

**ISRB approval:** This research work has been approved by ISRB committee

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Original Article

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# Effect of Task Specific Circuit Training on Gait and Functional Mobility among Spastic Diplegic Cerebral Palsy

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**Abstract**

**Background and Need for the Study:** Spastic diplegic cerebral palsy is the most prevalent and common form of the cerebral palsy. Gait, balance, and coordination are all negatively impacted because it mostly affects the bilateral lower extremities.

**Purpose of the Study:** The purpose of the research was to find out the effectiveness of task specific circuit training on gait and functional mobility in children with spastic diplegic cerebral palsy.

**Methods:** In this research, selected 30 children according to inclusion and exclusion criteria. All the Children participating in the study were separated into two groups, Task specific circuit training group and Conventional group, children's parents were explained about the safety and procedure. Inform assent was provided to the children's parents after explaining about the intervention and study procedure.

**Results:** Pre-test measurements and Post-test measurements of the gait and functional independence, assessed using the Edinburgh visual gait scale (EVGS) and GMFM-88. Paired t-test and unpaired t-tests were used for calculating the mean and standard deviation.

**Conclusion:** The research eventually reached the conclusion that task-specific circuit training is an efficient method for improving gait and functional mobility when used in conjunction with regular physiotherapy.

**Keywords:** Functional independence, GMFM-88, Cerebral palsy.

## Introduction

A neurological disorder known as the cerebral palsy (CP) is characterized by abnormalities in tone, posture, mobility. Based on primary motor ability, it is split Clinically into types: spastic hemiplegia, spastic quadriplegia, and spastic diplegia and dyskinetic and ataxic cerebral palsy Mostly CP occurs due to damage to the neonatal or fetal brain. Cerebral palsy occurs postnatally and is caused by brain damage that occurs after the neonatal phase but before the age of five, TBI,meningitis, near drowning experience are some common causes for postnatal cerebral palsy [1]. CP refers to a collection of impairments that is permanent which causes abnormal Motion and posture-related patterns that limit activities and are the outcome of non-progressive issues with fetal or infant brain development [2.] Early diagnosis and

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intervention are crucial to providing appropriate medical and therapeutic support to children with cerebral palsy, as it can help better their overall functioning and standard of life. Physiotherapy is an important part of CP rehabilitation since it helps to correct gait and improve walking ability by strengthening muscles [3] .

Spastic cerebral palsy is classified as spastic diplegia, spastic quadriplegia, or spastic hemiplegia. Among all the other types, spastic diplegic cp occurs more commonly. With appropriate treatment and support, many individuals with spastic diplegic CP can lead fulfilling lives and achieve significant functional improvements. Spastic diplegic cerebral palsy affects primarily both lower limbs. Although the symptoms of spastic diplegic cerebral palsy are like those of other types of cerebral palsy, the following characteristics are more prominent in spastic diplegic cerebral palsy: stiff and tight leg muscles, increased reflexes in the lower limbs, and scissoring gait. CP children who are ambulatory exhibit a variety of abnormal gaits. Spastic diplegic children may exhibit a recognisable walking pattern known as a "scissoring gait" Due to the increased muscle tone, the legs cross over one another when you walk. Children with spastic cerebral palsy typically walk without restriction, but most of them have a deformed gait that includes abnormalities such as crouch gait, walking in toes, knees flexed [4] . In spastic diplegic cerebral palsy, true equinus, apparent equinus, crouch gait, and jump knee are the common gait pattern observed[5]. To provide targeted and effective gait rehabilitation identifying the most impaired gait is important[6]. Performing daily living tasks without anyone's direct support and ensuring individuals full participation in daily life activities. Cerebral palsy children find difficulty in performing daily life activities. Task-specific circuit training consists of a set of goal-oriented tasks and activities which aims in improving overall functional independence and gait[7]. Task-specific circuit training (TSCT) is an exercise training technique that can be employed to improve walking patterns. Circuit training technique involves exercises that are performed in stations with a pre-planned number of repetitions for a set of duration. It is an approach for training aerobic capacity[8]. TSCT focuses on developing the neural plasticity in CNS and in the tasks are performed with several repetitions of tasks, which aids the children in performing the motor tasks by adapting to different circumstances of daily life [9].

The GMFM-88, the original version of the test, consists of 88 items that have been divided into five categories according to gross motor function: sitting, crawling, walking, running, and leaping. Numerous articles have used the Gross motor scale to evaluate the efficacy of therapies for CP kids because it enables measurement of motor function[10]. Numerous studies have established the Edinburgh visual gait score (EVGS) as a on point and reliable quantitative OGA scale with good reliability, good validity with other gait assessments, and it is an effective tool to detect changes following physiotherapy. It can be used by experienced and non-experienced observers [11]. The EVGS has a high level of reliability and is a valuable technique used for the overall pathological assessment of CP patients as well as educational purposes using observational gait analysis[12]. EVGS analyses gait pattern through visual gait analysis through video, coronal and sagittal planes were analysed for each lower limb [13]. The study focuses on the effect and improvement in spastic diplegic children on gait and functional mobility post the TSCT intervention. It is essential to understand how TSCT influences walking gait and functional movement in people with spastic diplegic CP in order to improve long-term outcomes and optimize treatment plans.

## AIM

The aim of the research was to find out the effectiveness of task specific circuit training on gait and functional mobility in children with spastic diplegic cerebral palsy.

## Materials and Methods

The study has been conducted with an experimental design from February 2022 to April 2023, and sample collection began in July 2022 and therefore carried with treatment period of 8 weeks. The study was conducted in a private hospital in Chennai. Informed assent was provided and parents' consent was obtained for the child's participation in the study. Ethical approval was obtained from a private college and the college's ethical committee approved the research to be performed on humans

after ensuring that it followed with all applicable national laws and institutional norms. (ISRB NO -01/048/2022/ISRB/PGSR/SCPT) .

Selection of the samples were based on the inclusion and exclusion criteria and 30 children were finalized. All the children participating in the study treatment program were selected after assessing them using the functional mobility scale (FMS) and children with grades 5,6 were included in the study. Children who participated in the study were divided randomly into two groups TSCT group and conventional group using concealed envelope method.

**Inclusion Criteria**

Children with both gender, Ages between 9 and 14 years, Functional mobility scale (FMS) grade –5, grade – 6, All Ambulatory spastic diplegic cerebral palsy patients were included in the study.

**Exclusion Criteria**

Uncontrollable seizure, had received nerve block or orthopedic surgery, having hip and knee flexion contracture, Children with True equinus, apparent equinus, and jumping gait were excluded from the study.

**Outcome Measures**

**Edinburgh Visual Gait Score:**

The EVGS was developed and created to visually assess the deviations in gait for children with ambulatory CP. There are 17 observational parameters for each lower limb which will be scored on a three-point scale.The maximum total score is 34 for each lower extremity and values lesser to maximum value indicates lesser deviation.

**Gross Motor Functional Measure (Gmfm-88):**

It is an assessment tool used to measure the changes in CP. The GMFM-88 has many more components which describe and assess each gross motor function separately. As my study focuses particularly on functional mobility and gait, ITEM -E from GMFM-88 will be used as an outcome measure in the study.

**Procedure:**

Selection of the samples were based on the inclusion and exclusion criteria and 30 children were finalized. All the children participating in the study treatment program were selected after assessing them using the functional mobility scale (FMS) and children with grades 5,6 were included in the study. Children who engaged in the study were categorized into either unit TSCT and conventional. The intervention was provided for about 8 weeks (about 2 months), before the treatment pretest measurements were taken, and after the completion of 8 weeks (about 2 months) of intervention. Post-test measurements were taken. Pretest measurements and post-test measurements of the gait parameters and functional mobility were measured using the EVGS and GMFM-88. In accordance with the norms 30 children had been selected and they were categorized into Task specific circuit training group which consisted of 15 children and conventional group which consisted of 15 children.

**Task Specific Circuit Training (Tsct)**

TSCT consists of a set of activities they are as follows treadmill training, and cycling given for 15 mins, followed by 1 set of straight leg raises and squats were made to perform which consists of a repetitions of 15 and then the patient was made perform tandem walking for 5 minutes and one leg standing for each leg was carried separately for a time period of 6mins, one leg standing on foam for each leg carried out for a period of 4 minutes and then the children were made to walk on different surfaces includes walking on sand, trails, grass and turf, asphalt, and cement for 5 mins and finally staircase climbing, standing on balance board, walking on the obstacle were also performed by the children's. A total of 45 minutes was given for task-specific circuit training and before the task-specific training warm-up exercises (ankle toe movements, stretching for limb, jumps) were given for 5mins.Total intervention time:50 minutes.

**Conventional Group**

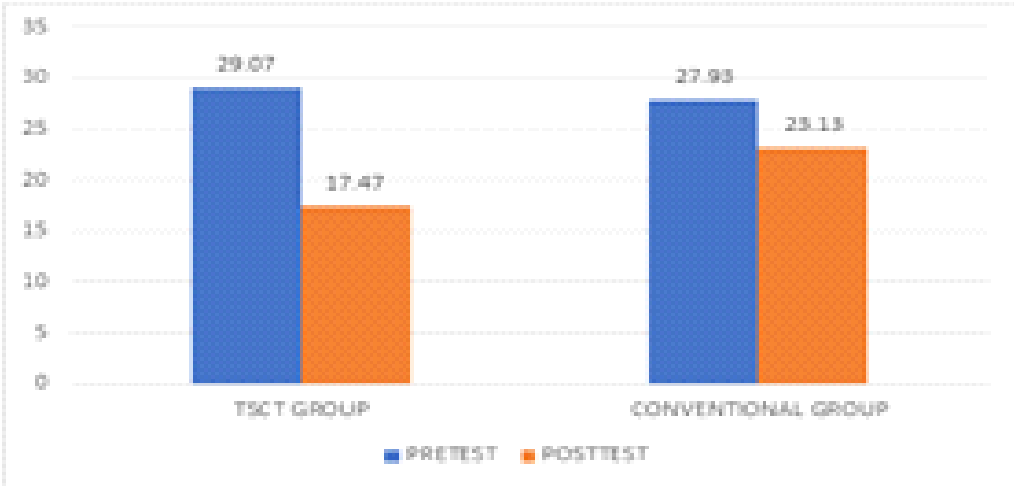
The conventional group received traditional physiotherapy which includes passive stretching for the lower limb, strengthening exercises concentrating lower limb and core muscles, positioning, weight-bearing, and gait training using a parallel bar given for 50 minutes.

**Materials Required:**

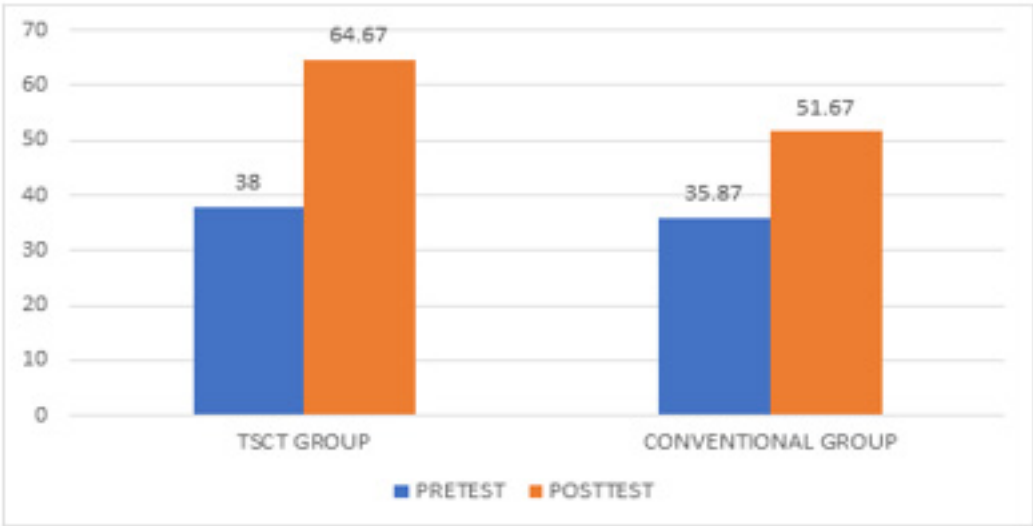
Treadmill, cycle, balance board, standing foam, wedge, bolster.

**Data Analysis and Results**

Paired t-test and unpaired t-test were used for calculating the mean and standard deviation. To analyse pre and post-test measurements within the group paired t-test was used. Unpaired t-test was used to analyze pre and post measurements between groups. The P value of <0.0001 was deemed statistically significant.




**Graph-1 Pre-test and Post-test values of both TSCT group and Conventional group Using EVGS**




**Graph -2 Pre-test and Post-test values of both TSCT group and Conventional group using the GMFM-88**

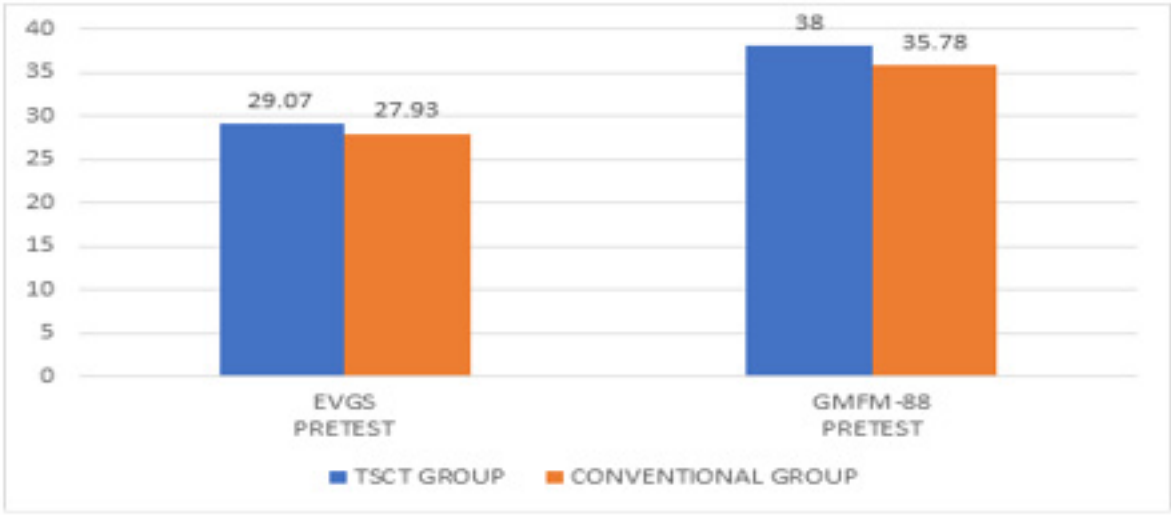
**Graph-1**

Shows the pretest and post-test values of both TSCT and Conventional groups using the EVGS. Pretest mean value was 29.07 and post-test mean value was 17.47 for the Task specific circuit training group using the outcome measure EVGS. Pretest mean value was 27.93 and post-test mean value was 23.13 for conventional groups using the outcome measure EVGS. Considering the EVGS lesser the score to the maximum score 34 the lesser will be the deviations and impairments. The P value was <0.0001 and considered to be statistically significant.

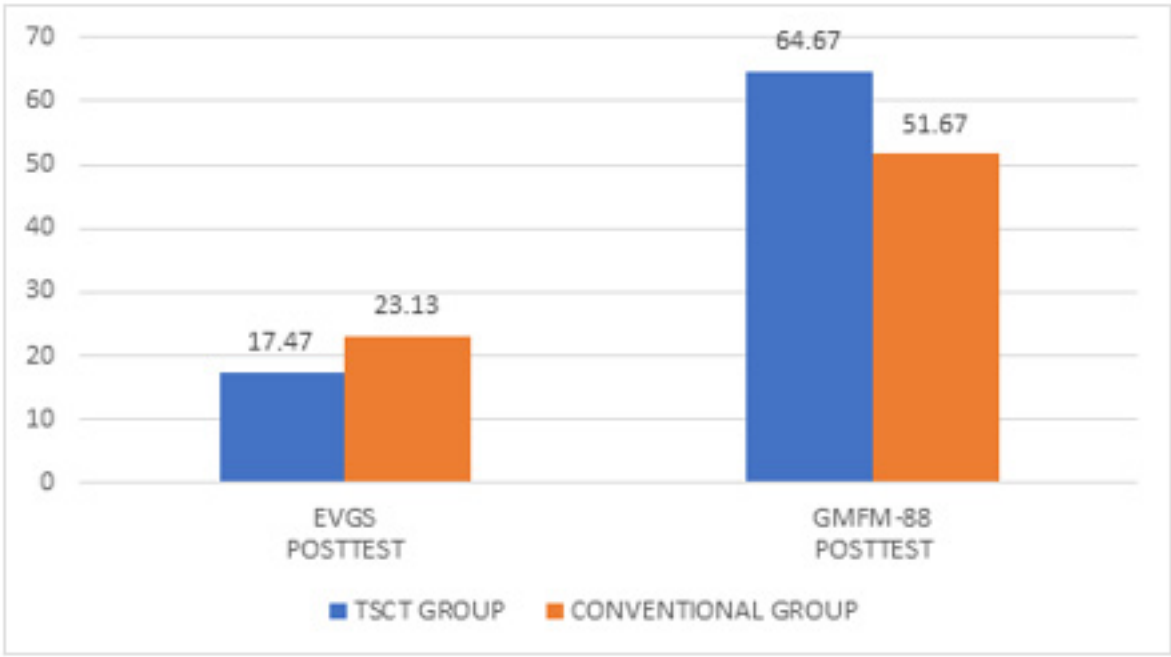
**Graph-2**

Shows the pretest and post-test values of both TSCT and Conventional groups using the GMFM-88(ITEM-E). Pretest mean value was 38.00 and post-

test mean value was 64.67 for the TSCT group using the outcome measure GMFM-88(ITEM-E). Pretest mean value was 35.87 and post-test mean value was 51.67 for conventional groups using the outcome measure GMFM-88(ITEM-E).The p value was <0.0001and considered to be statistically significant.




**Graph 3: Pre-test values of both TSCT and Conventional group using both EVGS and GMFM-88(ITEM-E)**




**Graph 4: Post-test values of both TSCT group and Conventional group EVGS and GMFM-88(ITEM-E)**

**Graph-3**

Shows the pre-test values of both TSCT and Conventional groups using the outcome measures EVGS and GMFM-88(ITEM-E).

The pre-test mean value was 29.07 for TSCT and Pre-test mean value for conventional group was 27.93 using the EVGS. P-value was 0.3397 and the results are considered statistically significant. The Pre-test mean value was 38.00 for TSCT and Pre-test mean value for conventional group was 35.87 using the GMFM-88(ITEM-E). P-value was 0.2860 and the results are not statistically significant.

**Graph -4**

Shows the post- test values of both TSCT and conventional group using the EVGS and GMFM-88 as outcome measures.

The post-test was 17.47 for TSCT and for conventional group was 23.13 using the EVGS. The results were statistically significant with p-value <0.05. The post-test mean value was 64.67 for TSCT and post-test mean value for the conventional group was 51.67 using the GMFM-88(ITEM-E). The P value was <0.0001 and considered to be statistically significant.

## Discussion

The study's main target was to detect the effect of TSCT on improving gait and overall movement participation in spastic diplegic CP children. In 2022,Zai et.al., W conducted a systematic review on the impact of activity driven learning on kids with CP, mobility performance, equilibrium, and routine duties. The meta-analysis was carried out using RevMan5.4 software, and the methodological caliber of the included publications was assessed. To establish a more reliable scientific foundation for the adoption of TOT in clinical practice, only a few studies of poor were included; there is the demand for high quality RCTs[14].

In 2021 **Liang X et.al.,** conducted a meta-analysis in which the exercise therapy's impact on patients' movement ability, ambulatory velocity and power was evaluated in individuals with CP. The review stated task-specific circuit training as an intervention for spastic diplegic cerebral palsy children helps in the overall enhancement of functional mobility [15].

In 2021 **Lee NY et.al.,** conducted an experimental investigation to see how in kids with spastic diplegia, double activity regime may enhance equilibrium and agility. In this study, 14 children with spastic diplegia took part. The outcomes of the investigation indicate that kids with spastic diplegia benefit from dual-task exercises in terms of balance and gross motor skills and suitable therapeutic approach for children with spastic diplegia [16].

In 2020 **Han YG, Yun C,** conducted a meta-analysis in which eight studies were included with 179 participants participating. The study's results showed that cerebral palsy patients who trained on a treadmill saw improvements in their endurance, velocity, and limb support period. But the step length and cadence are clinically insufficient[17].

In 2018, **Qurat-ul-Ain AN et.al.,** have conducted a study on a stroke survivor's gait characteristics and mobility after dependent on the task circuit practice. The study found that task-specific circuit training enhances mobility and gait metrics. Gait and mobility are both improved by performing certain tasks associated with balance and gait in a circuitous approach[18.]

In 2017 **Kim JH** conducted research into the impact of task-based training on the mobility function and postural stability of those with cerebral palsy children. This study demonstrates that successful and practical Children with cerebral palsy can strengthen their lower limbs over the course of an eight-week task-oriented training program to improve their mobility function and postural stability [19].

In **2016 Han HK et.al.,** conducted an investigation to assess the impact on gait, balance, and gross motor function in cerebral palsy patients. The GMFM, ambulation and equilibrium capacities in CP were examined in this trial to determine how task-oriented training affected them. The study came to the conclusion that activity based instruction , walking, and movement ability can help people with CP [20].

In **2016 MK Franklin Shaju et.al.,** examined task-oriented training's influence on spastic diplegic CP's balance and movement through research. Studies have demonstrated that activity-based instruction and regular regime were beneficial in enhancing the children with spastic diplegia's equilibrium and coordination. Comparing the two groups, compared to the traditional physiotherapy group, the task-based exercise group had greater improvement in mobility and balance [21].

In 2015 **Mansoor Rahman, et.al.,** conducted a pilot study to determine how a circuit training program affected the functional abilities of children with CP who are spastic. The study found that the circuit training used in this study helped children with spastic cerebral palsy improve their standing, leaping, walking, and running abilities[22].

In 2013, **Kumban W et.al.,** implemented an experiment to see how task-specific training affected the functional abilities of kids who have cerebral palsy that is mild to moderate. According to the study, children with cerebral palsy function more successfully when task-specific training is paired with traditional gait training [23].

This study concentrated on improving the gait pattern and encouraging efficient walking in CP children. Spastic diplegic CP children tend to have better improvement with efficient training compared to the other types. Task-specific circuit training as an intervention for spastic diplegic cerebral palsy children helps in the overall enhancement of functional mobility, thus helping the children to perform daily life activities efficiently.

## Conclusion

The study's findings suggest that task-specific circuit training, when combined with routine physiotherapy, is an effective strategy for enhancing gait and functional mobility. The findings of this study suggest that task-specific circuit training can help children with spastic diplegia and cerebral palsy improve their ability to move , gait and benefit from TSCT by having better overall performance and standard of life.

**Ethical clearance:** This study was performed in line with the principles of the declaration of Helsinki. Before recruiting the first participant for the study, the study proposal was submitted to the institutional scientific review board committee for approval. The Saveetha College of Physiotherapy, ethical committee approved the research to be performed on humans after ensuring that it followed all applicable national laws and institutional norms (ISRBNo-01/048/2022/ ISRB/PGSR/SCPT).

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**Conflict of interest:** Nil

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Original Article

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# Impact of Xbox Gaming on Object control skills and Balance for children with autism spectrum disorder-A Pilot study

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**Abstract**

**Background:** Children with ASD could face difficulties in a variety of areas including object handling skills and balance. These issues can impair their ability to accomplish everyday tasks, participate in physical activity and successfully communicate with their surroundings.

**Purpose:** To determine the impact of xbox gaming on object control skills and balance for children with ASD.

**Methods:** A pilot study was conducted with a total of 20 ASD children who were allocated into two groups. The experimental group (n=10) received xbox gaming and the conventional group received conventional therapy (n=10) The therapy was provided for 40 minutes five days a week for eight weeks to both groups. The test of gross motor development scale-2 and a pediatric balance scale were used to determine the before and post-test values of Object control skills (OCSs) & Balance.

**Results:** The results findings shows that the experimental group pre and post-test values using the test of gross motor development scale-2(14.2±4.04,33±8.02) and conventional group (12.2±4.56,23.2±2.85) have a p value of <0.01.Experimental group pre- and post-test values using pediatric balance scale was(30.4±4.59,46.9±5.04) and conventional group was (28±4.94,36.9±5.38)with a p value<0.01.The outcome revealed highly significant differences within and between the two groups.

**Conclusion:** This study concludes that xbox gaming for children with ASD proves a promising way for improving object control skills and balance. Participants revealed significant gains in advanced technology.

**Keywords:** Pediatric balance scale,Test of gross motor development scale-2,Xbox gaming,Object control skills.

## Introduction

Motor development is the process of acquiring key motor abilities that allow people to execute different stances, move around, and handle items[1]. According to research, when children gain motor competencies, their cognitive abilities and athletic abilities increase, which can benefit cognitive growth. Children with Autism Spectrum Disorder (ASD) frequently have limited chances to engage in sporting activities, resulting in a lack of activity that increases vulnerability to illnesses connected with inactivity. According to studies, a significant number of children with autism, which can vary from 50% to 70%, have significant deficits in core motor abilities. These

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kinds of movement disturbances are characterized by difficulties managing fundamental motions which include walking and position, coordination, and balance [2-4]. In short, children with ASD encounter challenges when it comes to partaking in sporting activities, which can have an influence on their development of motor skills and general health.

Basic Movement Skills are a collection of important talents that serve as the foundation for their physical growth. Basic Movement Skills are a collection of important talents that serve as the foundation for their physical growth. Object Controlled skills entails adjusting and directing items and things with parts of the body that include the hands, legs, or another part of the body. Object controlled skills talents comprise the ability to catch and throw an opponent's ball, hitting a football, and efficiently utilizing tool[5]. These talents are critical for developing advanced motor skills required for involvement in activities or sporting activities subsequently in life[5,6].

Balance control is an enthralling issue in cognitive research because it involves a complex interaction of numerous cognitive systems. These consist of handling data, planning of movements, and muscle action timing and sequencing [7].

Kinect Xbox games are a new type of technology that provides participants with an interactive setting that interacts to their movements and body motions, which leads to varied simulators on the video gaming panel [8,9]. This technique serves as an extra mirror for kids with autism, allowing them to see themselves as digital dolls or creatures within the game. These virtual representations replicate and adapt to the motions of the kids, effectively acting in sync with their actual life actions[10]. As a consequence, autistic kids can take part in a one-of-a-kind and realistic experiences, seeing themselves actively interacting and influencing the activities of the characters that appear on the screen.Children can be inspired and engaged by motion-based gaming applications such as Xbox the Kinect (xbk). Playing such games can raise their conviction in their own capacities to accomplish particular abilities (skill-specific self-efficacy) and so increase their chances of acquiring those competencies. In basic terms, motion-based computer games such as Xbox Kinect may be used as a motivational tool for enhancing children's skill acquisition and self-assurance.[11]Children's learning and play engagement can be influenced positively by motion-based computer games that require active physical participation. Children that participate in these activities receive a successful outcome, which leads to favourable criticism that increases their emotional satisfaction along with their emotions of accomplishment. The encouragement of beneficial encounters could enhance children's drive for exploring fresh experiences and things[12].

## Aim

To determine the impact of xbox gaming on object control skills and balance for children with autism spectrum disorder.

## Materials and Methods

This pilot study was carried out in the period of August 2022 to February 2023. 20 participants were diagnosed with autism spectrum disorder (ASD). The participants were selected from special education centre Kamal Deep using a concealed envelope method for random allocation were utilized in this research study.

**Inclusion criteria**

- Children aged between 5 and 10 years old
- Children who had the capability to comprehend and complies with the therapist's instructions
- Children diagnosed with mild and moderate autism as determined by scores ranging from 70 to 106 on the Indian scale for assessment of autism
- Children with ASD diagnosed according to the DSM-V criteria and only those with IQ scores of 70 or above that were independentlyconfirmed bypsychologists were included in this study

**Exclusion criteria**

- Children with any genetic conditions
- Children who have experienced recent fractures
- Individuals with cardiac issues
- Children diagnosed with epilepsy or those who have vision impairment would also be excluded from the study

**Outcome Measures**

**Test of gross motor development scale-2**

The Test Gross Motor Development-2(TGMD-2) is a frequently used assessment instrument for measuring a child's motor competency and identifying any possible motor delays or issues. The TGMD-2 examines both locomotor and object control abilities through a series of subtests.In this object control skills are utilized from this study.The child's performance is used to score each subtest. The grading criteria differ based on the skill being evaluated. The exam includes a variety of tasks, and the child's performance is evaluated and graded depending on certain criteria. A child obtains a score of 1 (properly executed the skill) or 0 (did not correctly do the task)[13.]

**Pediatric balance scale**

The Pediatric Balance Scale (PBS) is a standardized assessment tool used to evaluate balance and stability in children, including those with autism. It is designed to measure a child's ability to maintain equilibrium during various static and dynamic tasks. The PBS provides valuable information about a child's balance performance, which can be used to identify any balance deficits, track progress over time, and design appropriate interventions or therapies to address specific balance challenges[14]

**Procedure**

The children were divided into two groups at random: the experimental group (n=10) and the conventional group (n=10). Over an eight-week period, children in the experimental group enjoyed 40-minute Xbox gaming sessions five days a week. Similarly, the conventional group received the same length of intervention. Prior to being a part of the study, informed assent forms were collected from the children's parents or legal guardians, confirming that they were aware of and consented to their child's participation in the research. During these sessions, children took an active role in simulated sports activities such as soccer, volleyball, bowling, and baseball. They controlled the simulated characters and performed the tasks necessary in the games by using their body motions and gestures.

**Experimental group (Xbox gaming)**

In Kinect sports games players require a Kinect sensor compatible with their gaming console (Xbox 360).19 Inches LED monitor, which serves as equipment.The Kinect sensor allows the games to be controlled solely through body movements, eliminating the need for traditional controllers. When starting the Kinect sports game, follow the onscreen instructions.The therapist chose the sports based on the object control skills and balance in the study.Depending on the game, you need to calibrate the Kinect sensor before their treatment Calibration ensures that the Kinect can track your motions properly.To calibrate the Kinect sensor, follow the on-screen instructions.

Select the Kinect sports that include:

1. **Inbaseball, players** pitching involves standing in the designated position on the pitcher's mound and delivering the ball to the batter with a throwing motion using the upper arm.

- On the other hand, when a player is at bat, they stand in the batter's box and simulate swinging their arm as if they were hitting a bat when the pitch comes their way.
- These two fundamental aspects of baseball, throwing and batting, play a crucial role in determining the outcome of the game, and players work hard to excel in both skills to contribute effectively to their team's success.

2. **In bowling, players** can enjoy the game by standing in front of the Kinect sensor and executing a bowling motion to release the ball.

- To perform a realistic bowling motion by swinging your arm as if you were actually throwing a bowling ball.The kinect sensor will track your body movement and replicate it in the game.
- As you swing your arm,the game will allow you to control the direction and speed of throw.Aim by adjusting your arms trajectory and release the virtual ball by letting go at the desired point.
- The interactive and immersive experiences in these sports video games offer a fun way for players to engage with the virtual world of sports.

3. **In volleyball, players** can enjoy the game by walking around in front of the Kinect sensor, you can control the personality and positioning of your in-game player.

- When the ball approaches, you can use hand motions to strike the ball with virtual precision, imitating a real volleyball hit.
- To block incoming shots, simply raise your hand or both hands above your head When the ball is out of reach, you can execute a dive by physically leaning or lunging forward.
- The Kinect sensor accurately captures your movements, translating them into dynamic actions within the game.
- This intuitive gameplay mechanic allows you to fully immerse yourself in the excitement and intensity of a volleyball match, making for an engaging and interactive gaming experience.

4. **In soccer video games**, players can enjoy an immersive experience that involves various aspects of the sport.

- To kick the ball, participants perform an arching motion with their foot, replicating the action of a real soccer kick.
- Moving about the virtual field allows players to control their in-game characters, manage team formations, and strategize gameplay.
- When it comes to passing, shooting, and tackling, players use their hands and to execute these actions with precision and skill.
- The game captures these hand motions, translating them into accurate and dynamic movements in the virtual soccer world.
- This interactive gameplay offers an engaging and realistic soccer experience, allowing players to score goals, control players, and compete in thrilling soccer matches.

**Conventional Group**

Conventional physiotherapy exercises, including single leg stance, balance board exercises, Frenkel exercises, step up exercises, and step down exercises, form a cornerstone of rehabilitation programs aimed at improving motor skills, coordination, and balance. These techniques are carefully designed to address different aspects of physical functionality and are frequently employed by physiotherapists to aid patient's recovery. For example, the single leg stance exercise focuses on the ability to sustain equilibrium on one leg, enhancing weight distribution and bolstering proprioception the body's innate sense of its spatial orientation. Balancing on a single leg not only challenges the body's stability mechanisms but also encourages the refinement of neuromuscular connections that are vital for coordinated movements.

Balance board exercises and step-up & step down exercises introduce controlled instability, prompting the body to engage a broader range of muscles for stabilization and coordination.

The deliberate challenge of maintaining balance on a dynamic surface or executing precise step movements stimulates both the musculoskeletal and sensory systems, leading to improved motor control and heightened proprioceptive awareness. Frenkel exercises, on the other hand, involve purposeful and repetitive movements that enhance body awareness and proprioception. By consistently engaging in these movements, patients develop a more refined understanding of their own physicality and can better adapt to changes in their surroundings.

## Data analysis & Results

In this study, all variables were analysed based on their mean and standard deviation. To assess significant differences between pre and post-test measurements, the Wilcoxon rank test was employed.

Additionally, to compare the two groups, the Mann-Whitney U test was utilized. Statistical significance was considered achieved when the P-value was less than 0.01.The analysis of the results demonstrated that within each group, there were statistically significant differences in pre and post scores using the TGMD-2 and PBS scores,with a p-value of <0.01(Table1).However, when considering only the pretest scores of TGMD-2 and PBS, there were no statistically significant differences between the group with a p-value of <0.01 (Table 2). Conversely, the post-test scores for TGMD-2 and PBS showed statistically significant variations between the groups, with a p-value of <0.01 (Table3).

**Table 1: Pre and post test scores of TGMD-2 & PBS within a group utilized by experimental & conventional group**

| Outcome measures | Groups | Test | MEAN ± SD | Z value | p value |
|---|---|---|---|---|---|
| TGMD-2 | Experimental group | Pre test | 14.2 ± 4.04 | -2.8031 | .00338 |
| | | Post test | 33 ± 8.02 | | |
| | Conventional group | Pre test | 12.2±4.56 | -2.9341 | .00256 |
| | | Post test | 23.2±2.85 | | |
| PBS | Experimental group | Pre test | 30.4±4.59 | -2.8031 | .00256 |
| | | Post test | 46.9±5.04 | | |
| | Conventional group | Pre test | 28±4.94 | -2.3953 | .00084 |
| | | Post test | 36.9±5.38 | | |

*TGMD 2-Test of gross motor development scale-2 ,*PBS-Pediatric balance scale,

*SD-Standard deviation

**Table 2: Pre-test scores of TGMD-2 & PBS between group utilized by experimental and conventional group**

| Outcome measures | Groups | Tests | MEAN ± SD | Z score | p value |
|---|---|---|---|---|---|
| TGMD-2 | Experimental group | Pre test | 14.2±4.04 | -1.70084 | .08914 |
| | Conventional group | Pre test | 12.2±4.56 | | |
| PBS | Experimental group | Pre test | 30.4±4.59 | -1.66304 | .04846 |
| | Conventional Group | Pre test | 28±4.94 | | |

*TGMD 2-Test of gross motor development scale-2 ,*PBS-Pediatric balance scale,

*SD-Standard deviation

**Table 3:Pre-test scores of TGMD-2& between group utilized by experimental and conventional group**

| Outcome measures | Groups | Tests | MEAN ± SD | Z score | p value |
|---|---|---|---|---|---|
| TGMD-2 | Experimental group | post test | 33 ± 8.02 | -3.74185 | .00009 |
| | Conventional group | post test | 23.2±2.85 | | |
| PBS | Experimental group | post test | 46.9±5.04 | 3.13711 | .00084 |
| | Conventional group | post test | 36.9±5.38 | | |

*TGMD 2-Test of gross motor development scale-2 ,*PBS-Pediatric balance scale,

*SD-standard deviation

## Discussion

The present investigation's major goal was to investigate the impact of Xbox gaming on the balance and object handling abilities of children with autism spectrum disorder (ASD). Based on the findings, it is acceptable to conclude that playing active video games can help children improve coordination and balance. Virtual reality training utilizing technology such as Kinect might be one way to achieve this goal.

Recently, contemporary advances have been gradually included into rehabilitation programs for a wide spectrum of people, including those with ASD.

Using immersive gaming equipment like Xbox and virtual reality technology like Kinect to support skill development in children with autism is a promising method, especially when it comes to enhancing their motor abilities. However, while the study's findings show good benefits, further research with bigger sample numbers as well as control groups would be required to create more convincing evidence. The potential advantages of employing technology-driven therapies in the therapeutic process and skill development of autistic children are still being researched.

According to **Noor et al. (2012)**[15] study findings shows that computers and gaming consoles are the most popular resources among those on the autistic spectrum disorder.

These platforms were found to be frequently used by this population, demonstrating their importance in their everyday lives and activities.

The similarity in findings between the two research emphasizes the continuous dominance of computers and gaming consoles as the principal mode of interaction for people with autism. Such consistent results highlight the value of these electronic tools in adapting to the special needs and preferences of those on the autism spectrum, providing them with essential avenues for interaction, development, and entertainment.

In contrast to the current hypothesis, there was a study **(Berkeley et al., 2001)**[16] that reported some efficiency in object control skills in male children with autism spectrum disorder (ASD).

This difference in findings could be attributed to several factors. Firstly, the study by Berkeley and colleagues used a different methodology and involved tasks that required virtual object manipulation compared to the natural object manipulation tasks were utilized in this study.

As a result, it is plausible to expect different patterns of performance when comparing autistic children with a low level of symptom severity to children across the entire range of ASD (as in the current study, **Jarrold and Brock, 2004)**[17].

The severity of ASD symptoms may influence how object control skills manifest, leading to contrasting outcomes between the two studies **(Edward et al ., 2017)**[18].

In regard to the findings, the short length of the intervention may not have offered enough time for the children to practice and enhance their OCSs skill-related movement patterns.

An AVG program could prove more beneficial if conducted over a longer length of time or integrated into treatment sessions inside a well-planned setting rather than being used as informal recreation in the context of the home.Nonetheless, playing sports-themed AVG games proved to positively alter children's assessments of their ability levels. Even if the objective gains in OCSs abilities were not as noticeable, this increase in self-perception may lead to more positive active actions.

## Conclusion

This pilot study will provide initial insights into the effectiveness of using xbox gaming as an intervention to improve object control skills and balance in children with autism spectrum disorder. The positive results observed in this research pave a way for larger scale studies and encourage the integration of technology-basedintervention intherapeutic approaches for children with ASD.

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Original Article

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# Efficacy of Traditional Kegels Versus Reverse Kegels on Vaginal Atrophy among Post Menopausal Women

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**Abstract**

**Background:** Menopause leads to a dramatic drop in ovarian function which lower the oestrogen in the circulating blood may cause atrophy of vaginal epithelium. Traditionally the atrophy of vaginal epithelium was managed by Kegels exercise but not attempted using reverse Kegels exercise.

**Purpose:** This present study attempted the reverse Kegels exercise and compares the effectiveness with traditional Kegels exercise on vaginal atrophy and vaginal pH among postmenopausal women.

**Materials and Methods:** 32 postmenopausal women in the age group between 40 to 60 years with vaginal atrophy were recruited and randomly assigned to one of the two groups: Traditional Kegels group (n=16) and Reverse Kegels group (n=16). The vulvovaginal symptom questionnaire (VSQ) and vaginal pH test kit were used as outcome measures to assess the vulvovaginal symptoms and vaginal pH level before and after the intervention.

**Results:** The t-test analysis was used to analyse the comparison within and between the groups. The *p* value of the Vulvovaginal symptom questionnaire in post-test values between the groups was 0.0256 ($p$ value < 0.05) which was statistically significant.

**Conclusion:** Based on the outcome measures the participants in the traditional Kegels exercise found to be better in reliving the vulvovaginal symptoms. However, the vaginal pH level in both the groups after intervention does not show any changes.

**Keywords:** Genitourinary syndrome of menopause, pelvic floor muscle, Vulvovaginal atrophy, vaginal pH, Menopause, Reverse Kegels.

## Introduction

Menopause is described as the termination of ovulation once a woman hasn't had a menstrual period for 12 consecutive months, that typically happens in the fourth or fifth decade of life[1]. During the post-menopausal period, reduction in ovarian function results in 95 percent decline in oestrogen production[2] that alters the function of genitourinary tract accompanied with vulvovaginal atrophy which was found to be prevalent approximately in half of postmenopausal women[3-7].

In vaginal atrophy (VA), the epithelium of vagina gets atrophied and dries out, resulting in reduced vaginal lubrication[8] and it is a common

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condition yet frequently ignored, especially among postmenopausal women[2]. VA is now categorised with atrophic vaginitis, urogenital and vulvovaginal atrophy under the new phrase genitourinary syndrome of menopause (GSM)[9].

A study by Palma et al., in 2016 has concluded that out of 913 females, 722 participants have been confirmed with GSM, with the prevalence rate varying from 64.7% to 84.2%, from 1 to 6 years. after menopause[10].

In another study, 15% of female's report VA symptoms prior to menopause, while 40 to 57 percent develop symptoms in their postmenopausal period[2].

Further, the menopause influences the pH level of vagina, as the oestrogen level decreases the vaginal pH level increases. Lactobacillus in the vaginal region produces lactic acid which in turn makes the vaginal pH acidic to maintain the vaginal health and this mechanism alters after menopause as it occurs in response to oestrogen[11].

Optimal vaginal pH level is ≤ 4.5 during the reproductive years, whereas it is >4.5 before menarche and in postmenopausal in absence of vaginal infections[12]. Elevation in the vaginal pH level makes the vagina more prone to infections and aggravates the vaginal symptoms related with VA[13]. Vaginal pH >5 has indeed been reported in certain research as a particular perspective to diagnose menopause with specificity of 64-67%[8].

The atrophy of vaginal epithelium could be managed by pelvic floor muscle training (PFMT) that involves contraction of pelvic floor muscles and it is proved to be an effective management strategy to reduce the symptoms of VA among postmenopausal women in a study conducted by J. Mercier et al., at 2019 that suggests that PFMT improves blood flow in vulvovaginal atrophy[14]. But to the best of our knowledge no study has addressed the effect of reverse Kegels exercise on VA and the impact of exercise on vaginal pH level.

Kegels exercises are the most common technique of strengthening the pelvic floor muscles, originally described by Arnold Kegel, an American gynaecologist in 1948. A non-invasive treatment that does not require the use of vaginal weights or cones and the most cost-effective treatment which differ from other therapies in that patients can do them anytime, anyplace, while doing other work, and without having to visit the hospital on a regular basis. Patients must simply be taught how to tense their pelvic floor muscles[15].

A reverse Kegel is a simple stretching exercise that assists in pelvic floor relaxation. It reduces pelvic pain and tension while also increasing flexibility. Traditional Kegels are a type of exercise that focuses on contracting and releasing the pelvic region and the absolute opposite of reverse Kegels. The goal of reverse Kegels is to release and relax the pelvic floor muscles.

Approximately 70% of women are often hesitant or ashamed to report their problems or seek therapy for them as they think it's natural and part of the aging process and the majority are even unaware of therapeutic options. Cultural, religious, and societal beliefs must also be considered. The signs and symptoms of vaginal atrophy are similar to those of many other genitourinary disorders which lead to under diagnosis as well as under treatment of the condition[7,8].

There is a lack of awareness among the post-menopausal women about the genitourinary syndrome - vaginal atrophy especially among Indian women. Studies with the usage of reverse Kegels exercises on vaginal atrophy among the menopausal women are yet to be explored further. However, to the best of our knowledge, no study has compared the effect of Traditional Kegels with Reverse Kegels on vaginal pH. The purpose of the study is to compare the effectiveness of Traditional Kegels with Reverse Kegels on vaginal atrophy and vaginal pH among postmenopausal women. The alternate hypothesis of this study states that there is a significant difference between Traditional Kegels and Reverse Kegels on vaginal atrophy among postmenopausal women.

## Aim

This present study attempted the reverse Kegels exercise and compares the effectiveness with traditional Kegels exercise on vaginal atrophy and vaginal pH among postmenopausal women.

## Materials and Methods

A total of 48 postmenopausal women were referred from the Department of Obstetrics and Gynaecology to the Department of physiotherapy at a private hospital from August 2022 to January 2023.

**Inclusion criteria:**

- Subjects within the age group of 40 to 60 years
- Subjects who attained menopause either naturally or by surgically induced
- Subjects diagnosed with vaginal atrophy
- Subjects with an elevated vaginal pH level (4.6-7)

**Exclusion criteria:**

- Subjects with any active vaginal infections
- Subjects with UTI
- Subjects under hormonal therapy
- Subjects using topical oestrogen
- Subjects taking any medications for vaginal atrophy

**Outcome Measures**

- Vulvovaginal questionnaire
- Vaginal pH level

**Procedure**

Based on the inclusion and exclusion criteria, 32 subjects were recruited out of 48 in which 28 subjects attained the menopause naturally and 4 subjects had history of hysterectomy. Prior to initiation of procedure after thorough explanation of the study proceedings, an informed consent was obtained from all the subjects. Regular clinical history which includes questions like age, history of amenorrhea, previous surgical history was obtained. The subjects included in this study were blinded and randomly allocated into two experimental groups (group A and B) using a sealed envelope method. Group A (n=16) - received the Traditional Kegel exercises and Group B (n=16) - received the Reverse Kegel exercises. For the pre-test measures the Vulvovaginal Symptom Questionnaire (VSQ), vaginal pH test kit was used to analyse the vulvovaginal symptoms, vaginal pH level and the same was measured after 8 weeks of treatment as post-test values.

The VSQ is a reliable and internal consistent questionnaire, developed to evaluate the quality of life impacts of vulvovaginal symptoms among postmenopausal women. It is a written questionnaire which comprises 21 items and has 4 scales: symptoms, emotions, life and sexuality impact[16]. To assess the vaginal pH level, the subjects were placed in crook lying position and the vaginal swabs were collected using sterile gloves and evaluated immediately with the vaginal pH test strips[13] and it was assessed by an Obstetrician at the Outpatient Department of physiotherapy at a private hospital in Chennai.

The subjects in both the groups were placed in crook lying position and instructed to identify their pelvic floor muscle which stops or slows the urination. Once identified, the subjects in group A who received traditional Kegels exercise were asked to contract the muscles and hold the contractions for up to 24 seconds and relax for about 3 to 6 seconds without holding the breath. They were given 3 sets of 10 contractions per session, twice a day. Holding the contractions progressed from 3 seconds in week 1 up to 24 seconds in week 8.

The subjects in group B who received reverse Kegels exercise were instructed to stretch the pelvic floor muscles as much as possible for up to 24 seconds a cycle. They were given 3 sets of 10 cycles per session twice a day. Stretching the PFM progressed from 3 seconds in week 1 up to 24 seconds in week 8.

The first week of this study period is the familiarization phase. During this phase, the subjects in both the groups performed the exercises only under the supervision of the therapist. After the familiarization- the follow up was done through the phone call until the completion of the study duration.



**Figure 1: Participant from the study performing exercise to sign**

**Data Analysis**

In this study, SPSS version 27.0 was used for statistical analysis. Normality was assessed using the Shapiro-Wilk test. The variable vulvovaginal symptom questionnaire and vaginal pH was found to be normally distributed. For statistical analysis, Independent t test and paired t test was used for both the variables. The significant results were confirmed if *p* 0.05.

## Results

As stated in table 1, group A consists of 16 participants with mean age and postmenopausal period in years of 51 ± 6.26 and 2.81 ± 1.33 respectively. Group B consists of 16 participants with mean age and postmenopausal period in years of 51.13 ± 5.9 and 2.88 ± 1.5 respectively. The baseline variables (age and post-menopausal period) were assessed for normality using Shapiro-Wilk test and were found to be normally distributed. Paired t test was used to analyze the differences in the baseline variables between the groups. The *p* value for age was 0.954and for post-menopausal period was 0.902 indicating that the baseline variables had statistically no difference between the groups ($p>0.05$).

In this study, Table 2 shows the mean and standard deviation (SD) values of both the experimental groups (group A and group B) for vulvovaginal symptom questionnaire and vaginal pH level. The severity of vulvo vaginal symptoms were assessed using a Vulvovaginal symptom questionnaire that had a mean value of 12 ± 3.7 at the baseline and 7.5 ± 3 post intervention for group A and was 12 ± 3.9 at the baseline and 10.5 ± 4.2 post intervention for group B.

The vaginal pH level as assessed with vaginal pH test kit had a mean value of 6 ± 0.86 at the baseline and 6 ± 0.86 post intervention in group A, and was 6 ± 0.74 at the baseline and 6 ± 0.83 post intervention in group B which is stated in table 2. After the completion of the intervention, the mean and SD values of the vulvo vaginal symptom questionnaire for group A was 7.5 ± 3 and for group B was 10.6 ± 4.2. The mean ± SD values of vaginal pH

level for group A was 6 ± 0.86 and for group B was 6 ± 0.83.

The *p* values of the vulvo vaginal symptom questionnaire was 0.026, for the vaginal pH level was 0.967 and thereby indicating the statistically significant difference between the groups as $p<0.05$ for only one variable. This indicates that severity of vulvovaginal symptoms was much reduced in group A than group B. But there is no difference in the vaginal pH level in both the groups. The differences in the mean ± SD of the variables indicated that the participants who received traditional Kegels exercise (group A) were highly benefitted than those who received reverse Kegels exercise (group B).

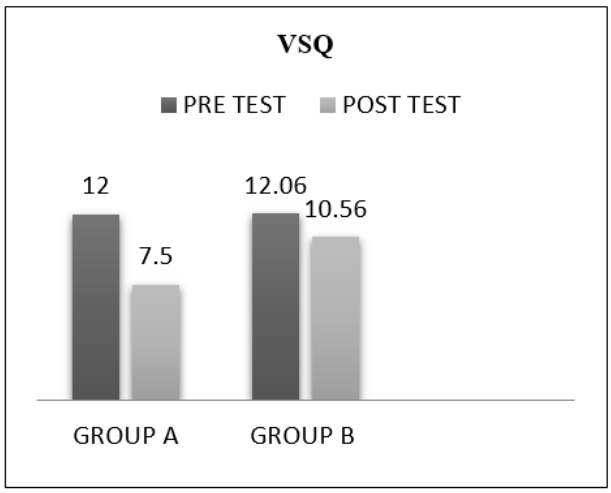



**Figure No. 2**

**INTERPRETATION: Pre and Post Values of Vulvovaginal Symptom Questionnaire**

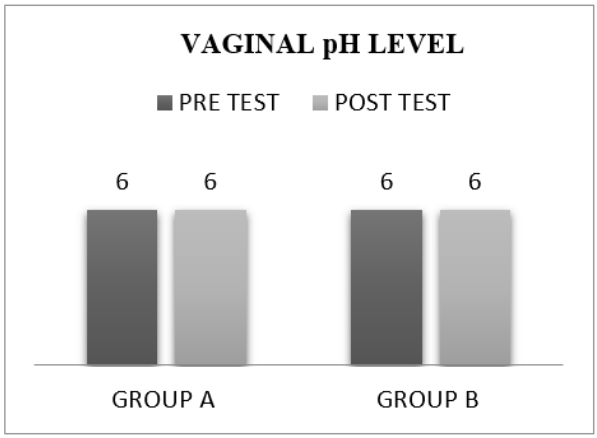



**Figure No. 3 INTERPRETATION: Pre and post values of pH level**

## Discussion

The current study was aimed to test the impact of the 8 weeks' application of Traditional Kegels and Reverse Kegels in vaginal atrophy and vaginal pH among the postmenopausal women. The participants in group A Received Traditional Kegels exercise and group B received Reverse Kegels exercise. The severity of vulvovaginal symptoms as measured using Vulvovaginal symptom questionnaire (VSQ) was found to be reduced in group A with mean ± SD at post intervention was 7.5 ± 3 when compared with group B mean ± SD at post intervention was 10.5 ± 4.2 which indicates participants who received traditional Kegels exercise were responded well compared with reverse Kegels exercise.

**Table 1: Baseline characteristics of subjects in both groups**

| VARIABLES | AGE (IN YEARS) | POST MENOPAUSAL PERIOD (IN YEARS) |
|---|---|---|
| GROUP A (n=16) | 51 ± 6.26 | 2.81 ± 1.33 |
| GROUP B (n=16) | 51.13 ± 5.9 | 2.88 ± 1.5 |
| *p* VALUE | $0.954^{NS}$ | $0.902^{NS}$ |

$^{NS}p > 0.05$ = Non significant

**Table 2: Analyses of differences between the groups for outcome measures**

| STATISTICAL ANALYSIS | GROUP | MEAN ± SD | | p VALUE |
|---|---|---|---|---|
| | | PRE TEST VALUES | POST TEST VALUES | |
| VSQ | GROUP A | 12 ± 3.7 | 7.5 ± 3 | $0.026^{*}$ |
| | GROUP B | 12 ± 3.9 | 10.6 ± 4.2 | |
| VAGINAL pH LEVEL | GROUP A | 6 ± 0.86 | 6 ± 0.86 | $0.967^{NS}$ |
| | GROUP B | 6 ± 0.74 | 6 ± 0.83 | |

*=statistically significant, NS= Non significant

This data shows that the subjects in both the groups have shown a significant difference in their outcome measures. Compared to reverse Kegels exercise, traditional Kegels were much more effective in reducing vulvo vaginal symptoms as the PFM was contracted which results in increased blood flow in PFM unlike the reverse Kegels which only relaxed the PFM and also increased the intra-abdominal pressure. From this study, the traditional Kegels exercise has been proved to be effective in decreasing vulvovaginal symptoms as researchers suggest that PFMT improves the blood supply in the vulvovaginal tissues. It is well known that exercises of skeletal muscle contribute to an increase in the number of capillaries in the target muscles. The arteries which supply PFM also supply the vulvovaginal tissues, so the PFM training improves vulvovaginal blood flow and it leads to a better tissue quality as well as vaginal lubrication [17,18].

Due to various factors, the orientation strength of the pelvic floor decreases with ageing. This might pave the way for postmenopausal women to experience pelvic floor weakness[24].

A hypothesis was introduced by J. Mercier et al., in 2020 who conducted a study to determine the potential means of action for the enhanced GSM symptoms and indications in post-menopausal women with urinary incontinence after the completion of a 12 week PFMT program. The mean values of the vaginal atrophy index pre and post intervention were 9.93 ±.44 and 11.14 ± 1.48. The p value is < 0.001

which is statistically significant. He has concluded that PFMT improves the signs and symptoms of GSM by improving the blood flow in the arteries supplying the vulvo vaginal tissues[25].

A similar hypothesis was introduced by the same author in 2016 who conducted a case study which aimed to find the efficacy of PFMT in reducing signs and symptoms of vulvovaginal atrophy has stated that 12 weeks of PFMT which involves contraction of PFM reduces vaginal dryness and dyspareunia symptoms[18]. But in this current study we have found a similar effect in the participants in group A who received 8 weeks of traditional Kegels exercise which also involves the PFM contraction. An another single-arm feasibility study was conducted by the same author in 2019 involving 30 postmenopausal women with GSM who were treated with PFMT program also supports our study and has revealed that PFMT is the most beneficial and an effective managing strategy for postmenopausal women with GSM and urinary incontinence[14]. There is a lack in research articles to support the effect of reverse Kegels exercise on VA among postmenopausal women. The subjects in the reverse Kegels group also showed an improvement but comparatively less than the traditional Kegels group. The vaginal pH level as measured using vaginal pH test strips with mean ± SD at baseline and post intervention was 6 ± 0.8 in both the groups. This indicates that there was no statistical difference in the vaginal pH level in both the groups even after the intervention which suggests that both the exercises do not have any impact on the vaginal pH level.

The participants in both the groups have shown improvement in vaginal atrophy but the group which involved the administration of Traditional Kegels exercise has shown statistically significant improvement while comparing with the group that involved the administration of Reverse Kegels exercise but there is no significant difference in vaginal pH level in both the groups.

In this study, both the therapist and the assessor were not blinded. Further studies can be done in subjects during their pre and peri menopausal period with larger sample size and extended period of follow up, to evaluate the effect of Reverse Kegels exercises on men along with its comparison with other interventions.

## Conclusion

Based on the outcome measures the participants in the traditional Kegels exercise group found to be better in reliving the vulvovaginal symptoms than the reverse Kegels group. However, the vaginal pH level in both the groups after intervention does not show any changes. Though the reverse Kegels exercise relieves the vulvovaginal symptoms of the postmenopausal women, the traditional Kegels exercise found to have better effect.

**ISRB Approval:** ISRB clearance was taken before recruiting the participants.

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Original Article

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# Efficacy of Swiss Ball Exercise and Resistance Training in Polycystic Ovarian Syndrome

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**Abstract**

**Background:** Women of reproductive age are frequently affected with Polycystic Ovarian Syndrome, an endocrine disorder that causes anovulation and infertility. There is a paucity in the evidence of comparing the effectiveness of the Swiss ball and resistance training among PCOS subjects.

**Purpose:** To compare the effect of Swiss ball exercise and Resistance training in symptoms females with Polycystic Ovarian Syndrome.

**Materials and Method:** A total of 30 subjects were selected from Private Institute. As outcome measures, the menstrual irregularity questionnaire (MIQ), BMI, and abdominal girth measurement were used. Subjects were divided randomly into resistance training group (n = 15) received exercises with dumbbells and Swiss ball training group (n = 15) received exercises with Swiss ball, in addition to aerobic exercise.

**Results:** Females with PCOS symptoms in RTG experienced statistically significant improvement in BMI from 28.3 ± 3.3 to 25.3 ± 3.3, in Abdominal girth 93.6 ± 4.6 to 88.8 ± 4.6, in MIQ 18.3 ± 3.8 to 13.5 ± 3.3, with a p value of < 0.05 than in SBG which had BMI from 28.3 ± 3.7 to 27.9 ± 3.5, Abdominal girth 93.6 ± 5.3 to 92.6 ± 5.3, MIQ 18.1 ± 3.5 to 16.4 ± 3.8, with a p value < 0.05.

**Conclusion:** In comparison to a Swiss ball exercise, resistance training programme combined with aerobic activity is more effective at helping women with PCOS symptoms.

**Key Word:** Stein-Leventhal syndrome, Menstrual Irregularities, PCOS, Resistance training Hormonal Imbalance.

## Introduction

4–12% of women of childbearing age have polycystic ovarian syndrome, a prevalent disorder that affects females[1]. A diagnosis that consists of prolonged anovulation or hyperandrogenism without any adrenal or pituitary problems is known as polycystic ovarian syndrome[2]. Hyperandrogenism and prolonged anovulation are the most common findings in individuals with Polycystic Ovarian Syndrome[3].

A consensual definition of Polycystic Ovarian Syndrome was developed in Rotterdam, the

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Netherlands, in 2003 by the American Society for Reproductive Medicine and the European Society of Human Reproduction and Embryology[2]. The Rotterdam criteria, which defines Polycystic Ovarian Syndrome, states that two of the following three factors must be present for a diagnosis to be made: [1]oligo or anovulation,[2] elevated circulating androgen concentrations (hyperandrogenemia; for example, elevated testosterone, dehydroepiandrosterone), or clinical manifestations of androgen excess (hyperandrogenism; for instance, hirsutism, acne, alopecia), and [3]polycystic ovaries identified by ultrasound. The standard diagnosis of polycystic ovarian syndrome that is most frequently accepted is the Rotterdam version[2].

The aetiology of Polycystic Ovarian Syndrome has not been fully clarified because the source of the condition is uncertain[4]. According to the current theory, an inherited disorder called polycystic ovarian syndrome is brought on by the combination of protecting and predisposing genetic variations, which are subsequently altered by environmental factors (such physical inactivity)[6]. The clustering of patients within families provides evidence for a genetic component and points to an autosomal dominant mode of inheritance[7]. There have been numerous candidate genes examined for a potential causative role in Polycystic Ovarian Syndrome. These researches, however, are still conflicting and unconvincing[8]. So far, no one gene has been definitively linked to the development of Polycystic Ovarian Syndrome[9].

Resistance exercise might be prescribed to Polycystic Ovarian Syndrome women for physiological reasons. The disease's interconnected traits of insulin resistance and androgen excess lead to its aggravation. Given that individuals with Type II diabetes mellitus and Polycystic Ovarian Syndrome share several fundamental characteristics of insulin resistance, resistance training may also improve clinical outcomes in Polycystic Ovarian Syndrome[10]. It has been repeatedly demonstrated that resistance exercise increases insulin responsiveness among these patients. Four studies that used resistance training as part of a lifestyle-based intervention indicate that it is possible to recommend this type of training. Despite the obvious knowledge gaps, resistance training can be used to treat Polycystic Ovarian Syndrome, according to sufficient empirical evidence exercise prescription guidelines[11].

Exercise and nutrition programs are thought to be useful in the management of Polycystic Ovarian Syndrome, especially in obese people[9]. This improves their psychological well-being, self-esteem, anxiety, and so on. As a result, exercises are beneficial to clinical and metabolic health in both the short and long term[6]. In the study by Pitchai et al, 62 percent of the participants were aware of the benefits of exercise in the management of PCOS, and 39 percent were doing so on a regular basis. 95% of the participants in the study agreed to make lifestyle changes as part of their Polycystic Ovarian Syndrome treatment. Weight loss strategies adopted by subject's aid in the normalization of androgen, gonadotropin, and insulin levels, as well as the restoration of menstrual functions[7].

Exercise also has beneficial effects in reproductive function and cardiorespiratory fitness according to Maiya et al., aerobic activities are useful in reducing weight in obese infertile women with Polycystic Ovarian Syndrome by reducing cyst size and boosting ovulation and pregnancy chances[20]. Although there is evidence to support the use of aerobic workouts in Polycystic Ovarian Syndrome management, there is little evidence to support the use of Swiss ball and resistance exercises.

## Aim

The aim of this study is to compare the effectiveness between Swiss Ball Exercise and Resistance Training on improving BMI, Abdominal girth and Menstrual Irregularity Questionnaire (MIQ) in females with Polycystic Ovarian Syndrome.

## Materials and Method

A total of forty-two subjects were chosen by convenient sampling method and were randomly assigned into two groups using concealed envelope method. The study was conducted from the month of September to December 2022 at Private institute, Chennai. Baseline characteristics (age, age of Menarche and average cycle length) were similar for both the groups. BMI, abdominal girth and menstrual irregularity questionnaire (MIQ) was recorded for

pre and post-test and evaluated after 8 weeks of intervention. Each subject was monitored both in person and through video calls based upon their convenience.

**Inclusion criteria:**

- Between the ages of 18 and 35 years
- Subjects with confirmed diagnosis of Polycystic Ovarian Syndrome
- BMI ranging from 23-35 kg/$m^2$
- Subjects having at least two of three Rotterdam criteria.

**Exclusion criteria:**

- Subjects who exercised regularly
- Subjects who had recent abdominal surgery
- Subjects with a history of systemic illness.
- Subjects who were receiving treatment like oral contraceptives and Nutritional therapy for PCOS.

## Outcome measures:

BMI (Body Mass Index), Abdominal girth, and Menstrual Irregularity Questionnaire (MIQ)[12] were used as outcome measures. It measures obesity, waist circumference and menstrual activity respectively.

**Procedure**

A total of 42 females between the age group of 18-35 years with the symptoms of Polycystic Ovarian Syndrome were selected for the study. Out of 42 females 8 females did not meet the inclusion criteria and 4 females declined to participate in the study. Following a thorough explanation of the study and informed consent, using inclusion and exclusion criteria, 30 subjects were selected, and the consent was obtained prior to the commencement of the intervention. The selected subjects were randomly assigned to the Resistance training group (RTG) (n = 15) and Swiss ball group (SBG) (n = 15) using concealed envelope methods. In addition to the structured exercises both the groups received aerobic exercises, warm up and a cool down session. Resistance training was performed using dumbbells.

## Intervention Protocol

The resistance training group's exercise protocol and the Swiss ball training group's exercise protocol both have three phases: warm-up, dynamic phase, and cool-down. Both groups underwent a warm-up and cool-down period of 10 minutes. The warm phase includes breathing exercise, stretching of major muscle groups (Pectoralis Major, Triceps, Biceps, Calf, Hamstrings and Quadriceps). In the warm up phase diaphragmatic breathing was done for 3 minutes and each stretch for 10 second hold with 3 repetitions. The cool down phase includes breathing exercise (diaphragmatic breathing) for 3 minutes and ankle-toe movements, 4 sets with 8 repetitions for both the groups.

Jumping jacks, hopping up onto chairs, wall sits, running in place, high knees and lunges are among aerobic activities included in the first half of the dynamic phase in both groups. Aerobic exercises were performed for 15 minutes, each exercise 4 sets with 8 repetitions. In addition to that resistance training subjects received abdominal curl ups, abdominal oblique curl up, bridging, half-kneeling wood chop, leg raise and dumbbell deadlift up and squats during the second half of the dynamic phase for another 15 minutes, 4 sets with 8 repetitions. The resistance was prescribed according to Delorme's 10RM theory and progressed each week. The second half of the dynamic phase in the Swiss ball training group was given abdominal curl ups, abdominal oblique curl ups, bridging, lower trunk rotation, back extension, side plank and front plank for 15 minutes.



**Fig 1: Abdominal curl ups with swiss ball**

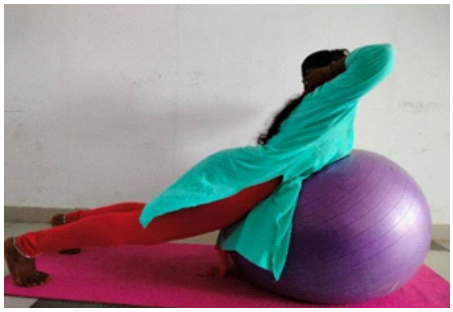


**Fig 2: Back Extension with Swiss ball**



**Fig 3: Bridging with Swiss ball**

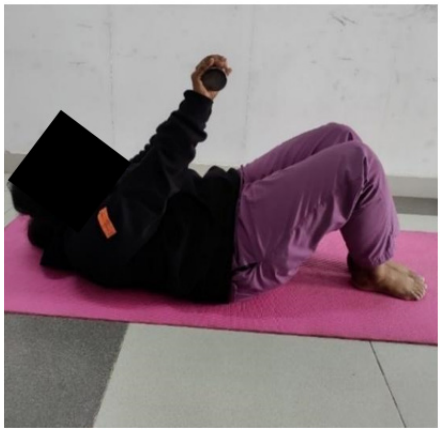


**Fig 4: Abdominal curl ups with dumbbell**



**Fig 5: Half-kneeling wood chop with dumbbell**



**Fig 6: Abdominal oblique curl up with dumbbell**

## Data analysis

SPSS version 27.0 was the software used in this study's statistical analysis. Normality was assessed using the Shapiro-Wilk test. Independent t test and paired t test was used for normal distributed variables BMI and Menstrual irregularity questionnaire. Mann Whitney and Wilcoxon tests were used for non-normal distributed variable abdominal girth measurement. The significant results were confirmed if $p < 0.05$.

## Result

The mean age of the subjects in the Resistance Training group (RTG) was 25.56 ± 4.7 years and in the Swiss ball training group (SBG) was 25.4 ± 4.8 years respectively. The baseline variables (age, age of menarche and average length of cycle) were assessed for normality. Normality was assessed using the Shapiro-Wilk test. Independent t test and paired t test was used for normal distributed variable age. Mann Whitney and Wilcoxon tests were used for non-normal distributed variable age of menarche and average length of cycle. The p value for age was 0.852, for age of menarche was 0.982 and for average length of cycle was 0.403 indicating that the baseline variables had Statistically no difference between the ($p>0.05$).

In this study, Table 1 shows the mean and standard deviation (SD) values of both the experimental groups [Resistance Training group (RTG) and Swiss ball training group (SBG)] for BMI, abdominal girth and menstrual irregularity questionnaire. The mean

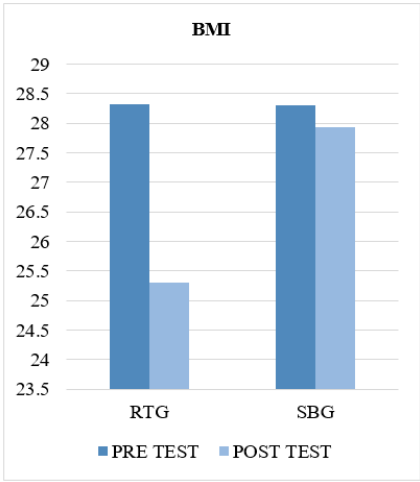
value of BMI was 28.3 ± 3.32 kg/$m^2$ at the baseline and 25.31 ± 3.3 kg/$m^2$ post intervention for Resistance Training group (RTG) and was 28.3 ± 3.73 kg/$m^2$ at the baseline and 27.94 ± 3.5 kg/$m^2$ post intervention for Swiss ball training group (SBG) (Graph 1). The abdominal girth measured by inch tape had a mean value of 93.64 ± 4.62 pre intervention and was 88.86 ± 4.6 post intervention for Resistance Training group (RTG) and for Swiss ball training group (SBG) it was 93.9 ± 5.3 pre-intervention and was 92.66 ± 5.32 post intervention (Graph 1). The mean value of the menstrual irregularity assessed by menstrual irregularity questionnaire for Resistance Training group (RTG) was 18.33 ± 3.8 at the baseline and 13.53 ± 3.3 at the end of the study, and for Swiss ball training group (SBG), the mean value was 18.13 ± 3.5 at the baseline and 16.40 ± 3.8 at the end of the study (Graph 1).

After the completion of the intervention, the mean and SD values of BMI for the Resistance Training group (RTG) was 25.31 ± 3.3 and for Swiss ball training group (SBG) was 27.94 ± 3.5. The mean ± SD values of abdominal girth measurement for the Resistance Training group (RTG) was 88.86 ± 4.6 and for the Swiss ball training group (SBG) was 92.66 ± 5.3. Similarly, the mean ± SD values of the menstrual irregularity questionnaire for the Resistance Training group (RTG) was 13.53 ± 3.3 and for Swiss ball training group (SBG) was 16.40 ± 3.8. The *p* values of BMI were 0.045, for abdominal girth measurement was 0.032 and for the menstrual irregularity questionnaire was 0.039 thereby indicating the statistically significant difference between the groups as $p < 0.05$ for all the three variables. The differences in the mean ± SD of the three variables indicated that the participants who received resistance training along with aerobic exercise (Resistance Training group (RTG)) were highly benefitted than those who received swiss ball exercise along with aerobic exercise protocol (Swiss ball training group (SBG).

**Table 1: Analysis of differences between the groups for outcome measures**

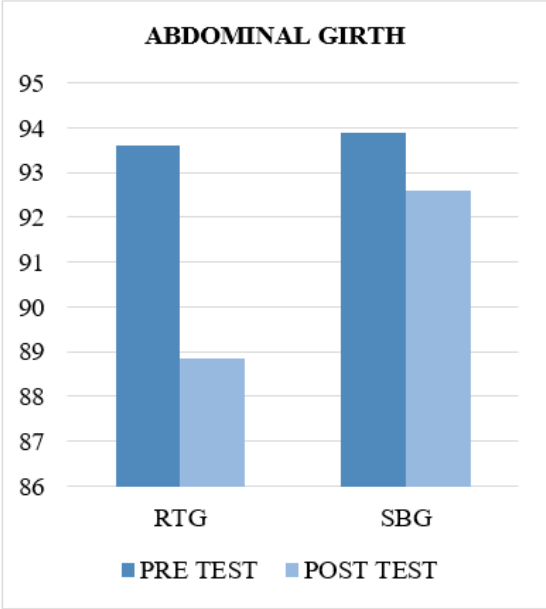
| STATISTICAL ANALYSIS | GROUP | MEAN ± SD | | p VALUE |
|---|---|---|---|---|
| | | PRE-TEST VALUES | POST TEST VALUES | |
| BMI (kg/m2) | RTG | 28.3 ± 3.3 | 25.3 ± 3.3 | 0.045* |
| | SBG | 28.3 ± 3.7 | 27.9 ± 3.5 | |
| ABDOMINAL GIRTH (cm) | RTG | 93.6 ± 4.62 | 88.8 ± 4.6 | 0.032* |
| | SBG | 93.9 ± 5.3 | 92.6 ± 5.3 | |
| MENSTRUAL IRREGULARITY QUESTIONNAIRE | RTG | 18.3 ± 3.8 | 13.5 ± 3.3 | 0.039* |
| | SBG | 18.1 ± 3.5 | 16.4 ± 3.8 | |

RTG – Resistance training group, SBG – Swiss Ball Training group * = statistically significant



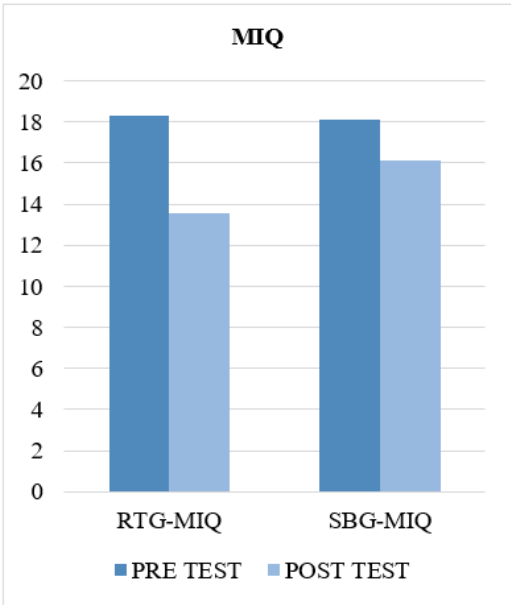

**Graph No 1**

**INTERPRETATION: Difference in the BMI (kg/m$^2$) between the groups before and after the interventions**




**Graph No 2**

**INTERPRETATION: Difference in the Abdominal girth (cm) between the groups before and after the interventions**




**Graph No 3**

**INTERPRETATION: Difference in the MIQ between the groups before and after the interventions**

## Discussion

The aim of our study was to compare the effect of resistance training program with swiss ball training program on reducing BMI, abdominal girth and menstrual irregularity in individuals with Polycystic Ovarian Syndrome. Around 30 participants received the resistance training along with aerobic exercise (resistance training group) and swiss ball training along with aerobic exercise (swiss ball training group). The participant BMI as measured by weight and height was found to be reduced with mean (SD) 25.31 (3.3) kg/m$^2$ in resistance training group when compared with mean (SD) 27.94 (3.5) kg/m$^2$ in swiss ball training group. Which indicates participants who received resistance exercise responded well compared with the swiss ball training group. The abdominal girth as measured by inch tape was reduced with a mean (SD) of 88.86 (4.6) cm in resistance training group and 92.66 (5.32) cm in swiss ball training group indicating the higher reduction in waist circumference in resistance training group than swiss ball training group. The menstrual irregularities measured by menstrual irregularity questionnaire was found to be reduced with a mean (SD) 13.53 (3.3) in resistance training group and 16.40 (3.8) in swiss ball training group which indicated that participants in resistance training group had better improvement when compared to those in swiss ball training group.

Analyzing resistance training and Swiss ball exercises in the treatment of PCOS among fertile females is not well supported by the available research. In PCOS sufferers, we discovered that including Swiss ball exercises in a routine of aerobic exercise dramatically reduced belly fat and menstrual abnormalities with just a minor impact on BMI. Resistance training exercises were observed to help people lose more body weight than their equivalents who received Swiss ball with aerobic exercises.

We discovered safe, enjoyable, moderately intense Swiss ball activities and resistance exercises that make people with PCOS feel better. Exercise-induced weight loss benefits people by boosting ovulation, restoring hormonal balance, and addressing irregular menstruation.

Exercises with a Swiss ball offer an unstable surface that causes the abdominal muscles to contract,

increasing the demands placed on proprioception and raising the strength of the core muscles to their highest possible degree. There will be a co-contraction of the pelvic floor muscles and the transverse abdominis muscle during abdominal activities that target the abdominal muscles, particularly the transverse abdominis. The fasting insulin and insulin resistance are thought to be decreased by aerobic exercise. Interval aerobic exercise raises testosterone levels and affects the central obesity index. Resistance training falls under the genre of anaerobic exercise, which involves making repeated motions against a certain resistance to cause the muscles to contract. The contraction of the muscle, which consists of both mechanical and metabolic qualities, is facilitated by resisted exercise. Exercise improves insulin sensitivity, increases glucose intake, and boosts functional strength.

A study done by Jayabalan Prakash (2021) has found the effect of similar swiss ball exercise protocol in reducing BMI, abdominal fat and menstrual irregularity with a mean difference of 2.9kg and -0.6kg post intervention[12]. Subjects in their study had also undergone a 12-week aerobic exercise along with swiss ball training protocol. In comparison to their study, the subjects of our study have undergone either swiss ball exercise or resistance exercise protocol.

Our findings were also supported by an experimental study reported by Gislaine Satyko Kogure (2016)[13] to determine the impact of progressive strength training, waist circumference, muscle mass index and lean muscle mass which was found to have a p value < 0.01 post intervention.

Studies done by Almenning I[14] and Pericleous P[15] suggested that the performance of resistance exercises improves the overall endurance of the body, hormonal levels, insulin resistance and reduces obesity, thereby having an effect on Polycystic Ovarian Syndrome which supports our findings of strength training exercise also being effective in reducing BMI, abdominal girth and menstrual irregularities. In addition to the designated exercise protocol, all the subjects also received aerobic exercise which had a supplementary effect in reducing BMI. Along with abdominal girth and menstrual irregularity was also evaluated in our study using inch tape and menstrual irregularity questionnaire and the results state that performance of exercises along with aerobic exercise has an effect on reduction in the waist circumference i.e. the abdominal fat.

A Study by Narmadha M (2022)[16] concluded that performance of resistance exercises majorly focusing on core and pelvic floor enhances body composition, skeletal muscle size, together with a decrease in visceral fat, and glycemic control. The major cause of PCOS, hyperandrogenemia, is shut down by this glycol-regulation, which also lowers androgen production. Regular exercise lowers insulin resistance and contributes to the reduction of visceral fat. In order to increase metabolic rate, exercise has an effect that controls insulin protein signaling in skeletal muscles. By managing menstrual cyclicity, increasing ovulation rate, and improving sex hormones, insulin levels, and waist circumference, proper exercise training combined with a hypocaloric high protein diet has addressed reproductive concerns thereby, supporting our findings of resistance training protocol being more effective than the swiss ball training protocol in reducing BMI, abdominal girth and menstrual irregularity.

Blood tests to examine the hormonal alterations due to the effect of exercises could be evaluated in future studies.

## Conclusion

This study compared the effects of resistance training and swiss ball training on PCOS women, and it was shown that resistance training had a better effect than swiss ball training after 8 weeks. According to the study's findings, resistance training with aerobic exercise is more effective than a Swiss ball exercise regimen with aerobic activity to help females with Polycystic Ovarian Syndrome to reduce weight, reduce fat around the abdomen, and address erratic periods. Resistance training has good impacts on PCOS-afflicted women's health outcomes, but it also improves body composition in PCOS patients. Women with PCOS can benefit from the exercise protocols as a non-pharmacological approach to changing their lifestyle and managing their discomforts.

**ISRB approval:** This research work has been approved by the ISRB committee.

**Source of Funding:** Self

**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# Comparison of Structured Exercise Program and Aerobic Exercise on Reducing Pain in Females with Cyclic Mastalgia

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**Abstract**

**Background:** Cyclic mastalgia is described as pain occurring in the breast that begins before menstruation and subsides with the onset of the menstrual cycle. Studies indicate the usage of yoga, LASER and various other pharmacological methods for treating cyclic mastalgia. There is inadequate literature to report the effect of exercises on cyclic mastalgia.

**Purpose:** To compare the effect of structured exercise program and aerobic exercise on reducing pain in females with cyclic mastalgia.

**Materials and Methods:** In phase 1, the prevalence of cyclic mastalgia was analyzed using premenstrual syndrome scale from a private institute. In phase 2, a total of 52 subjects were selected from phase 1 based on the inclusion and exclusion criteria and were divided randomly into two groups, where group A (n = 26) received structured exercises and group B (n = 26) received aerobic exercises, along with breast massage and advice on usage of properly fitting brassiere for both the groups. NPRS and Cardiff breast pain charts were used as outcome measures.

**Results:** In phase 1, percentage calculation was used to determine the prevalence. In phase 2, t test analysis and non-parametric tests were used for post intervention analysis. Both groups have shown a significant reduction in severity and duration of breast pain, but the difference was higher in group A.

**Conclusion:** In phase 1, the prevalence of cyclic mastalgia was 69%. In phase 2, structured exercise protocol was more effective in reducing pain in females with cyclic mastalgia when compared with aerobic exercise.

**Keywords:** Breast pain, menstruation, premenstrual syndrome, discomfort, massage

## Introduction

Mastalgia is a term used to describe breast pain, which is one of the common symptoms experienced by women of the age 15 to 40 years[1]. Studies report that approximately 70% of women are affected in their lifetime[2]. The pain reported is described as sharp, shooting, stabbing, aching, throbbing and a feeling of heaviness[3].

Mastalgia is classified into three types based on the nature of pain and its etiology: Cyclic mastalgia, non-cyclic mastalgia and extramammary mastalgia.[1,2]. Non cyclic mastalgia is often associated with the anatomical changes, injuries, surgeries, any breast pathology such as cysts or fibroadenoma. It is not related to the menstrual cycle. The pain is usually localized, sharp and unilateral. Extramammary

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mastalgia is used to describe pain in the breast having its origin from region outside the breast such as heart, lungs, chest wall or esophagus.[1,2]

Cyclic mastalgia is described as pain in the breast that begins before menstruation and subsides with the onset of the menstrual cycle. Studies report that 67%- 75% of women experience premenstrual breast discomfort[2]. It is reported that 20 to 40 years of life is the period where the occurrence of cyclic mastalgia spikes[1]. The unilateral or bilateral pain experienced is often accompanied with breast tenderness[3]. The pain typically occurs during the luteal phase of the menstrual cycle.[3] Excess estrogen, progesterone inadequacy, an imbalance in the estrogen/ progesterone ratio, changes in the secretion of follicle stimulating hormone and luteinizing hormone, low levels of androgens and high levels of prolactin are considered to be contributing elements to cyclic mastalgia.

Studies report the positive association between physical activity and menstrual period[4]. Exercise leads to the release of prostaglandins in the body contributing to reduction of pain and discomfort. Exercises also have an impact in regulating hormones such as estrogen, progesterone which are the major causative factor of cyclic mastalgia.[3,5.] Similarly, another intervention for cyclic mastalgia was found to be breast massage which stimulates the touch receptors and improves blood circulation thereby providing relief from mastalgia.[6]

Another simple method reported to reduce the severity of cyclic mastalgia is using proper brassiere. 60%-70% of women experienced reduction in discomfort by using proper fitted brassiere as it provides support to the breast during movement[7,8]. A set of guidelines have been suggested by Triumph International regarding the observational criteria to be met for selecting a properly fitting brassiere. Two sections consisting of 4 questions each are used to assess the proper fitting of the brassiere, where a score of zero indicates the usage of properly supporting and fitting bra whereas a positive score (+1 for each question in section A) indicates the bra is too large and a negative score (-1 for each question in section B) indicates the bra is too small[9].

The premenstrual syndrome scale is a 5 point Likert scale consisting of 40 questions comprising 3 sub divisions- physical, physiological and behavioral. The response for each item involves: never, rarely, sometimes, very often and always which are given scores from ranging from 5 to 1 respectively. Score value ranging from 1-40 indicates absence of symptoms, from 41-80 indicates mild symptoms, 81-120 indicates moderate symptoms, 121-160 indicates severe and 161-200 indicates very severe state of premenstrual syndrome.[10]

The Cardiff breast pain chart is used to document the severity and duration of the pain in correlation to various shapes such as a circle for no pain, a triangle for mild pain, and a square for severe pain. The day of the onset of menstruation is marked by the letter P.[11]

Cyclic mastalgia tends to affect the individual's work performance and quality of life. Women tend to manage pain by either oral or topical NSAIDS. Topical application of creams has been reported as inconvenient and individuals are more likely to discontinue using it and oral consumption of drugs interferes with the menstrual cycle, weight gain and so on[12]. Due to these side effects women tend to approach conservative therapies. There are studies indicating the usage of yoga[14], LASER[15], and Primrose oil[15,16] for treating cyclic mastalgia. However, the effect of structured exercises in comparison to aerobic exercises along with the impact of breast massage and supported brassiere in the management of cyclic mastalgia is lacking and this study aims to compare the effect of structured exercise protocol with aerobic exercises in cyclic mastalgia.

## Aim

To compare the effect of structured exercise programs and aerobic exercise on reducing pain in females with cyclic mastalgia.

## Materials and Methods

This study was conducted in two phases from October 2022 to January 2023 in a private university. In phase 1, the prevalence of cyclic mastalgia was determined. In phase 2, the comparison between the effectiveness of structured exercise programs and aerobic exercises in reducing pain in females with cyclic mastalgia was determined.

**Inclusion criteria**:

- Subjects within the age group of 18-40 years
- Subjects with the symptoms of cyclic mastalgia
- Subjects with regular menstrual cycle

**Exclusion criteria:**

- Subjects with irregular menstrual cycle
- Subjects who were pregnant and lactating
- Subjects complaining of pain arising from the chest wall
- Subjects under hormonal therapy
- Subjects taking any medications for mastalgia
- Subjects with the presence of breast pain associated with the lump (non cyclical mastalgia)
- Subjects who are diagnosed with cases of breast cancer or any other condition which is under investigation.

**Outcome Measures**

NPRS and Cardiff breast pain charts were used to analyze the severity and duration of breast pain before and after the study to evaluate the effect of exercises.

**Procedure**

In phase 1, the prevalence of cyclic mastalgia among college students was analyzed using the premenstrual syndrome scale (PMSS). 390 subjects from the age group 18-30 were selected from Saveetha Institute of Medical and Technical Sciences and were explained about the study. The study was conducted from the month of July 2022 to February 2023. Informed consent form was obtained from the participants before the commencement of the study.

In phase 2, a total of 74 females between the age group of 18-30 years with the symptoms of cyclic mastalgia and with regular menstrual cycle were selected from the phase 1 study. Based upon the inclusion and exclusion criteria, 52 females were recruited in phase 2 and the consent was obtained prior to the commencement of the intervention. The NPRS and Cardiff breast pain chart was used to evaluate the severity and duration of breast pain before the study. Using the sealed envelope method, the 52 participants were divided randomly into two groups - Group A (Structured exercise protocol) and Group B (Aerobic exercise protocol). The participants in experimental group A (n=26) received structured exercises such as (Diaphragmatic breathing exercise, thoracic expansion exercise, pectoral stretch, cobra stretch, retractor strengthening- wall push-up, shoulder shrugging and bracing and trunk mobility exercise) in addition to breast massage and advice on usage of supported brassiere. Whereas, the participants in experimental group B (n=26) received aerobic exercises such as (warm up involving diaphragmatic breathing exercise, ankle rotation, ankle toe movements, neck movements, wrist movements for 10 minutes, exercises involving arm rotation, trunk rotation, jogging in place, jumping jacks, marching in place, alternate knee tapping and a cool down phase involving diaphragmatic breathing exercise, ankle toe movements. hamstring stretch, calf stretch for 5 minutes), breast massage and advice on usage of supported brassiere. Table 1 shows the exercise frequency for both structured exercise protocol and aerobic exercise protocol. The participants in both the groups were instructed to perform breast massage in a circular motion by placing both the hands over the upper and lower breast. Selection of a proper well-fitting bra was taught to both the groups using the guidelines set by Triumph. Both the groups performed the exercises on alternate days a week for a total of 8 weeks. After initial training of the exercises, follow up was done using a phone call. The NPRS and Cardiff breast pain chart was used to assess the severity of pain again at the end of 8$^{th}$ week to evaluate the effectiveness of the exercises.



**Figure 1: Participant from the study performing cobra stretch**



**Figure 2: Participant from the study performing trunk rotation**

**Table 1: Structured exercise and aerobic exercise protocol**

| S.NO | GROUP A (STRUCTURED EXERCISE) | | GROUP B (AEROBIC EXERCISE) | |
|---|---|---|---|---|
| | EXERCISE | FREQUENCY | EXERCISE | FREQUENCY |
| 1. | Diaphragmatic breathing | 4 min | Diaphragmatic breathing exercise, | 4 min |
| 2. | Thoracic expansion, Wall push-ups, Shoulder shrugging, Shoulder bracing, Trunk mobility exercise - (flexion, extension, lateral flexion and rotation to both sides) | 4 sets with 8 repetitions | Ankle rotation, Ankle toe movements, Neck movements, Wrist movements, Arm rotation, Trunk rotation, Jumping jacks, Alternate knee tapping, | 4 sets with 8 repetitions |
| 3. | Pectoral stretch, Cobra stretch | 30 seconds hold with 4 repetitions | Jogging in place, Marching in place, | 3 min<br>3 min |
| 4. | | | Hamstring stretch, Calf stretch | 30 seconds hold with 4 repetitions |

**Data Analysis**

In this study, SPSS version 27.0 was used for statistical analysis. In phase 1, frequency was analyzed using percentage calculation for finding the prevalence. The normality was assessed using the Shapiro-Wilk test were $p>0.05$ is indicated as a normally distributed variable. In phase 2, the variable NPRS was found to be normally distributed ($p = 0.056$ for group A and $p = 0.119$ for group B) whereas the variables severity of breast pain ($p<0.00$ for group A and $p<0.001$ for group B) and duration of breast pain ($p = 0.188$ for group A and $p = 0.02$ for group B) were found to be non-normally distributed. For statistical analysis, Independent t test and paired t test was used for the variable NPRS as the data was normally distributed. Mann Whitney and Wilcoxon test was used for the analysis of the variables- severity of breast pain and duration of breast pain as the data were not normally distributed. The significant results were confirmed if $p$ 0.05.

## Results

In phase I, 390 participants responded to the online google survey with the mean age

of 24.2 ± 2.1 years and with an average BMI of 23.4 ± 2.4 kg/m$^2$. From the 390 participants, 270 participants responded as having regular periods while 120 had irregular periods. The participants' severity of physical, psychological and behavioral components of premenstrual syndrome was assessed using the premenstrual syndrome scale. The severity of the physical component is shown in figure 3, the severity of the psychological component is shown in figure 4 and the severity of the behavioral component is shown in figure 5. Among 390 participants, 67 participants had no history of premenstrual symptoms while 44 of them had symptoms quite severe which interfered with their daily activities. Also, the cyclic mastalgia prevalence in the participants was found to be 69%, the occurrence of breast pain was responded as never in 31%, rare in 12%, sometimes in 6%, very often in 36% and always in 15% which is depicted in figure 6.

For phase 2, the mean age and BMI of the subjects in group A was 23.3 ± 3.2 years and 23.5 ± 3.5 kg/m$^2$ and in group B was 24 ± 2.8 years and 22 ± 3.8 kg/m$^2$. The baseline variables (age and BMI) were assessed for normality using Shapiro-Wilk test ($p$ > 0.05 indicates normal distribution). The p value for the variable age in group A was 0.770 and in group B was 0.494. Similarly for the variable BMI, the p value for group A was 0.356 and for group B was 0.640. Both the baseline variables were found to be normally distributed as their $p$ values were greater than 0.05. Paired t test was used to analyze the differences in the baseline variables between the groups. The $p$ value for age was 0.45 and for BMI was 0.78 indicating that the baseline variables had statistically no difference between the groups ($p$ > 0.05).

In this study, Table 2 shows the mean and standard deviation (SD) values of both the experimental groups (group A and group B) for NPRS, severity of breast pain and duration of breast pain. The mean value of NPRS was 4.9 ± 1.5 cm at the baseline and 1.46 ± 1.1 cm post intervention for group A and was 4.6 ± 1.4 cm at the baseline and 2.19 ± 1.2 cm post intervention for group B, which is depicted in figure 7. The severity of breast pain as assessed by Cardiff breast pain chart had a mean value of 1.76 ± 0.42 pre intervention and was 0.76 ± 0.42 post intervention for group A and for group B it was 1.76 ± 0.42 pre-intervention and was 1.15 ± 0.54 post intervention, which is depicted in figure 8. The mean value of the duration of breast pain assessed by Cardiff breast pain chart for group A was 4.2 ± 1.2 at the baseline and 2.1 ± 1.0 at the end of the study, and or group B, the mean duration was 4.7 ± 1.25 at the baseline and 3.2 ± 1.37 at the end of the study, which is depicted in figure 9. After the completion of the intervention, the mean and SD values of NPRS for group A was 1.46 ± 1.1 and for group B was 2.19 ± 1.2. The mean ± SD values of severity of breast pain for group A was 0.76 ± 0.42 and for group B was 1.15 ± 0.54. Similarly, the mean ± SD values of duration of breast pain for group A was 2.1 ± 1.0 and for group B was 3.2 ± 1.37. The $p$ values of NPRS was 0.0334, for severity of breast pain was 0.008 and for the duration of breast pain was 0.001 thereby indicating the statistically significant difference between the groups as $p$ < 0.05 for all the three variables. The differences in the mean ± SD of the three variables indicated that the participants who received structured exercise protocol (group A) were highly benefitted than those who received aerobic exercise protocol (group B).

Table 3 shows the analysis of non-parametric tests which was analyzed using the Mann Whitney U test and Wilcoxon test. The Z score of the variable severity of breast pain was -2.636 and for the duration of the breast pain was -3.224 indicating the statistical significance of hypothesis testing. Similarly, the $p$ value for the variable severity of breast pain was 0.001 and for the duration of the breast pain 0.008 indicating the significant reduction of pain by both the structured exercise protocol and the aerobic exercise protocol.

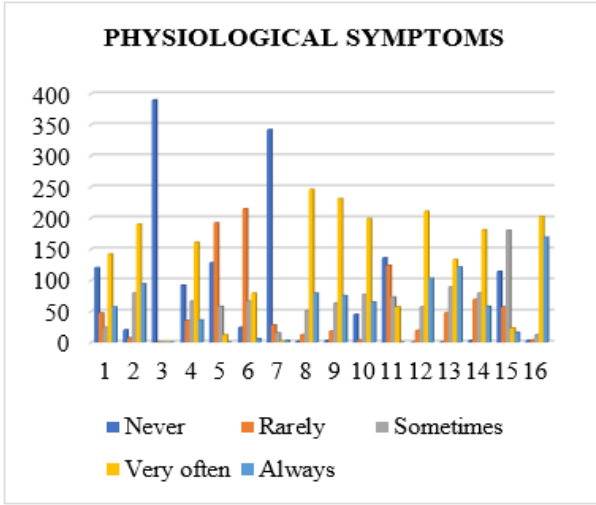



**Figure No 3**

**INTERPRETATION: Severity of physiological symptoms**

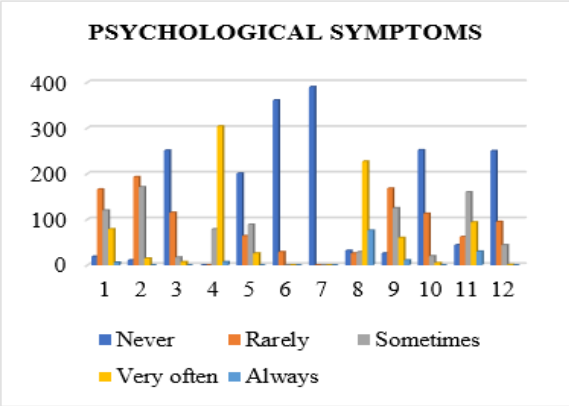



**Figure No 4**

**INTERPRETATION: Severity of psychological symptoms**

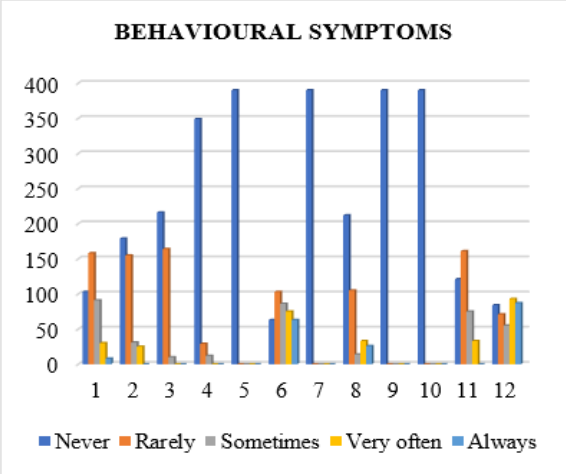



**Figure No 5**

**INTERPRETATION: Severity of behavioural symptoms**

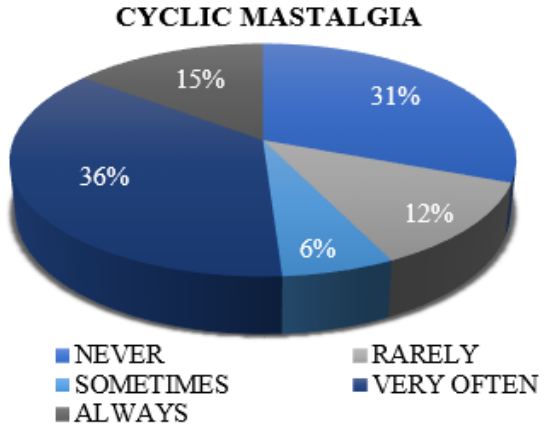



**Figure No 6**

**INTERPRETATION: Prevalence of the severity of cyclic mastalgia**

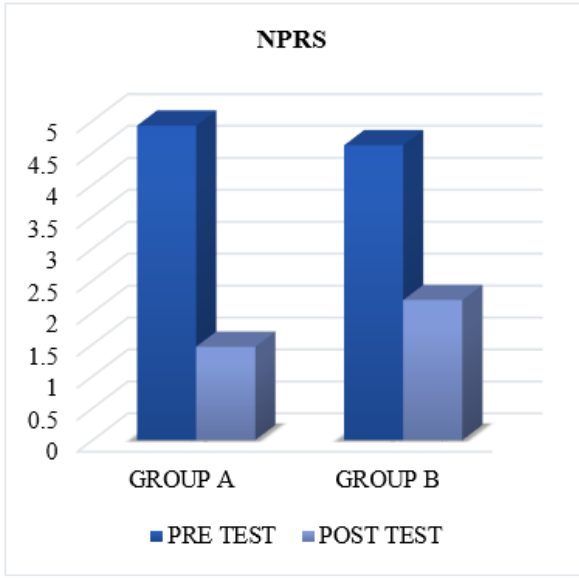



**Figure No 7**

**INTERPRETATION: Difference in the NPRS (cm) score within and between the groups before and after the interventions**

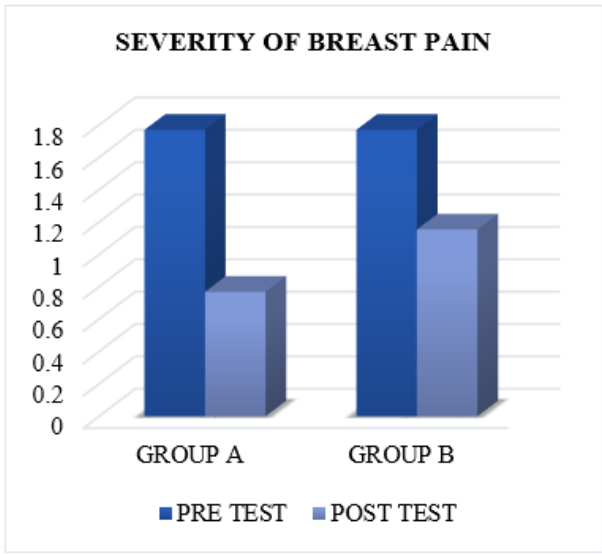



**Figure No 8**

**INTERPRETATION: Difference in the severity of breast pain within and between the groups before and after the interventions**

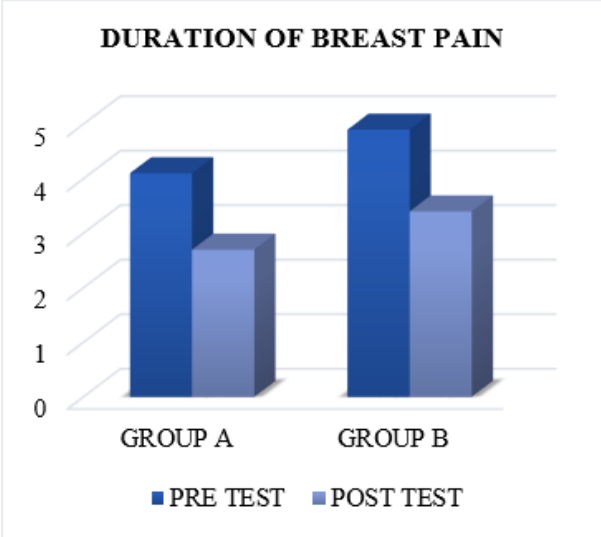



**Figure No 9**

**INTERPRETATION: Difference in the duration (number of days) of breast pain within and between the groups before and after the intervention.**

**Table 2: Analyses of pre and post mean values of the outcome measures of both the groups**

| STATISTICAL ANALYSIS | GROUP | MEAN ± SD | | p VALUE |
|---|---|---|---|---|
| | | PRE-TEST VALUES | POST TEST VALUES | |
| NPRS | GROUP A | 4.9 ± 1.5 | 1.46 ± 1.1 | 0.0334* |
| | GROUP B | 4.6 ± 1.4 | 2.19 ± 1.2 | |
| SEVERITY OF BREAST PAIN | GROUP A | 1.76 ± 0.42 | 0.76 ± 0.42 | 0.008* |
| | GROUP B | 1.76 ± 0.42 | 1.15 ± 0.54 | |
| DURATION OF BREAST PAIN | GROUP A | 4.2 ± 1.2 | 2.1 ± 1.0 | 0.001* |
| | GROUP B | 4.7 ± 1.25 | 3.2 ± 1.37 | |

* = Statistically significant

**Table 3: Test statistics**

| | SEVERITY OF BREAST PAIN | DURATION OF BREAST PAIN |
|---|---|---|
| Mann-Whitney U | 226 | 166.5 |
| Wilcoxon W | 577 | 517.5 |
| Z | -2.636 | -3.224 |
| *p* value | 0.008 | 0.001 |

## Discussion

The aim of our study was to compare the effect of structured exercise programs with aerobic exercise programs on reducing the severity and the extent of pain in individuals with cyclic mastalgia. The cyclic mastalgia was found to be prevalent in 69% of women from phase 1 findings. From that around 54 participants in phase 2 received the structured exercise (group A) and aerobic exercise (group B), along with breast massage and usage of supported brassiere. The participant pain severity as measured by NPRS was found to be reduced with mean (SD) 1.46 (1.1) cm in group A when compared with mean (SD) 2.19 (1.3) cm in group B indicating that the participants who received structured exercise responded well compared with aerobic exercise. The severity of pain as measured by the Cardiff breast

pain chart was reduced with a mean (SD) of 0.77 (0.43) in group A and 1.15 (0.54) in group B indicating the higher reduction in pain in the structured exercise group than the aerobic exercise group. The duration (extent) of breast pain measured using Cardiff breast pain chart was found to be reduced with a mean (SD) of 2.15 (1.08) in group A and 3.27 (1.37) in group B which indicated that participants in structured exercise group had better improvement when compared to those in aerobic exercise group.

A study done by SS Brave (2019) has found the effect of similar structured protocol in reducing pain and tenderness in cyclic mastalgia along with a 12 week yoga therapy which had a mean VAS score of 6.10 ± 1.26 mm before intervention and 2.90 ± 1.24 mm post intervention[3]. In comparison to their study, the subjects of our study have undergone either structured exercise protocol or aerobic exercise protocol and no other additional exercise interventions were added.

Our findings was also supported by a case study reported by N Chauhan (2019) to find the effect of similar structured exercise protocol by measuring the values of VAS and breast tenderness which was found to be 8/10 and 6/kg respectively at the baseline and post intervention the values were 3/10 and 3/kg respectively[2].

Studies done by Ugariza[17] and Samadi[18] suggested that the performance of aerobic exercises improves the overall endurance of the body and enhances the blood circulation, thereby having an effect on premenstrual symptoms which supports our findings of aerobic exercise also being effective in reducing breast pain and its duration. In addition to the designated exercise protocol, all the subjects also received breast massages and advice on wearing supported brassiere which had a supplementary effect in reducing breast pain and its duration.

Studies concluded that performance of exercises majorly focusing on the upper body enhances blood circulation to the target area, and pectoral stretching has a role in reducing the breast pain by breaking the tender points on the muscle fibres which cause pain which, thereby supporting our findings of structured exercise protocol being more effective than the aerobic exercise protocol in reducing the severity and the extent of the breast pain.[2,3]

This study does not assess the baseline physical activity of the participants and the relationship between the breast size and cyclic mastalgia which could be assessed in future studies. Blood test to examine the hormonal alterations due to the effect of exercises was not assessed in this study which could be evaluated in future studies. Isolated effect of the exercises could be determined in further studies.

## Conclusion

The prevalence of cyclic mastalgia was 69% which was reported higher from the participants enrolled in this study. Further, study concludes both structured exercise and aerobic exercise combined with breast massage and the practice of wearing an adequately fitting brassiere reduces the pain encountered before and during menstruation. Among the two interventions, the effect of structured exercise was found to be more significant than aerobic exercise in reducing pain on females with cyclic mastalgia

**ISRB Approval:** ISRB clearance was taken before recruiting the participants.

ISRB number: 01/052/ISRB/PGSR/SCPTIf

**Funding:** Self

**Conflict of Interest:** Nill

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Original Article

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# Effect of Peanut Ball Exercise on Fear of Labour among Primigravida Mother

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**Abstract**

**Background:** Fear of giving birth is the primary factor that has reduced the preference for natural birth. The sudden rise in the percentage of C-sections has harmed women's pregnancy and new-born health.

**Purpose:** To evaluate the effectiveness of peanut ball exercise on reducing fear among primigravida mothers.

**Materials and Methods:** Thirty participants were randomly assigned to experimental (peanut ball exercise, antenatal exercise, antenatal education) and conventional (Antenatal exercises) groups. The fear of childbirth questionnaire (FCQ) was used to evaluate the pre-test the same test used to determine post-treatment values after 12 weeks of the treatment.

**Results:** A significant difference was observed between the experimental and control groups (P =0.0001). peanut ball exercise and antenatal education were effective in mothers with a fear of childbirth.

**Conclusion:** Peanut ball training is effective in mothers with a fear of childbirth.

**Key Word:** pregnancy, antenatal education & exercises, peanut ball exercise, fear, labour

## Introduction

One of the most prevalent childbirths–related fear is around 20%, with 6%-10% of women experiencing poorly functioning or disabling fear of labour and birth. In the population, caesarean section (CS) rates are greater over According to a recently published WHO report, there is a large disparity in CS rates in Asia (19.2%)[1]. Fear of pain, anxiety about perineal damage, low self-efficacy, worry about sexual problems following delivery and fear of maternal and neonatal death is the most common reason for fear of childbirth[2]. The prevalence rate of caesarean sections in India has been steadily increasing over the years. According to data from the 2015-16 National Family Health Survey (NFHS) approximately 17.2% of births in India were Delivered via caesarean section. This suggests a significant rise in the Caesarean section rate compared to previous years. Fear of childbirth, in in addition to negative psychological effects, is strongly linked. Anxiety, depression and a history of having an eating disorder are examples of psychological problem, sadness is another psychological complication that forces mothers to seek counselling in the postpartum period[3,6].

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Using a birth ball during labour is common practice in hospitals that value humanized birth and women's empowerment because it is a low-cost, reusable, non – pharmacological, and non-invasive resource. Based on feedback, nurses and midwives have used birthing balls and peanut balls as alternative non-pharmacologic adjuncts to labour management for decades. The Peanut ball was a different kind of plastic birthing ball which is frequently used by health care professionals as an alternative to the conventional birthing ball for people who are labouring with an epidural because it is more mobile[4].

The physical movements involved in the (PB) exercise can help relieve stress by releasing endorphins which are known as the "feel-good" hormones. These endorphins help improve mood, reduce anxiety and promote a sense of relaxation. By incorporating the peanut ball exercise into their routine expectant mothers may experience a decrease in fear and an increase in overall well-being. "Peanut balls" reduced labour time and increased vaginal birth rates, the use of peanut balls to a significant reduction in labour length and caesarean rates[5].

Regular exercise during pregnancy has been shown to have numerous benefits including helping to reduce fear and anxiety associated with antenatal care. Here are some ways in which exercise can contribute to reducing fear in antenatal care: Promotes a sense of control, Endorphin release, enhances physical fitness, Decrease pregnancy discomforts, social support and connection[7].

Physiological Factors: Sympathetic Nervous System Activation: Fear triggers the body's – "fight or flight" response has been defined by Sympathetic nervous system activation. This results in the production of Stress hormones such as cortisol and adrenaline, which can raise heart rate and blood pressure, and respiratory rate. These changes prepare the body for a potentially dangerous situation but they can also hinder the progress of labour by causing muscle tension and reducing blood flow to the uterus and interfering with the Progression of labour. The birthing person may experience increased pain, Reduced muscle relaxation, and slower cervix dilation. For some individuals, this can lead to prolonged labour or difficulties progressing Through the different stages of childbirth. In cases where fear-induced Physiological responses impede labour progress or pose potential risks to the mother or baby, healthcare providers may recommend a caesarean section.[8]This study aimed to determine whether Peanut ball exercise reduces fear in labour and childbirth.

## Aim

To evaluate the effectiveness of the Peanut ball exercise on fear of labour among primigravida mothers.

## Materials and Methods

It was an experimental study conducted on 30 subjects with a fear of childbirth during the antenatal period age of 20-28 years primigravida mothers taken from Saveetha Medical College and Hospital, Chennai. Convenient sampling Technique.

**Inclusion Criteria:**

- Subjects who are willing to do exercises.
- Primigravida mothers.
- Age group between 20-28.
- Starting of second and trimester mothers (13 to 36 weeks).

**Exclusion Criteria:**

- who had a history of respiratory illness, cardiovascular diseases.
- Mothers with unstable vitals
- who had high-risk pregnancies were excluded.
- Mothers not willing to do exercise
- Subject of multiparous women excluded
- Previous history of surgery
- Intrauterine insemination (IUI) & In vitro fertilization

**Outcome Measure:**

The assessment was performed (before starting treatment) in the antenatal period and after 12 weeks of study before the labour.

- Fear of childbirth questionnaire (FCQ)

**Procedure**

Thirty-five respondents were initially enrolled in the study based on study criteria. Among them 4 lefts after Explaining the procedure and another one-mother transferred to native place. Finally 30 mothers were chosen and the study continued using a convenient sampling technique, Finally, of the 30 Primigravida mothers, n = 15 were allocated to the experimental group, and n = 15 were allocated to the control group. based on the inclusion and exclusion criteria. All individuals provided written informed consent before beginning the study. Assessment of all the included participants was done according to the assessment form.

The primigravida mother with fear of childbirth during the antenatal period was assessed using the FCQ questionnaire to evaluate the pre-test and post-test.

**Group A: (Peanut ball exercise, Antenatal exercises, Antenatal education given)**

Participants receive the peanut ball exercise for the duration of 12 weeks (3 days in the week alternatively) From the second trimester till the third trimester (5th to 8th months) When the Peanut ball Exercises provided by the physical therapist only in OPD with Therapist for 45 minutes exercise for 3 days / 12 weeks. The antenatal exercise was taught for 30 minutes for 3 days /12 weeks first few weeks in the OPD OBG department and then monitored through phone.

- **Pelvic tilt:** with the back on the birthing ball, lean it up against a wall and sit. Push and gently curve the back towards the ball by slightly moving the abdomen. Stronger lower back and uterine muscles can be achieved with this abdomen.
- **Circling movement:** Put the feet slightly wider than hip-width apart on the floor and firmly alight on the ball. In a circular motion, move the hips to "draw" little circles on the Ground with the ball.
- **Side to side:** Starting Position - sitting with feet flat on the floor, buttocks Lightly pressed into the Ball. Action - tilt pelvis to the left and right, and keep head and shoulders Steady. Contract abdominal muscles, so that the trunk remains erect.
- **Side-lying position:** The side-lying position is when you lie on either your right or left Flow of oxygen and blood to the placenta. To assume this position, place a peanut ball between your thighs and wrap both of your legs around it. Keep your legs slightly bent and positioned low beneath you. Alternatively, you can try bringing your legs higher towards your And positioned low beneath you. Alternatively, you can try bringing your legs higher towards your Abdomen creating a squatting position while lying on the bed.



**Figure 1- side-lying position**

- **Bouncing exercise:** The bouncing exercise involves softly and repeatedly bouncing on the A Peanut ball for short durations. This activity aims to enhance Your leg strength, stability and balance.
- Lunge position: Rotate your upper body in order to open up your pelvis. Slide a ball horizontally underneath the top leg placing it between the thigh and the bed. Slowly lower body into a lunge position with the top leg extended Forward and the bottom leg bent at the knee. This variation of the exercise will help to open up the pelvis in a different direction providing a beneficial change to your routine.



**Figure 2: bouncing exercise**

- **Hula hoop exercise**: To engage and strengthen your core muscles can incorporate a peanut ball into your workout routine. Begin by sitting on the peanut ball and placing your hands on hips. Then mimic the motion of hula hooping by rotating hips in a circular motion. This exercise targets your abdominal muscles obliques and lower back helping to improve the stability and tone of the core.
- **Side-lying position:** The side-lying position is when you lie on either your right or left side in bed. This position is beneficial as it helps facilitate a good flow of oxygen and blood to the placenta.
- **Antenatal education given:** Introduction and overview of pregnancy early Signs of labour, relaxation techniques benefits, changes during pregnancy, progresses of labour, breathing awareness, back care, ergonomic advice given.

**Group B: (Antenatal exercise)**

- Breathing exercises, neck stretches, forearm stretches, calf stretches, hamstring stretches, cat and camel exercise, half squats, full squats butterfly stretch, and half circle.

**Treatment protocol:**

- Duration of the session: 30- 40 m
- Frequency: Single session per day / 12 weeks
- Sets: 2 sets Repetitions: 10 repetitions
- Rest: 2-3 mins break between sets

**Data analysis**

**TABLE 1: COMPARISON OF PRE-TEST AND POST-TEST ANALYSIS OF FCQ OF GROUP A**

| Test | Mean | SD | P value |
|---|---|---|---|
| Pre-test | 3.6 | 1.1 | 0.001* |
| Post-test | .48 | .63 | 0.001* |

***WILCOXON SIGNED RANK TEST**: 3

**TABLE 2: COMPARISON OF PRE-TEST AND POST-TEST ANALYSIS OF FCQ OF GROUP B**

| Test | Mean | SD | P value |
|---|---|---|---|
| Pre-test | 3.2 | .86 | 0.001* |
| Post-test | 2.4 | .63 | 0.001 * |

***WILCOXON SIGNED RANK TEST**

**TABLE 3: COMPARISON OF POST-TEST ANALYSIS OF FCQ OF BOTH GROUPS**

| Group | Mean | SD | P value |
|---|---|---|---|
| A | .48 | .63 | 0.001 * |
| B | .24 | .99 | |

***MANN-WHITNEY TEST**

## Results

- The study was conducted on 30 subjects. Both groups have 15 subjects each. Assessed using Kolmogorov-Smirnova, Shapiro-Wick, and Mann Whitney test and Wilcoxon test used for non-normality distributed variable fear of childbirth questionnaire. The significant results were confirmed if p 0.01. Out of 30 subjects were the second trimester 17 and were third trimester 13 .
- Using the FCQ questionnaire for the analysis of the Study revealed that the mean and SD reduction of pain using the (FCQ) pretest was 3.6± .48 and post-test 1.1 ±.63 In experimental exercise and conventional group pre-test 3.2±.86 post-test 2.4 ± .99 the mean Reduction in the experimental group whereas it was less improvement in the conventional group comparatively after the completion of the study. Both groups Significantly improved as measured but in comparison to the conventional group. The experimental group showed noticeably better improvement in alleviating pregnancy-Related fear in the antenatal period.

## Discussion

The peanut ball exercise also known as the birthing ball or stability ball Has gained popularity as a form of exercise during pregnancy. This Exercise involves conducted by Smith et al. (2019)

demonstrated that Pregnant women who engaged in peanut ball exercise experienced Significantly lower levels of fear compared to those who did not Participate in the exercise.

Another study by Brown et al. (2018) found that antenatal women who Regularly practiced peanut ball exercises reported reduced fear and anxiety Along with improved positive emotions and overall well-being[9].

The American Pregnancy Association. The Use of a Birthing Ball During Pregnancy and Labour. Using a sitting bouncing or rolling on a peanut-shaped ball to improve strength flexibility and overall comfort during pregnancy can help the mother feel more comfortable and reassured, reducing anxiety and stress levels. Studies have shown that women who receive continuous emotional support during Labour experience decreased levels of pain perception and require lesser Pain relief interventions (Eisenach et al 2008).

**Limitation**

The (PB) exercise itself might not be sufficient as the sole method of Managing fear or anxiety during the antenatal period. It is crucial to address fear and anxiety with a comprehensive approach that includes Emotional support education counselling and other relaxation techniques.

PB for exercise during pregnancy that may not be suitable for Everyone. Pregnant women with certain medical conditions or Complications may need to consult with their healthcare provider before Engaging in any exercise program including the use of a peanut ball. Additionally, women must be cautious while using the peanut ball and should not overexert themselves especially as pregnancy progresses.

PB are typically used during labor to help optimize fetal positioning and facilitate progression. However, they may not be available in all Birthing facilities or used as a routine practice. It is advisable for expecting Parents to discuss and plan their birth preferences with their healthcare Provider including the use of a peanut ball well in advance to ensure that all necessary arrangements are made.

**Individual differences:** While the use of a (PB) during labour can help Promote comfort and encourage efficient contractions it is essential to understand that its effectiveness may vary from person to person. Each Labour and delivery experience is unique and what works for one woman May not be as effective for another. It is crucial to listen to your body Communicate your needs with your birth support team and be open to Exploring other comfort measures if needed.

**Access and availability:** The use of a peanut ball for exercises may depend on the availability and accessibility of these balls in antenatal care settings. Some healthcare facilities may not have the resources or equipment to Provide peanut balls for every pregnant woman limiting the feasibility and Practicality of using this tool for fear reduction.

## Conclusion

All outcome indicators in both groups showed significant improvement. There was a slight improvement in peanut ball exercise, antenatal exercise, and education, which was statistically significant. This study concluded that Peanut ball exercise reduces fear of childbirth during the antenatal period and it will help them in labour time. A further recommendation for this study was to conduct using increased number of samples.

**Ethical clearance:** The study was approved by the committee of the institutional scientific review board. All study participants were informed about the study objectives and those who agreed to participate signed informed consent forms.

**Funding:** Self

**Conflicts of interest:** The authors declare that they have no conflicts of interest.

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Original Article

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# Effectiveness of Abdominal Hypopressive Technique on Diastasis Recti among Postpartum Women

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**Abstract**

**Background:** Diastasis recti (DR) is the separation of the abdominis rectus muscles in the central region, along with the white linea, in postpartum women. Less attention given towards the management of DR results in further complications such as urinary incontinence, descending reproductive organs, both umbilical and abdominal hernias, low back pain, and pelvic pain.

**Purpose:** The aim of the study is to find the effectiveness of abdominal hypopressive techniques on diastasis recti in postpartum women.

**Materials and Methods:** A total of 44 participants were recruited from the Department of Obstetrics and Gynaecology, SMCH and randomly assigned into 2 groups- Hypopressive exercise group (n = 22) with the mean age of 27.22 ± 1.71 years and conventional abdominal exercise group (n = 22) in with mean age of 26.36 ± 2.25 years. The Digital Vernier caliper and Oswestry Disability Index (ODI) version 2.0 were used as outcome measures to assess the inter recti distance and low back pain at baseline and after 8 weeks. Both therapies were administered 3 times a week for eight weeks.

**Results:** At the end of the treatment session, both groups showed significant improvement in inter recti distance and pain, but the participants who underwent hypopressive exercises had statistically ($p < 0.05$) better results.

**Conclusion:** The study shows that hypopressive exercises can be utilized to treat individuals with diastasis recti in postpartum women.

**Keywords:** Rectus Muscle of Abdomen, Postpartum period, Inter recti distance, Hypopressive technique, Lower Back Pain.

## Introduction

Pregnant and postpartum women frequently experience the condition diastasis recti; in other terms, it is represented as midline inter-recti separation. Postpartum women with a visible longitudinal bulge have efforts and separation of not less than two centimetres at 1 or more than one points along the white linea that includes the umbilicus' level or 4.5 cm above or below it, which are required for determining the diastasis recti[1]. Other contributing

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factors to the occurrence of diastasis recti are maternal age and BMI[1].

Diastasis recti alters the posture and create extra strain on the low back, which decreases the mobility causing low back discomfort [2].

In pregnancy, enlarging the uterus changes the position of the lumbar spine leading to exaggerated lordosis and lengthening of the abdominal muscles. The lines alba may extend and become flaccid in addition to the rectus abdominis muscles, resulting in a potential increase in the distance between the medial borders of the muscles [3].

In postnatal women due to pregnancy period, the muscles in the abdomen are elongated, resulting in weakened and separation of rectus abdominis muscles. If this continues, trunk stability may be compromised, resulting in low back pain (LBP)[4]. According to Gandhi B et al., states that individuals who possess increased inter rectal distance obtain LBP[4]. Estimates show that 4 out of 10 women still experience low back and pelvic pain six months after giving birth [5].

Coordination among abdominal and lumbo-pelvic muscles play a significant role in postural stabilization [6]. Together with the muscles in the abdomen, the diaphragm creates hydraulic effects in the abdominal region that helps stabilize the spine[7,8].

This mechanism is altered in diastasis of rectus abdominis (DRA) which contributes to chronic low back pain [9]. Abdominal Hypopressive technique (AHT) directly stimulates the transversus abdominis and strengthens the abdominal wall[7]. Strengthening the muscles responsible for trunk stability is frequently beneficial in reducing LBP [7,8].

Diastasis recti is diagnosed using computed tomography, magnetic resonance imaging, and ultrasound. Without the involvement of radiation, DR can also be diagnosed using finger width method or vernier caliper method [9,10].

When DR is diagnosed, conservative treatment is the first choice of treatment to improve the morphological, functional, and quality of life of patients [11]. Michalska A et al., reported that core strengthening exercises, posture correction, instruction and training on proper lifting and movement techniques are employed in the treatment of DR [3].

Benjamin DR et al., suggested that abdominal sit-up, crunches, vigorous coughing without abdominal support and moving heavy objects increase the intra-abdominal pressure resulting in bulging of the abdomen leading to increase in space between the inter recti distance [12].

One of the conservative techniques to prevent pelvic floor (PF) disorders after postpartum and for postural training is known as AHT[13-15].

Similarly, in the same year at Europe, Low Pressure Fitness, commonly referred to as Hypopressive exercises, were developed with the aim of aiding postpartum women with the possible effects on the muscles of the abdomen and PF as well as perineal dysfunctions like prolapse or incontinence of the bladder [16].

AHT procedure involves complete exhalation followed by apnea, closing of glottis and widening of thoracic cavity, stretching of diaphragm and producing involuntary stimulation of the deep muscles of the trunk. The addition of this approach to postural exercises promotes the coordinated activity of all postural muscles, including the deep muscle groups in the trunk [17].

In terms of postural techniques, AHT is carried out in a series of postures that often begins with the performer standing up and ends with the performer lying down [18].

Many postpartum women with DR commonly experience LBP due to altered trunk mechanics, impaired pelvic stability and postural change. Moreover, it can have an impact in parturition, trunk movements including (flexion as well as rotation, extension, side-bending) and the support of the viscera of the abdomen, PF functions[19]. Studies have reported the effect of various exercises[20], kinesiotaping[21], electrical stimulation [22] on reduction of the inter recti distance. However, to the best of our knowledge, no study has compared the effect of AHT with conventional abdominal exercises.

## Aim

The aim of the study is to find the effectiveness of abdominal hypopressive techniques on diastasis recti in postpartum women.

## Materials and Methods

This study was conducted at a private Hospital, Chennai from October 2022 to April 2023. A total of 64 postpartum women were referred from the Department of Obstetrics and Gynaecology to the Physiotherapy outpatient department. Out of 64 participants, 20 were excluded based upon the inclusion and exclusion criteria and the remaining 44 participants were included in this study.

**Inclusion criteria**:

- Subjects between the age group of 23 and 30 years who are diagnosed with diastasis recti in their post-partum period
- Subjects with increased inter recti distance > 2 to 5 cm and associated with low back pain persisting from 3 to 6 months or up to 1 year after delivery and difficulty getting up from a sitting or lying down position.
- Subjects who gave vaginal birth with or without episiotomy, who underwent caesarean section, both primi and multiparous women.

**Exclusion criteria:**

- Subjects with Untreated high blood pressure, cardiovascular illness, hernia
- Subjects who are Pregnant
- Subjects who underwent any recent abdominal surgeries (except caesarean section)

**Outcome Measures**

- Digital Vernier caliper
- Oswestry disability index (ODI) 2.0

**Procedure**

The informed consent was obtained from all the participants prior to the initiation of the procedure after thorough explanation of the study proceedings. ISRB clearance was taken before recruiting the participants. The participants included were randomized into two groups (group A and group B) using lottery method and were blinded. Participants were assessed for disability and pain of lower back using Oswestry disability index-(ODI) and inter-recti distance using Vernier caliper at baseline and 8$^{th}$ week. The vernier caliper was placed at the three sites: on & at the level of umbilicus, 4.5cm below and above the level of umbilicus. The 10 ODI criteria are: the degree of pain, the ease of personal hygiene, carrying objects, work, standing and sitting, sleeping, sexual life, interaction with others, and traveling which are used to determine a patient's functional impairment. A patient has a very low level of disability if their ODI is between 0 and 20%, a moderate level of disability if it is between 21 and 40%, a very high level of disability if it is between 41% and 60%, profound functional disability if it is between 61 and 80%, and bedridden if it is between 81 and 100%.[23]

Participants who receive hypopressive maneuver (group A) were instructed to hold their breath (apnea) and stretch their thoracic cage, which cause their abdominal wall to pull inward and downward without inhaling. The women were told to maintain the apnea and thoracic-cage expanding for around 10 seconds before returning to their normal breathing. Once the participants were capable of performing this technique while lying flat, sitting or standing, they were instructed to perform the maneuver in a series of "hypopressive postures." With a variety of both lower and upper limb positions in kneeling, standing, four-point kneeling, seated and lying positions, these positions are explained to the participants. The entire sequence happened 3 times per week for 20 minutes and was carried out for about 8 weeks. While keeping the hypopressive posture, with a rest breath between each session.

The participants in group B received the conventional abdominal exercises which included reverse sit-ups, posterior pelvic tilts, static abdominal contractions, and reverse trunk twists. All the participants in group B were instructed to complete three consecutive sets of twenty reps of each exercise, holding each contraction for 5 seconds and followed by relaxation for 10 seconds, 3 times a week for 8 weeks' period 20 minutes. Every participant was advised to incorporate the same workout practice into their regular routine at home, which was monitored through video call.

**Data Analysis**

In this study, IBM Statistical Package SPSS version 27.0 was used for statistical data analysis. Normality was tested using the Shapiro-Wilk test. Independent

t test and paired t was used to compare the difference between pre and post intervention in both the groups (group A and group B). The significant value was set as $p < 0.05$.

## Results

A total of 44 participants were selected with the mean age of 27.22 ± 1.71 years in group A and 26.36 ± 2.25 years in group B. The baseline variables (age) were assessed for normality using Shapiro-Wilk test and were found to be normally distributed. Paired t test was used to analyse the differences in the baseline variables between the groups.

The *p* value for age was 0.161 indicating that the baseline variables had statistically no difference between the groups ($p>0.05$).

In this study, Table 1 shows the mean and standard deviation (SD) values of both the

experimental groups (group A and group B) for inter recti distance at 3 levels using Digital Vernier caliper and Table 2 shows that the differences between the groups for ODI.

This study revealed that the mean reduction of pain using ODI was 82.68 ± 7.91 at baseline and 52.13 ± 7.79 was post intervention in group A and in group B 82.36 ± 5.26 at baseline and 56.72 ± 4.98 in group B as tabulated in table-2 and figure-5 and the mean Reduction of Inter-recti distance measured in three levels: at the level of umbilicus was 3.55 ± 0.71 at baseline and 2.55 ± 0.71 was post intervention in group A whereas it was 3.56 ± 0.71 pre intervention and 3.21 ± 0.79 in group B, below the level of umbilicus was 2.76 ± 0.22 was pre intervention and 1.74 ± 0.213 in post-intervention group A whereas it was 2.73 ± 0.22 pre intervention and 2.42 ± 0.26 in post-intervention group B, above the level of umbilicus was 2.42 ± 0.33 before intervention and 1.42 ± 0.33 after intervention in group A whereas it was 2.43 ± 0.35 before intervention and 2.21 ± 0.28 after intervention in group B as tabulated in table-1 and figure-2, 3, & 4. Both groups significantly improved as measured by the ODI and inter recti distance measured from Digital Vernier caliper. In comparison to group B, group A showed noticeably better improvement.

The inter recti distance measured at the three levels after the completion of intervention had a *p* value of 0.006 at the level of umbilicus, $p = 0.001$ below the level of umbilicus and $p = 0.001$ above the level of umbilicus. Reduction of pain using ODI post intervention had p value of 0.025 which means that the both inter recti distance measured using digital Vernier caliper and ODI had significantly beneficial.

After the completion of the intervention, the mean and SD values of inter recti distance measured by Digital Vernier caliper at three levels of umbilicus for group A at the level of umbilicus was 2.55 ± 0.71 and for group B was 3.21± 0.79, above the level of umbilicus for group A was 1.42 ± 0.33 and for group B was 2.21 ± 0.28, below the level of umbilicus for group A was 1.74 ± 0.21 and for group B was 2.42 ± 0.26. Similarly, the mean ± SD values of reduction of pain using ODI group A was 52.13 ± 7.79 and for group B was 56.72 ± 4.98. The differences in the mean ± SD of the four variables indicated that the participants who received hypopressive exercise (group A) were highly benefitted compared to those who received conventional abdominal exercise protocol (group B).

Table 3 shows the analysis of non-parametric tests (Mann Whitney U test and Wilcoxon test). The Z score of the variables post intervention above the level of umbilicus was -5.420 and for the below the level of umbilicus was -5.549 indicating the statistical significance of hypothesis testing. Similarly, the *p* value for the variable above the level of umbilicus was 0.001 and for the level of umbilicus 0.001 indicating the significant reduction of inter-recti distance by the interventions.



**Figure 1: Participant from the experimental group performing Abdominal Hypopressive technique**



**Figure 2: Measurement of Inter Recti Distance with Digital Vernier Caliper**

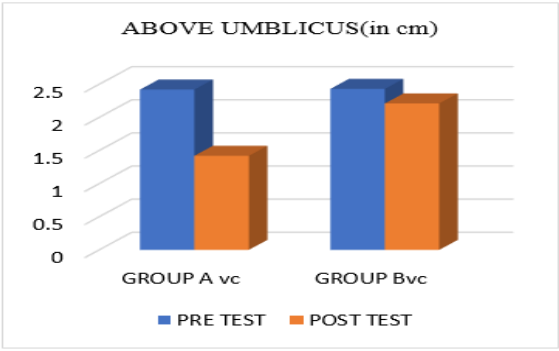



**Figure No. 3**

Interpretation: Groups A and B's pre and post Inter recti distance (in cm) above the level of umbilicus

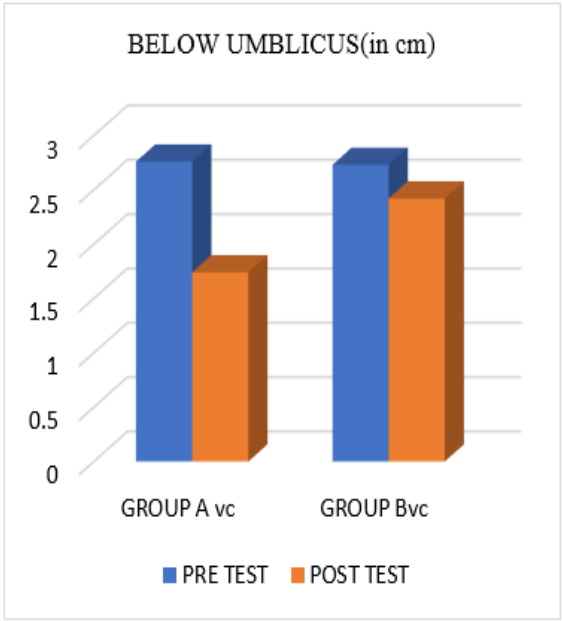



**Figure No. 4**

Interpretation: Groups A and B's pre and post Inter recti distance (in cm) below the level of umbilicus

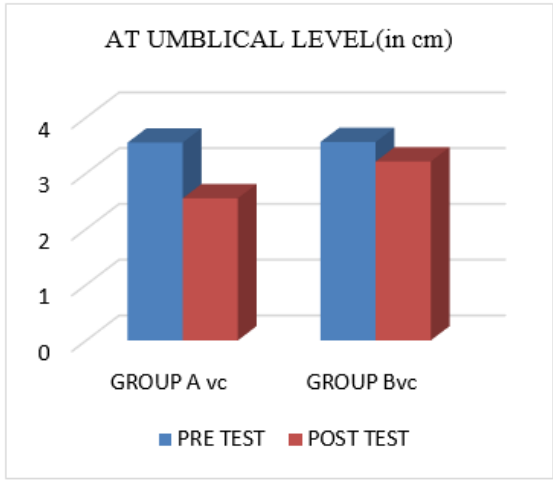



**Figure No. 5**

Interpretation: Groups A and B's pre and post inter recti distance (in cm) at umbilical level

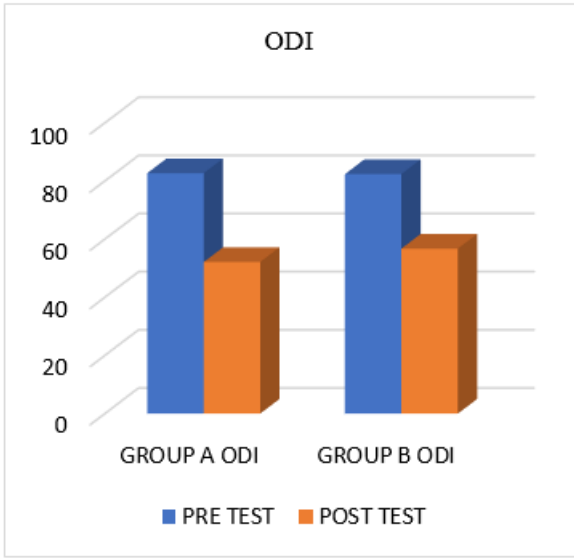



**Figure No. 6**

Interpretation: Groups A and B's pre and post-ODI scores

**Table 1: Analyses of differences between group A and group B for inter recti distance at 3 levels using Digital Vernier Caliper:**

| Statistical analysis of Digital Vernier Caliper | Group | Mean ± SD | | p-value |
|---|---|---|---|---|
| | | Pre-test | Post-test | |
| Above the level of umbilicus | Group A (n=22) | 2.42 ± 0.33 | 1.42 ± 0.33 | 0.001* |
| | Group B (n=22) | 2.43 ± 0.35 | 2.21 ± 0.28 | |
| At the level of umbilicus | Group A (n=22) | 3.55 ± 0.71 | 2.55 ± 0.71 | 0.006* |
| | Group B (n=22) | 3.56 ± 0.71 | 3.21 ± 0.79 | |
| Below the level of umbilicus | Group A (n=22) | 2.76 ± 0.22 | 1.74 ± 0.21 | 0.001* |
| | Group B (n=22) | 2.73 ± 0.22 | 2.42 ± 0.26 | |

**Table 2: Analyses of differences between group A and group B for ODI:**

| **Statistical analysis of Oswestry disability index(ODI)** | **Group** | **Mean ± SD** | | **p-value** |
|---|---|---|---|---|
| | | **Pre-test** | **Post-test** | |
| Oswestry disability index(ODI) | Group A (n=22) | 82.68 ± 7.91 | 52.13 ± 7.79 | 0.025* |
| | Group B (n=22) | 82.36 ± 5.26 | 56.72 ± 4.98 | |

Table 3: Analyses of non- parametric test statistics:

| | **Post above umbilicus** | **Post below umbilicus** |
|---|---|---|
| Mann- Whitney U | 12 | 7.5 |
| Wilcoxon W | 265 | 260.5 |
| Z | -5.420 | -5.549 |
| p value | <.001 | <.001 |

## Discussion

The current study aimed to determine the effect of abdominal hypopressive exercise for Diastasis recti and low back pain among postpartum women. The participants in our study were randomly divided into 2 groups: group A which received hypopressive exercises and group B received conventional abdominal exercises.

The inter recti distance was measured at 3 levels by using Digital Vernier caliper. The mean value of inter recti distance above the level of umbilicus for group A at pre intervention was 2.42 ± 0.33 and post intervention was 1.42 ± 0.33, and for group B in pre intervention was 2.43 ± 0.352 and post intervention was 2.29 ± 0.283. The mean value of inter recti distance at the level of umbilicus for group A before intervention was 3.55 ± 0.710 and after intervention was 2.55 ± 0.710 and for group B before intervention was 3.56 ± 0.710 and after intervention was 3.218 ± 0.793. The mean value of inter recti distance below the level of umbilicus for group A at baseline was 2.763 ± 0.225 and post intervention was 1.745 ± 0.213 and for group B at baseline was 2.731 ± 0.225 and post intervention was 0.422 ± 0.265. The mean values of Oswestry Disability Index which was used to evaluate the low back pain for group A at baseline was 82.68 ± 7.91 and after intervention was 52.13 ± 7.790, similarly for group B before intervention it was 82.36 ± 5.26 and after intervention was 56.72 ± 4.98.

This data shows that the subjects in both the groups have shown a significant difference in their outcome measures. Compared to conventional exercise, abdominal hypopressive exercise was much more effective in reducing inter-recti distance and low back pain as the diaphragm was consistently activated throughout the session unlike intermittent contraction in conventional exercise. A study done by Ramírez-Jiménez M et al., at 2023 has stated that hypopressive exercise programmes had a positive impact on reducing diastasis recti for postpartum women[24]. But in that study the involvement of the control group was not implemented. This study aimed to compare the effect of hypopressive exercise and conventional abdominal exercises to two different groups.

Cañamero-de León S et al.,2019 has reported the effect of an exercise program called as 'No Más Diastasis exercise program' which involved

hypopressive abdominal gymnastics, transverse muscle activation exercises, exercises of oblique and rectus abdominis activation in reducing the diastasis recti in women who had children and since their pregnancy was longer than 8 weeks. The results were obtained (by using a palpation method at three levels of the umbilicus – above the level, at the level, below the level) and concluded that improvements started from the 3rd week and progressed until the 9th week. However, Cañamero-de León S et al., did not evaluate the isolated effect of hypopressive abdominal exercise and presence of a control group to compare the effect of the intervention was not established [25].

Digital palpation with calipers, which has a high level of inter-rater reliability, was used; due to the lack of funding for the present study, quantitative assessment methods such as ultrasonography were not used. Another limitation was that both the therapist and the assessor were not blinded. Future recommendation is to evaluate the effect of AHT on obese men with DR. As DR is quite prevalent in the postpartum period, therapists are recommended to teach AHT as a part of postnatal care since it is effective.

From this study, it appears that in hypopressive exercises, the abdominal muscles, diaphragm, and spine stabilizers are targeted simultaneously, whereas in conventional abdominal exercises, a specific group of muscles is targeted at a single time. Hence, hypopressive exercises in group A are said to be more significant and recovery faster in patients with diastasis recti than conventional abdominal exercises.

## Conclusion

This study results concludes that the hypopressive exercise group showed a statistically superior improvement in inter-rectus distance reduction than those in the conventional abdominal exercise group. Hence, it is important to incorporate Hypopressive exercise to improve posture thus reducing the occurrence of back pain.

**Ethical Clearance:** ISRB clearance was taken before recruiting the participants.

ISRB number- 01 /054 /2022 /ISRB / PGSR/ SCPT

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**Conflict of Interest:** Nil

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Original Article

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# Effectiveness of Swiss Ball Exercise Compared to Mat Exercise on Pelvic Girdle Pain in Antenatal Women

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**Abstract**

**Background:** Pelvic girdle pain (PGP) is pain that occurs frequently in the sacroiliac joint (SIJ), which connects the gluteal fold and the posterior iliac crest, and can spread to the hips and thighs. Pubic symphysis discomfort and PGP can either occur simultaneously or separately. The symptoms of pelvic girdle pain (PGP) include pain and impairment.

**Purpose:** To assess the effectiveness of Swiss ball exercises against mat exercises in alleviating Pelvic Girdle pregnancy-related pain.

**Materials and Methods:** After receiving a thorough description of the study's objectives, 30 Women were chosen from Saveetha Medical College and Hospital based on the inclusion and exclusion criteria. Oswestry Disability Index 2.0 (ODI) and Pelvic Girdle Questionnaire (PGQ) measurements of pain and disability were utilised as outcome measures. Subjects were divided randomly into groups Swiss ball exercises (n=15) and Mat exercises (n=15).

**Results:** The statistical evaluation of Swiss ball exercises and mat exercises yields the following results: We discovered a substantial decrease in Impairment and discomfort, ODI scores (p=0.0029), and PGQ scores (p=0.0001) in the Swiss ball exercise group.

**Conclusion:** At the end of the study, it shows that Swiss ball exercises can be used to treat individuals who have pelvic girdle pain when pregnant.

**Key Word:** Pregnancy, Disability, Low back pain, Symphysis pubis diastasis, Training

## Introduction

Pain which occurs in the pelvic girdle, more specifically around the sacroiliac joint (SIJ), surrounds the gluteal fold and the posterior iliac crest, and may extend to the hips and thighs. Reduced ability to stand, walk, and sit; pain or functional disruption is repeated in clinical testing[1]. Groin girdle Compared to lumbar discomfort, pain is more frequent and causes higher disability in pregnant women. Pelvic Girdle Pain can cause substantial physical handicap, as well as major psychosocial consequences, a lower quality of life, and a higher risk of chronic pain syndrome[2]. Lower back pain, changes to the Pelvic Girdle, and compensatory postural changes, including an

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increase in lumbar lordosis, are all caused by the shift in the maternal centre of gravity. PGP worsens women's pelvic stability and pain by increasing the motion of the thoracic, lumbar, and pelvic joints[3].

PGP is diagnosed with certain provocative tests that can induce discomfort[4]. The three clinical tests for SIJ discomfort that are most theoretically and practically useful are Mennell's test, Patrick's Flexion, Abduction, and External Rotation (FABER) and Posterior Pelvic discomfort Provocation Test (P4). These two tests that are most accurate and reliable for symphysis pubis pain are the modified Trendelenburg test and symphysis palpation[5].

The Swiss ball is a popular training device for core stability exercises in the recreational training environment. The Swiss ball is a conservative back pain treatment alternative that can be used as part of a rehabilitation programme. Its goal is to prevent further occurrences of low back discomfort[6]. The goal of this study is to weigh the advantages and disadvantages of using the ODI as an outcome indicator for monitoring patients with chronic illnesses. The Pelvic Girdle Questionnaire (PGQ), utilised by women experiencing pelvic girdle pain. The reliability, validity, and utility of the PGQ for use in clinical treatment and research have been established. It includes questions regarding activity involvement and physical symptoms[7].

## AIM:

To evaluate whether conventional mat exercises and Swiss ball exercises are more effective at helping pregnant women with pelvic girdle pain.

## Materials and Method:

SMCH's Saveetha Physiotherapy department provided 30 patients with Pelvic Girdle Pain who were between the ages of 23 and 30 for this experimental investigation. The study took advantage of convenient sampling along with random assignment. The study was conducted between September 2022 to December 2022.

**Inclusion Criteria:**

- Subjects who had previously experienced back pain, soreness and stiffness in the pelvic joints
- Subjects who had trouble in walking, climbing stairs, rolling over in bed, getting from sitting to standing, and difficulty standing on one leg (for example, getting dressed or putting on trousers) and
- Subjects those who had presented with positive sign in special tests (Mennell's test, Patrick's Flexion, Abduction, and External Rotation (FABER) and Posterior Pelvic discomfort Provocation Test (P4), Trendelenburg test and symphysis palpation) were included.

**Exclusion Criteria:**

- Subjects, those who consume medication for back pain
- Subjects who had history of respiratory illness, cardiovascular diseases,
- Subjects with unstable vitals and
- Subjects who had high risk pregnancy were excluded.

## Outcome measures:

- Oswestry disability index 2.0 (ODI)
- Pelvic girdle questionnaire (PGQ)

**Procedure**

The criteria for inclusion and exclusion were taken into account when choosing participants. Participants were informed of the procedure before being requested to sign a consent form. All of the participants that were included were evaluated in accordance with the assessment form. Two groups—groups "A" and "B"—of participants were randomly assigned. Assessments were done at the beginning and four weeks into the trial.

**Group A: Swiss ball exercises**

Swiss ball exercises group (n=15) received warm up (Breathing exercises, calf and hamstring stretching for nearly 5 minutes) followed by

1. **Pelvic tilt:** With your back on the birthing ball, lean it up against a wall and sit. Push and gently curve your back towards the ball by slightly indulging your abdomen. Stronger lower back and uterine muscles can be achieved with this exercise.



**Figure 1: Pelvic tilt**

2. **Circling movement:** Put your feet slightly wider than hip-width apart on the floor and firmly alight on the ball. In a circular motion, move your hips to "draw" little circles on the ground with the ball. Start with 10 anticlockwise repetitions, then move to 10 clockwise.



**Figure 2: Circling movement**

3. **Side to side:** Starting Position → sitting with feet flat on the floor, buttocks lightly pressed into the Ball. Action - tilt pelvis to the left and right, keep head and shoulders steady. Contract abdominal muscles So that the trunk remains erect.

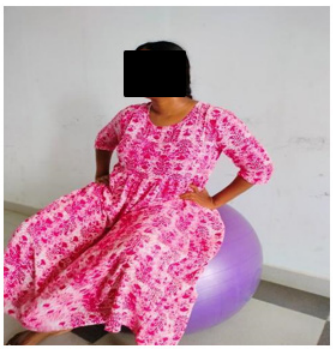


**Figure 3: side to side**

4. **Side bending:** Place your feet hip-width apart on the floor in a Swiss ball position. In order to avoid "hunching" your back and shoulders, lean slightly forward. Your hips, shoulders, and ears should all be in a straight line going up and down. Reach with your left arm while bending your upper body to the left. Raise your right arm overhead. As you bend, keep your upper body looking forward; don't twist it to the side. Ensure that the muscles along your side, from your lower back up to your shoulder, are being gently stretched. For 20 seconds, maintain the stretch. Go back to the beginning place. Stretch two more times. Stretch in the other direction after switching sides. A second time.



**Figure 4: side bending**

**Group B: Mat exercises**

Mat exercises group (n=15) received warm up (Breathing exercises, calf and hamstring stretching for nearly 5 minutes) followed by

5. **Cat and camel:** Begin by getting down on your hands and knees while on all fours. Make sure the shoulders, knees and hips are all in line, and that the wrists are straight. Maintain a tight core, a flat back, and a neutral spine. It is the starting place. Then inhale deeply. Pull the spine upwards towards the heavens as you exhale. Alternately, draw the belly button towards the spine while maintaining a strong core. Pulling your chin towards your chest will help you to relax your neck. The

position ought to resemble a cat extending. Arch your back as you inhale while relaxing your tummy. As you lift your head, tilt your tailbone up towards the ceiling. The neck should not be compressed. The Cat and Cow stretch is done in the cow stance. Breathe in and out with each movement as you continue to travel from cat to cow. Exhale as you adopt the cat stance while inhaling as you adopt the cow pose. In order to get the maximum rewards of the cow cat stance, you must perform at least 10 repetitions of it or until your abs, hips, spine, and neck are sufficiently warmed up.



**Figure 5: cat and camel**

6. **Child pose:** Put your toes together and spread your hips apart while you knead the mat. Put your head down, lean back a little, and extend your fingers in front of you.



**Figure 6: child pose**

7. **Backward stretch:** Test out the backward stretch to loosen up your thighs, pelvis, and back. Maintaining straight arms and placing your hands directly beneath your shoulders, begin on your hands and knees. Until your knees become comfortable, bend backwards towards your heels. Maintain an extended stance with your arms out in front of you. Then, go back to your starting position after holding for a while. Up the number of repetitions gradually to ten.

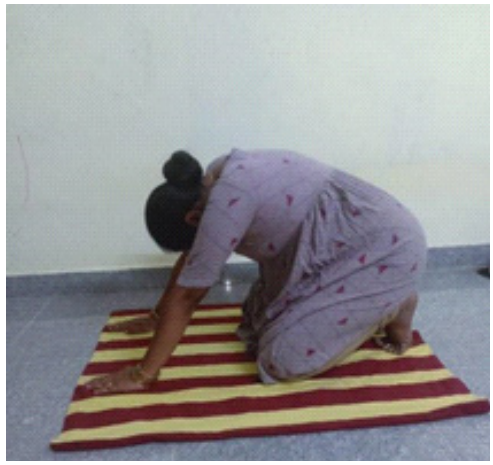


**Figure 7: backward stretch**

8. **Butterfly stretch:** Legs outstretched in front of you while sitting on the ground with your back straight. Your feet should be touching as you crouch down and bend your knees. Your feet or ankles can be held using your hands. Your thighs will descend to the floor if you gently press down on them. Inner thighs and the region around the groin should expand out. Continually breathe out after holding the stance for 30 to 60 seconds. Do this two to three times.



**Figure 8: butterfly stretch**

**Data Analysis**

**Table 1: Analyses of differences between the groups for ODI**

| STATISTICS | ODI | |
|---|---|---|
| ANALYSIS | SWISS BALL | MAT |
| MEAN | 50.80 | 59.33 |
| SD | 7.38 | 6.92 |
| N | 15 | 15 |
| Unpaired t test value (df,28) | 3.2658 | |
| P value | 0.0029* | |

***= Statistically significant**

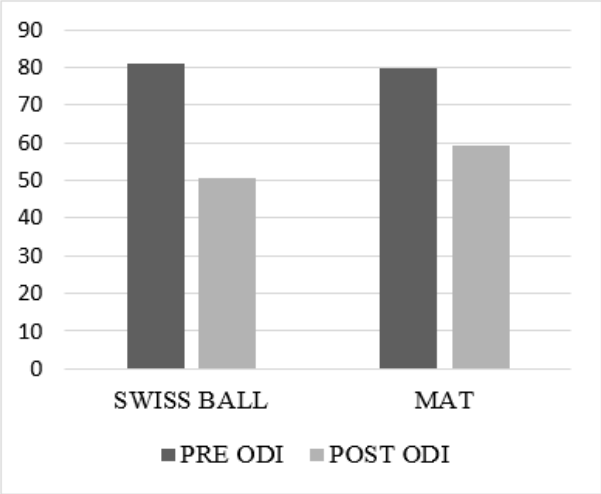



**Table 2: Analyses of differences between the groups for PGQ**

| STATISTICS | PGQ | |
|---|---|---|
| ANALYSIS | SWISSBALL | MAT |
| MEAN | 47.67 | 73.47 |
| SD | 9.54 | 7.16 |
| N | 15 | 15 |
| Unpaired t test value (df,28) | 8.3747 | |
| P value | 0.0001* | |

*= Statistically significant

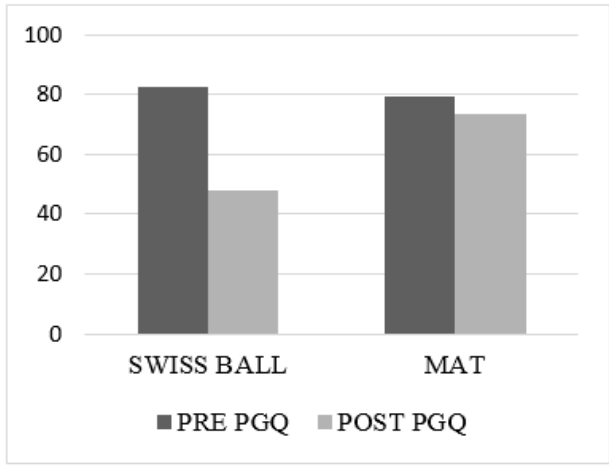



**Table 3: Demographic characteristics of included participants.**

| | |
|---|---|
| Age (years) (Mean ± SD) | 26.3 ± 2.2 Years |
| Participants | 30 |
| 2nd trimester | 22 |
| 3rd trimester | 8 |

**Table 4: Comparison of Pre-test and Post-test variables**

| Outcome | Pre-test (Mean ± SD) | Post-test (Mean ± SD) | P value |
|---|---|---|---|
| ODI | 80.4±0.98 | 55.05±6.01 | <0.0029 |
| PGQ | 80.75±2.05 | 60.5± 18.2 | <0.0001 |

## Result

- Age and trimester were considered as the baseline characteristics. Out of 30 subjects 22 were second trimester and 8 were third trimester.
- Using PGQ questionnaire and ODI questionnaire for the analysis of the pain in the pelvic girdle, the results of the study were assessed in regards to the severity of pain and impairment.
- Graph pad InStat 3 demo tool was used for statistical analysis. This study revealed that the mean reduction of pain using ODI was 81.13 ± 50.8 in Swiss ball exercises and 79.66 ± 59.33 in Mat exercises and p value 0.0029 and the mean Reduction of PGQ was 82.26 ±

47.66 in Swiss ball exercises whereas it was 79.33 ± 73.46 in Mat exercises and p value 0.0001 after the completion of the study.

- Both groups significantly improved as measured by the ODI and PGQ. In comparison to Mat exercises, Swiss ball exercises showed noticeably better improvement.

## Discussion

Significant predictors of PGP included women with many children, past back pain, and past low back pain. Pregnancy-related biomechanical changes, strain on the pelvic and back bones, excessive stretching, or cumulative damage to the pelvic soft tissues may all contribute to this[13]. In the current study, the majority of respondents were pregnant women in their second trimester, in contrast to the published studies where most of the participants were women who were in the final trimester of pregnancy, when the PPGP symptom typically peaks with a mean gestation of 31 weeks. Additionally, there is a lot of variation in the outcome measurements. In other studies, for instance, self-report tools like questionnaires and pain site drawings were used[14]. According to the current study, there is a significant relationship between previous back pain and PGP discomfort and pelvic girdle pain in pregnant women. Numerous studies have identified equivocal risk factors, the recurrence of PPGP with successive pregnancies, and the absence of preventive strategies[15]. Symptoms can be reduced and the progression of symptoms can be stopped with conservative treatment methods which include altering one's activity level, wearing pelvic support clothing, controlling acute exacerbations, receiving physiotherapy, and engaging in regular exercise. In order to manage PGP, a multidisciplinary team includes general practitioners as a crucial component. With an estimated prevalence of 4–84%, during pregnancy common conditions include lower back discomfort and pelvic girdle pain (PGP). Uncertain definitions and diagnostic standards are to blame for the variation in incidence. The onset of pregnancy pain often occurs between 14 and 30 weeks gestation, however it can occur at any time during pregnancy and after delivery[16].

PGP in pregnancy will be the main topic of this article. According to an Australian study, only 25% of the female PGP reporting patients received any sort of treatment, and many practitioners do not consider PGP to be a serious pregnancy problem[17]. Exercises using a stability ball can improve daily living activities and lessen pregnancy low back pain. This programme of stability ball exercises offers healthcare practitioners an evidence-based intervention.

It is possible to lower the rate of handicap in pregnant women who are in the second half of their pregnancy by undertaking exercise activities and receiving training on how to execute everyday tasks correctly. It indicates that by engaging in preventive behaviours such as proper standing, sitting, and resting during pregnancy, pregnant women were able to lessen the degree of incapacity caused by back pain in the second half of their pregnancies. The women who did not take part in the training programmes raised their level of knowledge of the issue through personal experience or by seeking advice from others, but they were unable to lower the impairment rate. Average scores on disability in daily activities were compared between the two groups, and they revealed a substantial difference in the rate of daily activity disability brought on by around the third trimester of pregnancy, low back pain.

Chiu-FangYan MS, CNM, RN (Clinical Instructor) et al., 2014 has concluded as, clinical application of the stability ball exercise programme may be a useful supplementary tool for women in their second and third trimesters for enhancing their exercise behaviour, lowering their risk of low back discomfort, and minimizing interference with daily activities[18]. Faiqa Izhar et al., 2020 has also concluded that the Exercises using a balance ball and ergonomics training were successful in treating low back discomfort brought on by pregnancy. Exercises with a stability ball, however, were more successful in lowering the impairment[19]

## Conclusion

The outcomes of this investigation indicate that a 4-week intervention for women with Pelvic girdle pain including Swiss ball exercises were crucial in lowering pain and impairment. The study's objective was to assess the efficacy of mat exercises and Swiss ball exercises for women experiencing pelvic girdle pain which was achieved since the discomfort and functional limitations of the patients are momentarily

lessened by Swiss ball exercises. The results are distinctive due to the sharp decline in PGQ and ODI scores. This study thus provides the evidence in favour of using Swiss ball activities as a non-invasive, reasonably priced therapy for pelvic girdle pain.

**ISRB approval:** This research work has been approved by ISRB committee

**Source of Funding:** Self

**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# Effect of Task Oriented Approach on Cancer Related Fatigue and Functional Capacity among Subjects with Blood Leukaemia

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**Abstract**

**Background:** Cancer is the second leading cause of mortality worldwide.19.3 million new cases and 10.3 million deaths from cancer were reported worldwide. Cancer-related fatigue (CFR) has a complicated aetiology. Fatigue has a more detrimental influence on daily tasks and quality of life (QoL) than other ailments like pain or grief. This study aimed to determine the effect of task oriented approach on cancer related fatigue and functional capacity among subjects with blood leukaemia.

**Methods:** A randomised, clinical trial was conducted with a total of 30 blood cancer survivors. Subjects were randomised into a radiation therapy group (RT group) (n=15) and non-radiation therapy group (NRT group) (n=15). Both groups included a task oriented approach for 1section/day, 5 days /week for 4 weeks. The main outcome was fatigue as assessed by the Brief fatigue inventory, Other evaluated outcomes were functional capacity and Quality of life measured using 6 minute walk test and EORTC QLQ C30 (Version 3) . Data were collected at baseline and post-intervention.

**Result:** There is a significant improvement in both group in cancer related fatigue after the intervention, two groups, non-radiation group show much better improvement comparing to participants under radiation with a mean difference of 3.4 in Brief Fatigue Inventory, 5.93 in 6 minute walk test, 16.46 in EORTC QLQ C30 (Version 3).

**Conclusion:** It has been concluded that Task oriented approach has better effect on reducing the fatigue caused by cancer and enhancing the functional capacity, quality of life among blood leukaemia individuals. Participants who are not under radiation therapy have better prognosis than participants under radiation therapy.

**Keywords:** EORTC QLQ C30 (Version 3), Task oriented approach, Radiation or Non-radiation therapy, Fatigue, Blood Cancer.

## Introduction

Cancer is an unchecked cell proliferation that has the potential to spread to other bodily areas. According to the type of cancer, the mortality rates of the various cancers vary[1]. While rates varied greatly between countries, globally, the incidence rate for all malignancies combined was 19% higher in males (222.0 per 100,000) than in women (186 per 100,000) in 2020[2]. With over 1 lakh people receiving a blood cancer

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diagnosis each year, blood cancer has become one of the leading causes of mortality in India. Leukaemia accounted for 309,006 cancer fatalities and 437,033 new diagnoses in 2018, ranking as the 15th most often diagnosed cancer and the eleventh leading global cause of cancer-related mortality. The prevalence of the leukaemia disease is higher in men than in women worldwide. Male mortality was also greater than female mortality (4.2 per 100,000 versus 2.8 per 100,000)[3]. According to GBD estimates, population growth and aging were responsible for 97% of the increase in leukaemia incidence from 2005 to 2015, which was a global increase of 26%[4]. The estimated number of cancer cases in India is 600,000[5]. One of the frequent and the toughest symptoms reported by cancer sufferers is cancer-related fatigue (CRF). "NNCN (The National Comprehensive Cancer Network) defines CRF as "a distressing, persistent, subjective sense of physical, emotional, and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning"[6].After the end of treatment, CRF may continue for up to 5 years or even longer[7-9]. Even though the cause of CRF is uncertain, some molecular factors, including Pro-inflammatory cytokines, dysregulation of the hypothalamus -pituitary-adrenal axis[10], circadian rhythm desynchronization, skeletal muscle atrophy and genetic dysregulation, have been proposed[11]. The subsequent CRF risk elements were discussed in Bower[12]: inherited dangers (like single nucleotide polymorphisms), psychological warning symptoms (like melancholy), and psychological risk factors (like bodily inactivity). Exercise may focus on some of these elements. For instance, resistance training can prevent the wasting of skeletal muscle. In the 'Implementing Evidence in Practice' tool from the Oncology Nursing Society, work out and bodily activity were recommended as an initial-line therapy for CRF[13]. CFR has a complicated aetiology. Reduced physical activity and circumstances connected to the illness or its treatment combine to cause it. The continuation of physical activity is crucial in the management of weariness. Applying certain physiotherapy helps patients become more active, feel less worn out, as well as enhance their functional status, all of which directly enhance their QoL[14]. Work out and other non-pharmaceutical therapies have been used to lower CRF during and after treatment for the majority of cancer types[15]. Certain studies have shown that there is the efficiency of aerobic activity, exercise with resistance to cancer related fatigue but the concentration and attention of the patients during these exercises were questionable.

## Aim

The aim is to determine the effect of task oriented approach on cancer related fatigue and functional capacity among subjects with blood leukaemia.

## Material and Method

It was an experimental study, conducted from June 2022 to January 2023. Total of 64 blood leukaemia patients were screened for study. 30 samples were selected according to the inclusion and exclusion criteria.

**Inclusion Criteria:**

- Both males and females.
- Patients stage of I, II in rai staging system (American cancer society staging).
- Patients scoring mild to moderate in the scale of Brief Fatigue Inventory were included.

**Exclusion criteria**:

- People with recent fractures.
- People with other comorbidities like neurological and psychological impairments were excluded.

**Outcome measures:**

Assessment was performed at baseline and after 4 weeks of study.

- Brief Fatigue Inventory[16]
- 6 Minute walk test[17]
- EORTC QLQ C30 (Version 3)[18]

**Procedure:**

The aim and objective of the study were explained to them, and a written informed consent form was obtained. The mean age of participants is 44.6 ± 5.32. Out of 30, 18 were male, 12 were female. All participants were divided into two groups according to their treatment protocol and the group is named as the radiation therapy group (RT group) and non-

radiation therapy group (NRT group) Task oriented approach will be explained and demonstrated. Pre-test and post-test value of Brief Fatigue Inventory, Six minute walk test and lifestyle quality by using EORTC QLQ C30 (Version 3) were calculated and tabulated. The intervention is given to the subjects for 1 section/day, 5 days /week for 4 weeks. Exercises are Mentioned in the below Table 1: Task Oriented Approach

| Exercise | Description |
|---|---|
| 1. Stand and Reach | Standing and reaching in various directions for things that are farther away from the body to encourage loading of the lower limbs |
| 2. Catch and throw | A soft ball will be thrown towards the person; he/she collects it and throws it back. |
| 3. Sit to stand | Use different chair heights to sit and stand to build strength |
| 4. Dodgeball | A soft ball is given to participants, they were asked to throw the ball over each in aim to hit his/ her opponent and |
| 5. stepping forward and backward | stepping up and down on various heights of blocks |
| 6. Stepping sideways | stepping sideways into various heights of blocks |
| 7. Forward step-up onto blocks | Stepping up forward onto various-height blocks |
| 8. Heel(s) raise and lower | Raising and lowering the heel(s) while maintaining a standing position |



**Fig 1: Stand and Reach**



**Fig 2: Heel(s) raise and lower**

**Data Analysis and Result:**

Total of 30 blood leukaemia survivors met the inclusion criteria and were randomly allocated into two groups using an opaque concealed envelope (NRT, n = 15; NRT, n = 15) with no dropouts or losses to follow-up No intergroup differences were observed at baseline. Pre, post mean, standard deviation, Z- score, p-value were presented in table using Brief Fatigue Inventory.

| BRIEF FATIGUE INVENTORY for NRT Group | | | | | |
|---|---|---|---|---|---|
| NON - RADIATION GROUP (NRT) | | | | | |
| MEAN | | SD | | Z Score | P Value |
| Pre | Post | Pre | Post | | |
| 7.86 | 4.46 | 0.83 | 1.12 | 3.78 | <0.01 |
| 6 MINUTE WALK TEST For NRT Group | | | | | |
| NON - RADIATION GROUP (NRT) | | | | | |
| MEAN | | SD | | Z Score | P Value |
| Pre | Post | Pre | Post | | |
| 336.45 | 385.23 | 8.23 | 144.23 | 4.23 | <0.01 |
| EORTC QLQ C30 (Version 3) for NRT Group | | | | | |
| NON - RADIATION GROUP (NRT) | | | | | |
| MEAN | | SD | | Z Score | P Value |
| Pre | Post | Pre | Post | | |
| 94.26 | 77.8 | 2.86 | 4.79 | 3.40 | <0.01 |

Inventory, 6 minute walk test and Quality of life in table (1-6) respectively. There is a significant improvement in both group in cancer related fatigue after the intervention, two groups, non-radiation group show much better improvement comparing to participants under radiation with a mean difference of 3.4 in Brief Fatigue Inventory, 5.93 in 6 minute walk test, 16.46 in EORTC QLQ C30 (Version 3).Result Data were mentioned in Table 2 & 3.

**Table 2: Mean, SD, Z score and P Value for NRT Group Table 3: Mean, SD, Z score and P Value for RT Group**

| BRIEF FATIGUE INVENTORY for RT group. | | | | | |
|---|---|---|---|---|---|
| RADIATION GROUP (RT) | | | | | |
| Mean | | SD | | Z Score | p Value |
| Pre | Post | Pre | Post | | |
| 8.6 | 5.46 | 0.88 | 1.18 | 3.295 | <0.001 |
| 6 MINUTE WALK TEST for RT group. | | | | | |
| RADIATION GROUP(RT) | | | | | |
| Mean | | SD | | Z Score | p Value |
| Pre | Post | Pre | Post | | |
| 315.9 | 365.5 | 6.57 | 12.82 | 3.35 | <0.001 |
| Mean, SD, Z score and P value using EORTC QLQ C30 (Version 3) for RT group. | | | | | |
| RADIATION GROUP(RT) | | | | | |
| Mean | | SD | | Z Score | P Value |
| Pre | Post | Pre | Post | | |
| 98.86 | 85.06 | 3.18 | 3.19 | 3.42 | <0.001 |

## Discussion

The present study evaluated the effect of task oriented approach for both groups consisting of NRT and RT group on cancer related fatigue, functional capacity and lifestyle quality in Blood leukemia survivors suffering from CRF. An improvement in exhaustion, practical ability and lifestyle quality was observed of blood leukaemia survivors who underwent Task Oriented Approach with NRT rather than RT. One of the frequent adverse consequences of cancer is fatigue, which is more common in people with blood leukaemia than other cancer types. Exercise adherence in cancer patients is very low due to complexity of those exercises. Cancer related fatigue has an impact on reduced functional capacity in turn reduces quality of life. Author Virginia Prieto-Gómez in her study states supervised therapeutic exercise has better improvement in fatigue and function capacity in breast cancer survivors, our study also converges into that result stating task oriented exercise has a better effect on fatigue and functional capacity among blood leukemia survivors. One of the most universal and distressing cancer manifestations is exhaustion, which has a negative impact on one's lifestyle quality. Cancer-related fatigue (CRF) has an unclear pathogenesis, but it is likely complex and involves interconnected cytokine, muscle, neurotransmitter, and neuroendocrine alterations in every individual. The central and peripheral hypotheses that underlie the postulated CRF processes. Adenosine triphosphate and the capabilities of muscles to contract are related to peripheral mechanisms, whereas theories regarding the dysregulation of cytokines, disruption of the hypothalamic-pituitary-adrenal axis, disruption of the biological rhythms, 5-hydroxytryptamine, and vagal afferent nerve function are related to central mechanisms. These theories are currently largely supported by data from other illnesses where fatigue is a common symptom. Understanding pathophysiology may help with straightforward treatment strategies for cancer patients[19]. Agarwal S et al (2020), did a study of cross- sectional descriptive study examined the prevalence, predictors and effects of CFR on patients of palliative cancer with advanced cancer revealed that, Indian patients with advanced cancer who were receiving palliative care had a significant prevalence of fatigue, which had a detrimental effect on QOL. Albumin was discovered to be an independent predictor of CRF, as were pain, physical functioning, performance status, and albumin[20]. Banipal RPet al (2017), done a cross- sectional observational study on cancer related fatigue with cancer patients undergoing many treatments, revealed that cancer survivors have substantial levels of fatigue and it has to be assessed earlier once the patient is diagnosed with cancer before the treatment starts[21].

Patel JG et al (2017), said about aerobic exercise impact in cancer related fatigue states that, Rest and sleep do not always relieve CRF, and the severity of its symptoms is disproportionate to the intensity of actual physical exertion. According to the findings of the study, individuals with solid tumours who engaged in aerobic exercise for six weeks following chemotherapy and/or radiotherapy had a decrease in the type and severity of fatigue[22]. Dermal ridge has been associated with breast cancer and acts as a biomarker of the gene. Exercise or activity is much more important to reduce fatigue. Task oriented approach is a type of exercise which is designed with simple activity which we do in our day to day activities; the adherence of exercise training in this training is high. These exercises can be used in clinical trials too.

## Conclusion

According to the above result it has been concluded that a task oriented approach has a better effect on reducing the cancer related fatigue and improving functional ability, quality of life among blood leukaemia individuals. Participants who are not under radiation therapy have better prognosis than participants under radiation therapy.

**Conflicts of interest:** There are no conflicts of interest.

**ISRB clearance:**

ISRB clearance was taken from the institutional ethical committee.

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Original Article

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# Effectiveness of Myofascial Release on Mouth Opening in Subjects with Post Operative Buccal Mucosa Carcinoma

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**Abstract**

**Background:** Patient treatment after surgical excision of buccal mucosal carcinoma should prioritise symptom relief and cancer prevention. Mouth exercise physiotherapy is widely regarded as a staple for expanding the mouth, either on its own or in conjunction with other modalities. In order to better understand the manufacture and clinical effectiveness of Triscare mouth exercising devices in subjects with CA buccal mucosa, the current study was conducted.

**Purpose:** This study aims to evaluate the effectiveness of Myofascial release for postoperative buccal cancer patients.

**Materials and Methods:** Subjects with buccal mucosa carcinoma were recruited from Saveetha Dental College and Hospital for an experimental research using inclusion and exclusion criteria. Two week postoperative Buccal Mucosa Carcinoma subject volunteer. The participants were secretly separated into two groups using envelopes. Before and after treatment, jaw exercise and Myofascial release groups had their mouth opening and quality of life evaluated. Statistical analysis was performed on the collected data, and conclusions were drawn.

**Results:** At the 4-week follow-up, the intervention group's mean MO (48.06mm) was significantly higher than the control group's (44.66 mm) (p 0.002), and the intervention group also reported significantly higher GTQ scores and higher health-related quality of life scores across all domains and items.

**Conclusion:** We concluded that Participants in the intervention group improved more than those in the control group, and they also reported higher levels of engagement with and satisfaction with their therapy.

**Key word:** Jaw Exercises, Triscare device, Squamous Cell Carcinoma, Oral Cancer,Trismus.

## Introduction

Patients who have cancer of the buccal mucosa often suffer from trismus, which is the inability to completely open the mouth. Because trismus restricts mouth opening, eating, chewing, swallowing, oral hygiene, and dental examinations may all be affected by the condition. When a patient's quality of life declines, their mental health suffers as a direct result. One of these complications is trismus, which is characterized by a mouth opening of 35 millimetres or less[1]

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India has 30% of the world's mouth cancer cases. Female oral cancer rates in India and internationally is higher in the south. India is frequently called the "oral cancer capital of the world" since it accounts for one-third of all cases worldwide. Oral cancer is more common in southern Indian women and worldwide. India's oral cancer fatality rate is higher than that of developed countries because 60–80% of patients are diagnosed late[2].

These factors explain why 30–40% of these individuals experience depression after therapy. Additionally, a multidisciplinary team including speech and language therapists, nutritionists, physiotherapists, counsellors, orthodontist experts, and dentists may be necessary for their rehabilitation. Exercise therapy may help patients with head and neck cancer who are experiencing trismus[3]. The mouth size was raised by 18 mm after using a sledgehammer on the jaw for two minutes twice daily[4]. Trismus may be treated using rubber plugs, tongue depressors, and corkscrews. The Dynasplint Trismus System® (DTS) and other jaw stretching devices may help cure trismus. To permanently lengthen injured connective tissue, DTS slowly and gently stretches it with a little torque. To achieve the goal, this is done. Research conducted on animals has shown that low-torque, long-duration techniques for stretching have superior efficacy in restoring range of motion compared to high-torque, short-duration stretching methods[5]. The use of conventional training instruments, such as tongue depressors, fingers, and rubber plugs, has shown a moderate level of efficacy, as evidenced by patients experiencing an average increase in mouth opening of 5.5 mm. Evidence of this effect was supplied by historical cohort studies[6]. Patients with oral cancer were reported to have trismus at a rate of 4%-50% at the time of diagnosis, 44%-86% immediately after surgery and radiation, and 31%-65% six months after treatments[7]. There have only been a total of four studies conducted to evaluate the impact that interventions have on trismus. Randomised clinical trials found that therabite was superior to wooden tongue blade exercises and manual stretching for increasing mouth opening[8].

Deep pressure kneading and dry needling are two therapeutic techniques used for trigger point release, which have shown efficacy in pain reduction. Myofascial release of the restricted fascia around the head and neck may help alleviate facial and neck pain [9].Studies on its cost-effectiveness have revealed that the recently designed workout equipment for mouth opening may deliver better outcomes than more traditional methods. As a result, no one is absolutely certain how to treat the trismus that is brought on by buccal mucosa carcinoma. Some people are advised to participate in physical therapy, while others are given prescription drugs to use for their condition. A number of clinical tests have shown that the treatment of trismus using open mouth exercise devices is effective.

## AIM

The aim of the study is to investigate Effectiveness of Myofascial Release in subjects with post -operative buccal carcinoma.

### Material and Method

An experimental study, Total of 30 Buccal Mucosa Carcinoma subjects were screened for study. 30 samples were selected according to the inclusion and exclusion criteria. Patients were provided with a consent form with assurance of treatment. This study was done from September 2022 till December 2022.

**Inclusion Criteria**

Post-operative of Buccal Mucosa Carcinoma subject after 2 weeks, both genders volunteer.

**Exclusion Criteria**

- Unhealed Sutures
- Drainage tube
- flap failure
- Patient who going undergo radiation therapy immediately were excluded.

**Outcome Measures:**

Assessment was performed at baseline and after 4 weeks of study.

- Triscare device,
- Gothenburg trismus questionnaire (GTQ) [10],
- Health-Related Quality of Life Scale [11].

**Procedure**

An experimental study with a total of 30 Buccal Mucosa Carcinoma subjects were selected from Saveetha dental college and hospital based on the inclusion, the selected subjects were allotted into two groups with the help of concealed envelope method. Both groups were given jaw exercises, but the intervention group included before receiving myofascial release, a patient's mouth opening and quality of life were assessed as a baseline. The mouth opening was measured by Triscare device and Quality of life was measured with the help of Quality of life questionnaire. After taking the baseline values, interventions will be given for four weeks. At the end of the four weeks post-test values were taken. The obtained data were analysed statistically and results were obtained.

**Triscare Mouth opening device**

MIO, the greatest vertical distance between the maxillary and mandibular incisors, was the main outcome measure. The individual was seated upright in the Triscare Mouth opening device while the MIO was measured. Subjects were diagnosed with trismus if their MIO was less than 35 mm. Males should have a MIO of 50–60 mm and females of 45–55 mm, whereas a MIO of 30–35 mm is considered trismus. Each person in the intervention group saw the same physiotherapist for a demonstration and training on how to use the device. Using a jaw mobilisation device, patients began each session with a 30-second warm-up and stretching routine five times a day Active motions included biting against resistance, while passive actions included jaw stretches. The same physiotherapist assessed MIO before treatment, immediately after treatment, and again 4 weeks later. After the first 4-week exercise programme, patients were encouraged to keep up their exercise routine by doing so at least three times a week, or more often if necessary.

**Myofascial Release (MFR)**

Myofascial release techniques like kneading are helpful for increasing range of motion and reducing pain caused by scar tissue build up. To increase the flexibility of soft tissues, physiotherapists often utilize moderate manual manipulation. Forced passive movements & manipulations mobilise the temporomandibular joint to increase mouth opening. They received MFR, (based on the thickness of their fibrous bands), by having their fingers and thumbs knead the skin in the buccal area of the afflicted sides on a daily basis for 4 weeks.

**Jaw Exercises**

The fingers were gently stretched across the oral cavity to release tension. Mandibular deviation and jaw depression were treated with lateral glides and joint distraction at the temporomandibular joint. To avoid jaw stiffness, do these exercises for your jaw muscles. Seven times a day, repeat the complete procedure.

1. Maximise the width of your mouth opening. Keep your grip at its widest point for seven seconds before letting go. Seven times over.

2. Widen your grin, then shift your jaw to the left and relax. Five times over.

3. Relax your jaw by opening your mouth wide and then moving it to the right. Five times over.

**Statistical Procedures**

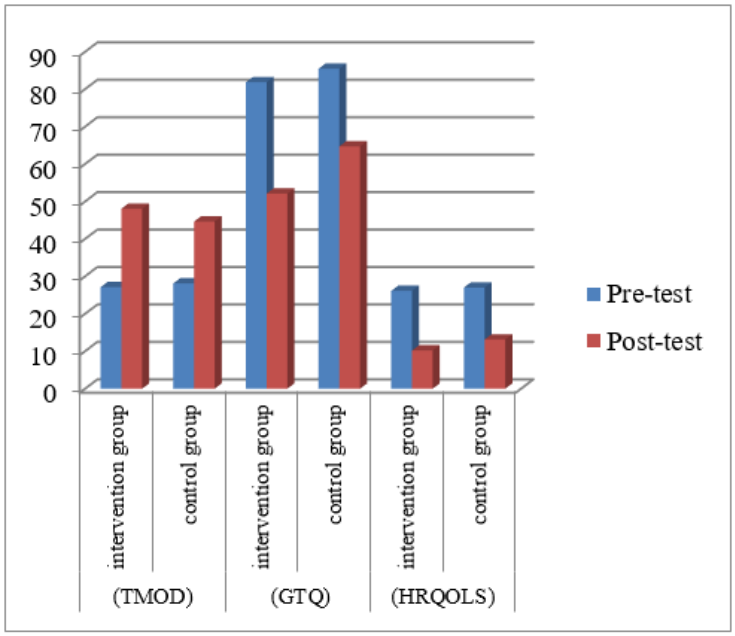
The intervention and control groups' pre- and post-test results were evaluated. Pairwise T-tests are used to compare mouth opening data within groups. For group investigations, the unpaired t-test has been used. The Wilcoxon test and Mann-Whitney U test have been used to analyse quality of life within and across groups, respectively. All analyses were performed using SPSS 27.0 for Windows.

**Data Analysis**

Among 15 subjects in control group 8 were females and 7 were male candidates. Whereas, in the intervention group 9 were females and 6 were male candidates. Thus, total 17 subjects were females and 13 subjects were male. From table 1 we conclude that females are most commonly affected than male. (See a table: 1)

**Table 1: Descriptive data on subjects**

| Years of Age | Intervention group | | | Control Group | | |
|---|---|---|---|---|---|---|
| | Male | Female | Total | Male | Female | Total |
| 37–75 | 6 | 9 | 15 | 7 | 8 | 15 |




**Graph: 1 paired t-test Analyses of differences between the groups for Mouth Opening using MFR**
**(TMOD- Triscare Mouth opening device,**
**GTQ- Gothenburg trismus questionnaire,**
**HRQOLS- Health-Related Quality of Life Scale)**

**Table 2: Analyses of differences between the groups for Mouth Opening using MFR**

| Statistical analysis | Group | Mean ± SD | | p-value |
|---|---|---|---|---|
| | | Pre-test | Post-test | |
| Triscare Mouth Opening Device (TMOD) | intervention group (n=15) | 27.13±3.56 | 48.06±4.55 | 0.002* |
| | control group (n=15) | 28.13±2.23 | 44.66± 2.78 | |
| Gothenburg trismus questionnaire (GTQ) | intervention group (n=15) | 81.86±5.99 | 52.13± 3.37 | 0.001* |
| | control group (n=15) | 85.46±6.45 | 64.73± 3.34 | |
| Health-Related Quality of Life Scale(HRQOLS) | intervention group (n=15) | 26.13±1.99 | 10.2± 2.04 | 0.003* |
| | control group (n=15) | 27±. 2.03 | 13.13± 1.80 | |

* = Statistically significant

**Table 3: Test statistics for HRQOLS**

| | |
|---|---|
| Mann-Whitney U | 33.00 |
| Wilcoxon W | 153.0 |
| Z | -3.325 |
| p value | <0.001 |

## Results

30 individuals, 53.8 ± 12.53 years in the intervention group and 53.46 ± 11.59 years in the control group. The Shapiro-Wilk test showed that age was regularly distributed. Paired t test compared baseline characteristics across groups. The age p value was 0.161, showing that the baseline characteristics were statistically similar across groups (p>0.05).

Table 2 displays the interventional and control groups' outcome parameter mean and SD values.

This study found that the mean TMOD was 27.13 ± 3.56 at baseline and 48.06 ± 4.55 post intervention in intervention group, and in control group 28.13 ± 2.23 at baseline and 44.66 ± 2.87 as tabulated in TABLE-2 and Graph-1. The mean GTQ was 81.86 ± 5.99 at baseline and 52.13 ± 3.77 post treatment in the intervention group, while it was 85.46 ± 6.45 pre intervention and 64.73 ± 3.34 in the control group. As shown in TABLE-2 and Graph-1, the intervention group's mean HRQOLS was 26.13 ± 1.99 pre-intervention and 10.20 ± 2.04 post-intervention, whereas the control group was 27 ± 2.03 pre-intervention and 13.13 ± 1.807 post-intervention.

The TMOD, GTQ, and HRQOLS improved for both groups. Intervention group improved much more than the control group. The intervention group's mean ± SD of the three variables was significantly higher than the control group.

Table 3 shows the analysis of non-parametric tests (Mann Whitney U test and Wilcoxon test). The Z score of the variables post intervention HRQOLS was -3.325 indicating the statistical significance of hypothesis.

## Discussion

The treatment of post-cancer treatment difficulties might include a variety of different treatments, including speech and swallowing therapy, manual therapy and therapeutic modalities, and vocational rehabilitation. Patients with head and neck cancer often have trismus and shoulder dysfunction as a consequence of radiation-induced fibrosis and paralysis of the spinal accessory nerve. Muscular fibrosis of the neck, trismus, neuropathy, inactivity, myofascial restriction, frozen shoulder, and postural dysfunction all call for medical attention[12].

Trismus is distinguished by a tonic contraction of the mastication muscles, such as the masseter, temporalis, or pterygoid, which limits mouth expansion[13]. A reflex contraction might be caused by a tumour that grows into or near the muscles that close the mouth. Because these mouth-closing muscles are prevented from extending as a consequence of this reflex contraction, trismus might develop. Scar tissue may be caused by surgery, which can result in a smaller mouth opening owing to muscular tightness caused by the scar tissue[14]. Examining the maximum inter-incisal distance and determining that it is less than 30-45 mm, which is caused by contracture, is how trismus is clinically diagnosed[15].

In a perfect world, one would be able to measure this with a millimetre scale while the patient was sitting in an upright position. In a study conducted by L. J. Melchers and colleagues, the researchers came to the conclusion that It has been shown that patients with radiation-induced trismus can benefit greatly from therapeutic massage, which is said to increase blood flow and relax the masticatory muscles, as well as exercises to break down myofascial adhesions and fibrosis, and jaw-mobilizing devices, especially in the first six weeks of treatment[16].

L B Calixtre etal., concluded that the mobilisation of the temporomandibular joint and the application of myofascial release to the muscles of the neck have both been shown to be effective[17]. A method called myofascial release, which is used in manual therapy, has been found to improve head and neck posture and has an effect on how postural alignments are maintained. Prathap L et al.,suggested that the dermal ridges serve as a useful diagnostic of genetic instability in breast cancer[18]. Our research participants also reported short-arm force, which makes using one's hands challenging. Ergonomics must be considered in future studies. First, the Myofascial Release (MFR) with the device significantly improved the participants' MIO and HRQLS; second, our device is five times cheaper than the Triscare device; and third, our device reduced participants' pain levels. Thus, one of our aims is to expand the number of patients who use the Myofascial Release with Triscare device to improve treatment results.

## Conclusion

The intervention group made more progress and showed more augmentation and enthusiasm than the standard exercises throughout therapy. Myofascial release improves quality of life and prognosis on the Health-Related Quality of Life Scale. Thus, buccal mucosa carcinoma patients benefit from myofascial release and mouth-opening devices. Oral cancer patients' quality of life and oral function improved.

**ISRB approval:** This research work has been approved by the ISRB committee.

(ISRB NO: 01/057/2022/ISRB/PGSR/SCPT)

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Original Article

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# Effect of Obstacle Training in Frailty among Geriatric Population

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**Abstract**

**Background:** This study was developed to determine the effectiveness of obstacle training in frailty among geriatric population.

**Purpose:** The purpose of the study is to evaluate the effectiveness of obstacle training in frailty among geriatric population and to analyze the balance and gait analysis and number of falls.

**Method:** A quasi experimental study was done in geriatric old age home with 30 samples by convenient sampling technique, allotted in a single group. In phase 1 the prevalence of frailty among Geriatric population will be examined using the Edmonton frail scale. In phase 2 the Tinetti scale and morse fall scale were used as outcome measures.

**Results:** According to the statistical analysis there is a clinically significant in groups, p value >o.oo1.

**Conclusion:** We concluded that obstacle training has an improvement in reducing risk of frailty among geriatric age group population.

## Introduction

The prevalent clinical condition of frailty among older people carries a higher risk of undesirable health issues, such as falls, recurrent impairment, hospital stay, and mortality.[1] Despite the fact that it has been established that frailty is a health issue that is separate from concurrent conditions, ageing, and disability.[2] There are some other characteristics that go along with frailty. Sarcopenia, deterioration of the physiological system of the body, and cognitive deficits are also seen as signs of frailty.[3] A stay in the hospital mortality, and morbidity risks are typically elevated by age-related illnesses, including those already described. They also lessen independence in doing activities of everyday living (ADL) duties.[4] Multiple factors, such as age, sex, economic indicators, and disease pressure, have been associated with the development of frailty in community residents.[5] Frailty is more common in older age groups (30.1%) than in younger age groups (12.2%), and it is more common in women (32.4%) than in males (10.1%) .[6]

The phenotype model, which stresses functional evaluation, and the overall deficit conditions approach, which highlights impairments in the areas of comorbidities, are the two main groups for the present frailty assessment instruments.[7] In order to

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help non-geriatricians in the west of Canada identify and assess elderly people who are frail in the primary care context and at their bedsides, the Edmonton Frail Scale, a performance-based multidimensional frailty assessment instrument, was developed.[8] The EFS consists of eleven items, nine of which are in different categories, including mental, social assistance, mood, dietary habits, and functional performance. The Edmonton frail scale was found to be a valid indication of frailty after carefully examining the patient's medical records and physical examination.[9] Due to an increased susceptibility to inadequate homeostatic recovery following a stress, the severity of negative results, such as falls, confusion, and disability, is heightened in an advanced stage of frailty.[10] In the CHS population, the relationships between frailty, comorbidity, and impairment were investigated (3, 96).

Frailty and comorbidity, which is defined as having a minimum of two of the nine diseases mentioned above (myocardial coronary artery disease angina, a congestive cardiac failure, claudication, arthritic pain diabetes, cancer, high blood pressure, and a chronic obstructive was present in 46.2% of the population. 21 persons, or 5.7% of the overall population, were considered frail and disabled, which can be defined as someone who has restrictions in at least one aspect of daily living. It is relevant that 26.6 percent of the research group's members showed frailty underlying comorbidities or disability. This study supports frailty as a distinct concept with regards to comorbidity and disability. Recent studies, however, suggest that this combination is increasingly frequent and worse with growing frailty.[11] Impaired stride and balance, which are two of frailty's key characteristics, increase the chance of falling. A "hot" fall is a minor illness that reduces the body's posture below the critical threshold needed to preserve gait integrity. Spontaneous falls can occur when essential postural functions (vision, balance, and strength), such as in more severe cases of frailty, are no much longer adequate for navigating securely through undemanding surroundings. All spontaneously occurring falls are frequently brought on by a psychological response known as "fear of future falls," which severely restricts one's mobility. Clinical care for fragile patients can be difficult to all those involved, including patients, their caregivers, and medical professionals. Frail elderly people often experience medically and psychologically complex issues, and weakness occurs throughout a range that is frequently not clinically evident until at an extremely late stage, creating a unique chance for interventions designed to full fill the specific needs of these patients in each phase of frailty.[12]The complex process of aging is influenced by early embryonic development, environment, and genetics. The fundamental mechanisms of aging have just lately been adequately recognized. Many medical professionals are currently looking for a technique to gauge age physiologically rather than just age in chronological order because aging is a highly varied process.

Frailty has been shown to too strongly correlate with the aging process, leading to the theory that it may represent just such a statistic.[13] The Morse fall scale is used to evaluate a patient's risk of falling by determining whether or not several risk factors are present in them. There are six parts to it: gait and mental health connected to gait, movement patterns, past experience with falls, further assessment, use of ambulatory assistance, intravenous medication, or use of heparin caps. Each item received an evaluation, with a higher attainable score of 125 scores. Patients with an average score of 45 or less were considered to have a moderate risk of slipping and falling, whereas those with a score of 45 or more was considered to have an elevated risk of falling. The Morse fall scale was used to assess the patient's fall risk upon admission, every day while they were in the hospital, and any time their condition changed. Electronic medical records were updated with the fall risk assessment findings.[14] The "Edmonton Frail Scale" demonstrated to be a valid measure of frailty in comparison to clinical perceptions of geriatric specialists following their more extensive evaluation. The Edmonton frail scale exhibited good construct validity and reliability, with adequate internal consistency. The discussion touches on 10 various subjects as an outcome of the variety of frailty's representation.

The nine dimensions that were looked at were: continence, general wellness status, independent functioning, social assistance, pharmacologic condition, nutritional aspect, and mental condition. In order to look at the prevalence of frailty by gender as determined by the Edmonton Frail Scale and its

link with multi-dimensional conditions assessed with specific screening methods, this study assessed the efficacy of the Edmonton Frail Scale to evaluate frailty. It is notable that the Edmonton frail scale was confirmed by non-specialists who lacked formal geriatric care experience. Furthermore, administering the Edmonton frail scale just takes a few minutes.[15]

Frailty is more common among elderly people who live in communities as they get older: it affects 4% of those aged 65 to 69, 7% of people aged 70 to 74, 9% of people aged 75 to 79, 16% of people aged 80 to 84, and 26% of people aged 85 and above.[16] Frailty often begins before the age of 65, while not all individuals, even those who live to advanced ages, become feeble. Notably, geriatric medicine has recently given way to the specializations of medicine in the applications of frailty markers for prognosis. This means that treatment choices, care objectives, and recovery expectations can all be influenced by an individual's frailty status. How quickly humans age is affected by the neuro-immuno-endocrine system, food, and exercise. These mechanisms of regulation are less effective in frail older individuals due to mild inflammation, additionally referred to as inflammaging, and severe and unchecked oxidative damage. Other underlying processes are probably involved in the aging process, illnesses associated with aging, and geriatric disorders including frailty. A long-term buildup of unrepaired damage to somatic and stem cell populations may cause them to lose their metabolic and functional capabilities, including the age-related decline in immune function known as immunosenescence. Inflammation and immunosenescence have been proposed as potential causes of sarcopenia, which is a gradual decrease of muscle mass and power in the skeleton accompanied by decreased physical performance. These diseases are typically regarded as defining characteristics of physical frailty. It should be mentioned that similar mechanisms probably explain how the fragility of the respiration, the renal system, hemopoietic, and metabolic processes shows themselves. Therefore, it should not come as a surprise that a lack of proper nourishment may contribute in one way or another to the downward spiral that characterizes frailty.[17] Conversely, the majority of interventions that delay or stop the progression of frailty are focused, at least in part, on increasing nutrition. This study set out to find out how common frailty syndrome is in elderly people and how it relates to the likelihood of falling. This research was inspired by the notion that a complex interplay of psychological, social, and biological elements throughout life leads to frailty.[18]

## Aim

To determine the effectiveness of obstacle training in frailty among geriatric population.

## Materials and methods

The Edmonton Frailty Scale was used to assess the frailty of 120 elderly persons. Of the 120, 67 were found to have moderate to severe frailty, and 30 subjects were randomly chosen using a covert opaque envelope. This 30-sample quasi-experimental investigation was carried out. The study was conducted at Elder's Resorts in Sriperumbudur. Ages between 60 and 80, all genders, and Edmonton frail scores between 8 and 17 were included into consideration. Exclusion criteria include severe osteoporotic individuals, those with an Edmonton fragile score of less than 8, mental health issues, and hearing and vision impairment. All participants provided their verbal or written consent. The intervention, baseline values for the Tinetti and Morse fall scales were measured.The collection of data began in january 2023, and treatment sessions began in february 2023 for four weeks

**Selection criteria:** Edmonton frail score between 8-17, age between 60 and 80, both gender, previous history of fall one year ago were included.

**Exclusion criteria**: Edmonton frail score less than 8, psychological disorders, hearing and visual impairment, severe osteoporotic patients.

**Outcome measure**: The Edmonton Frail Scale, phase 1, is used to gauge the prevalence of frailty. The Edmonton Frail Scale, an instrument used to measure frailty, comprises nine subscales that evaluate mental processes, general well-being, independent functioning, interaction with others, medication use, diet, state of mind, urinary continence, and ability to function.

In phase 2, the morse fall scale is utilized to identify the risk factors of falling. This scale has six characteristics, including fall history as a whole, secondary diagnosis, use of ambulatory aids, use of intravenous devices, impaired movement patterns, and impaired mental status.

A three-point ordinal scale with the values 0, 1, and 2 has a gait score and a balance score on the Tinetti scale. It is a person's feeling of balance, stability, and fear of falling during activities of daily living.

**Procedure**

One group of 30 samples received obstacle training that included zigzagging and stepping over obstacles. Figure-eight walking, random walking, and hurdles that get higher and higher. The institutional ethical committee approved the research. Obstacle walking will be given for four weeks, three times each week for 30 minutes each day with a minute of relaxation between exercises.

At the conclusion of the fourth week after the intervention, the same baseline measurements were taken.

Materials required: ridges, cones, hurdles, stopwatch.

## Result

The baseline measurement was conducted both before and after the intervention, and a total of 30 samples were allocated to one group. Tabulated values for the pretest and posttest are used. The baseline measurement has improved, as seen by the posttest's mean and standard deviation. Clinical significance was shown by the p value of 0.0001.

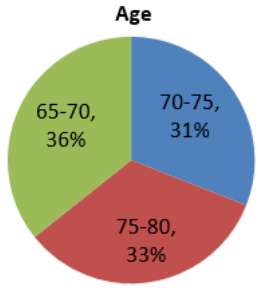



**Figure 1: Representation of Age**

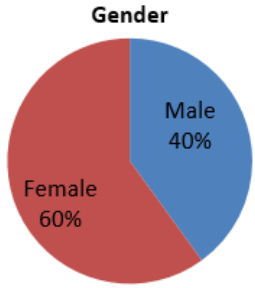



**Figure 2: Representation of Gender**

**Table 1: Shows Baseline Measurements**

| S. NO | OUTCOME MEASURES | PRE-TEST | | POST-TEST | | T-VALUE | P VALUE |
|---|---|---|---|---|---|---|---|
| | | MEAN | SD | MEAN | SD | | |
| 1. | TINETTI SCALE | 12.8 | 2.27 | 19.73 | 1.38 | 14.16 | <0.0001 |
| 2. | MORSE FALL SCALE | 34.5 | 3.79 | 28.75 | 3.22 | 6.33 | |

## Discussion

The wide range of outcomes was identified by review research utilizing meta-analysis that revealed a range of 6.7 to 44.0% and supported the present findings. Other studies discovered a percentage around 7% and 10.5% lower than those obtained here, which could be attributed to the characteristics of individuals with better economic or environmental circumstances, where a longer life expectancy is associated with a higher standard of living. The health-related standard of life is intimately associated with frailty and can be improved or decreased depending on the economic or social conditions of the elderly patient.

Seniors who have pre-frailty conditions make up a sizable portion of the population who need to be identified early and who have a 13 to 31% increased risk of becoming frail. Important to note is that it is a serious condition as it only identifies the illness in its early stages, indicating a need to take additional preventative actions to delay the emergence of frail and the possibility of loss of ability to function. Exercise programs are helpful for elderly adults who are weak, according to a systematic review. Only a few studies have examined the effects of exercise on frailty status and frailty phenotypes, with a large number of studies focusing on how exercise improves physical performance.

A systematic review found that exercise regimens are beneficial for frail older persons. Few studies have looked at how exercise affects frailty status and

specific frailty phenotypes; instead, most of them have focused on how exercise affects improving physical performance. The different elements of frailty must be distinguished in order to understand how the intervention will affect particular features of the frailty phenotype as opposed to the overall frailty state.[19] Gait speed is strongly correlated with changes in a person's frailty state. The most reliable indicator of chronic impairment and dangerous falls is slow gait speed.[20] A previous comprehensive review found that multidimensional interventions, such as exercise in combination with nutrition like protein supplements, are more effective than mono-domain interventions, such as exercise alone, at increasing muscle mass and stopping unintentional loss of weight.[21] The Asia Pacific health community's recommendation for managing the symptoms of frailty recommends calorie and protein supplementation under certain circumstances for weight loss. This suggests that the lack of a large reversing rate of unintentional weight reduction in our current trial may be due to the emphasis on a particular form of physical activity rather than a holistic intervention.[22] The goal of Ganea et al. was to establish a connection between frailty and the evaluation of fall risk.

The authors conducted Tinette tests and looked into body posture analysis in this work. The posture assessment was researched using the information produced by the inertial measurement devices mounted on the trunk.

However, the findings also failed to establish a direct link between frailty and the risk of falling.[23] It is widely believed that 32 nutritional intervention is a crucial part in managing frailty. But a sizable proportion of trials in diverse populations of elderly people at risk of malnourishment have fallen short of establishing overwhelmingly beneficial effects on physical activity and functional outcomes.[24] Due to this variability, it is challenging to determine the one program that would be most effective for a certain frail group. It may be argued that programs focusing on many physical abilities (strength, endurance, balance, and flexibility) improve performance in terms of older persons' overall functional capability. In addition, despite improving the generalization and accuracy of external data, the variety of elements in the CTL could also affect the particular results of the training.[25]

## Conclusion

According to the abovementioned findings, obstacle training has a positive impact on frailty, balance, and the risk of falling in the elderly population. Additionally, participants' fall rates have decreased over the course of three months.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 01/058/2022/ISRB/PGSR/SCPT).

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**Conflict of interest:** No conflict of interest

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# Effectiveness of Sensing and Feedback Alerting Smart Cane System: An Assisted Device for Geriatric Population to Prevent Falling

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**Abstract**

**Background:** The main cause of injury-related death among the elderly is falling. The smart cane is a type of assistive tool. A smart cane's electronic sensors provide feedback and alert users to potential hazards, assisting users in keeping their balance while moving around.

**Purpose**: To evaluate the effectiveness of a smart cane system for the elderly population that integrates feedback alerts and sensors to reduce falls.

**Materials and Methods:** A Randomized Controlled Trial was done in elderly resort with 30 sample allocated into two group using lottery method .group-A receives conventional training using cane with quadripod base , while the group-B receives smart cane training using quadripod base .modified two-point gait pattern is employed for 2 months of training. The outcome measure used for physical measure is Elderly Mobility Scale (EMS) and for psychological is Activities-Specific Balance Confidence Scale (ABC,s).

**Results:** According to the statistical analysis of the elderly mobility scale outcome measure, there were substantial changes in mobility and a decreased risk of falling .Based on the ABCs scale, when comparing the pre-test and post-test values, the experimental group's confidence in daily living is superior to the control group.

**Conclusion:** According to the study's findings, a smart assistive cane can help the elderly population both physically and psychologically. During the gait training, the user of the smart assistive gadget did not encounter any unfavorable therapy-related consequences.

**Key Word:** Fall, Smart Cane, Elderly Population.

## Introduction

Age plays a role in both disability and mobility issues. One of the most frequent and severe problems causing disabilities, particularly among the elderly, is falling. Elderly people have a higher risk of falling because

(1) With age, their abilities deteriorate (2) the likelihood of acquiring medical problems rises with age and (3) Associated drug dosages are frequently raised as well. Aging is typically accompanied by a wide-based gait, a decline in gait speed, step length, and lower extremity strength[1]. The interplay between

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these long-term predisposing lifestyle factors and short -term environmental risk factors, such as adverse drug response, an acute illness, or tripping on an uneven surface, most frequently lead to falls. The fall management can be complicated. For groups of elderly individuals, a combination of therapies, such as medical evaluation, an exercise regimen, vitamin D prescription, and home evaluation, has been recommended. Normal sensory, neuromuscular, and musculoskeletal system operation is necessary for normal gait and postural stability .Maintaining the body's centre of gravity within its base of support depends on extremities proprioceptive and tactile input, vision input, and vestibular input and age and illness may damage these sensory pathways. Furthermore, age-related modifications in the way that sensory and motor processes are organised and integrated in the central nervous system can affect the speed and reliably postural reflexes respond, this raises the possibility of falls.

It is doable in order to broaden a sufferer's base of support, enhance equilibrium, and promote activity and mobility, which can be increased by using assistive devices including canes, crutches, and walkers. There are significant attentional, neuromotor, and musculoskeletal demands placed on users of assistive devices, and these demands have even been linked to injuries and falls. There are several reasons for canes' limitations as supportive devices and the possible fall risk they pose, includes (1) Improper cane usage (2)Abandoning the cane usage (3) disorders and impairment brought on by repeated stress (4)Using a cane when there are potential environmental threats around, such as obstacles, stairs, and surfaces with a high coefficient of friction.(5) Balance disruption caused on by the attentional conflict between cane manipulation and motion. Provided the smart cane are also used as assistive device. The electronic sensors in a smart cane help people maintain good balance while moving around by enhancing visual feedback and navigating obstacles through alerting signals[2-5].

## Subjects and Methods

**Subjects:** Elderly Population

**Sampling technique:** Simple random sampling

**Sample size:** 30 samples

**Study Period:** From June 2022 to July 2023

**Selection criteria:**

**Inclusion criteria**

1. Both Male and Female age above 65 years,
2. Individual complaints of fall and poor balance during mobility.
3. Comorbid conditions like systemic hypertension, diabetic, hypertension, thyroidism.

**Exclusion criteria**

1. Any recent postoperative case.
2. Patients with lower limb disability associated with other health problems.
3. Severe visual deficit
4. Psychosomatic and neurological problem

**Procedure**

The study was carried out in Sriperumbudur Elder's Resorts, preferably with an 850 square foot walkway. From the starting point to the ending point, two cones are marked. A total of 30 samples are used in the study, and two groups with 15 samples each are assigned by lottery method. Group A practiced with conventional quadripod base cane and Group B practiced with smart assisted cane with quadripod base (Fig:1). Sample selection is based upon the inclusion and exclusion criteria, each subject is examined with history of 1.history of fall and its durability 2. Any use of walking aids and its withdrawal 3.personal history. The baseline measurements of Activities-Specific Balance Confidence Scale for a psychologically based measure and the Elderly Mobility Scale for a physical based measure.

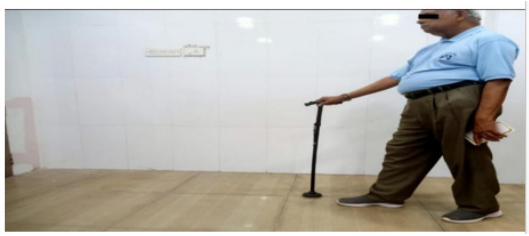


**Fig 1: Gait training with a smart cane system**

**Outcome measures:**

Elderly Mobility Scale: The 13-item Elderly Mobility Scale (EMS) was developed to evaluate

functional mobility in older people living in their communities[12].

Activities-Specific Balance Confidence Scale: is a 16-item scale that is frequently used to measure confidence in one's ability to perform daily tasks[13].

**Intervention**

Gait training with a conservative cane system

Samples are trained to walk around the walkway using a cane with a quadripod base. Two of the samples exhibited dysarthria, and they were advised to raise the unsupported hand if they were having trouble doing the gait activities. The therapist follows the samples during the training to prevent falling and sustaining an injury. To walk with a cane, a modified two-point gait is used. The measures are analysed in a variety of different ambulation situations, including straight walking, right and left turns, and straight walking over obstacles.

**Gait training with a smart cane system**

Samples are trained to use a smart assistive cane with a quadripod base in the walkway .The therapist assists the ambulation to prevent falling during training. A modified two-point gait is employed when using a cane. The metrics are analyzed while walking straight, turning right and left, and walking straight over obstacles, in ambulation scenarios.

For two months, both groups undergo training on using assistive technology on a daily basis,2 sessions with 10 minutes of duration .

**Statistical procedures**

Datas were analyzed using SPSS 22 software to compare pre -test and post- test scores using Wilcoxon test with $p<0.05$.

**Descriptive data on subjects**

| Elderly Mobility Scale | Pre-test | Post-test | |
|---|---|---|---|
| Study group | Mean ± SD | Mean ± SD | p-value |
| Control | 26.67±9.35 | 31.50± 9.35 | P=0.023 |
| Experimental | 20.67±5.05 | 26.17±5.95 | P=0.006 |

In the course of the investigation, it was noted that, among the 15 patients, from experimental group there were 5 (33.3 %) belong to 65-68 years of age, 6 (40%) were from 69-70 years of age and 1(6.6%) had belonged to 71-75 years of age, 3 (20%) were from above 75 years of age. In the control group, of the 15 subjects, 2(13.3) were from 65-68 years of age, 4 (26.6) from 69-70 years of age, 6 (40%) from 71-75 years of age and only 3 (20%) had belonged to above 75 year of age (Table:1).

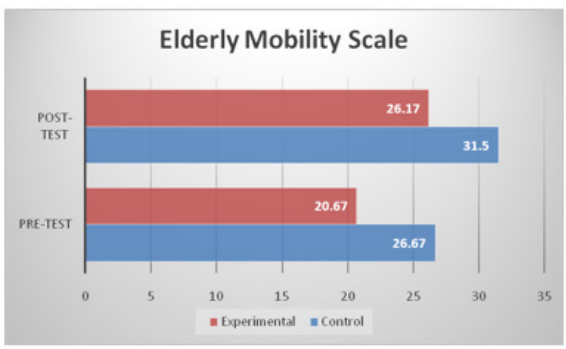
**Table: 1: Descriptive data of samples**

| Age in years | Experimental group | | | Control Group | | |
|---|---|---|---|---|---|---|
| | Male | Female | Total | Male | Female | Total |
| 65 -68 | 1 | 4 | 5 | 1 | 1 | 2 |
| 69-70 | 3 | 3 | 6 | 2 | 2 | 4 |
| 71-75 | 1 | – | 1 | 4 | 2 | 6 |
| 75 above | 2 | 1 | 3 | 2 | 1 | 3 |
| Total | 7 | 8 | 15 | 9 | 6 | 15 |

**Questionnaire data:**

Datas were analyzed using SPSS 22 software to compare pre -test and post- test score.

**Table 2: Mean and Standard deviation value of Elderly Mobility Scale**

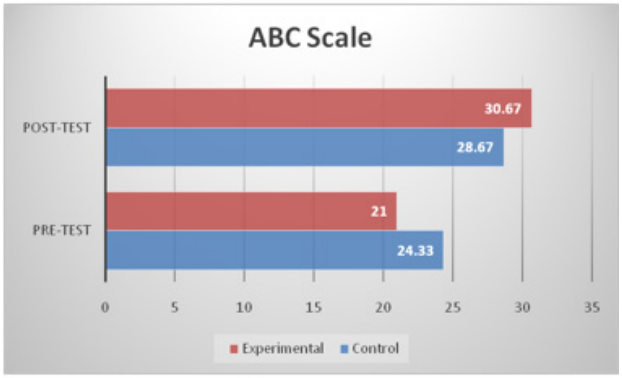


**Graph 1: Graphical representation of Elderly Mobility Scale**

Elderly Mobility Scale, the experimental group's mean ± SD of pre-test is 20.67±5.05 and post-treatment is 26.17±5.95 .The difference between pre-test and post-test is statistically significant with p=0.006. (Table 2) and the control groups mean ± SD of pre-test is 26.67±9.35 ,post-treatment is 31.50± 9.35.The difference between pre-test and post-test is statistically significant with p=0.023(Graph 1).

**Table 3: Mean and Standard Deviation value of ABC's Scale**

| ABC's | Pre-test | Post-test | |
|---|---|---|---|
| Study group | Mean ± SD | Mean ± SD | p-value |
| Control | 24.33±4.63 | 28.67± 4.68 | P=0.009 |
| Experimental | 21.0±9.25 | 30.67±6.19 | P=0.025 |




**Graph 2: Graphical representation of ABC's Scale**

From the Activities-Specific Balance Confidence Scale , the experimental group's mean ± SD of pre-test is 21.0±9.25 and post-test is 30.67±6.19 .The difference between pre-test and post-test is statistically significant with P=0.025.(Table 3) and the control groups mean ± SD of pre-test is 24.33±4.63 ,post-test is 28.67± 4.68.The difference between pre-test and post-test is statistically significant with P=0.009 (Graph 2).

## Results

### Ambulation with a smart cane system

According to the statistical analysis of the elderly mobility scale outcome measure, both the control group and the experimental group had significant changes in mobility and a reduced risk of falling.The ABCs scale reveals that the experimental group's confidence in daily living is higher than that of the control group comparing with the pre-test and post-test values.

### Ambulation with a conservative cane system

From the statistical analysis of elderly mobility scale outcome measure the study reveals that theireis significant change in mobility there by reduced risk of falls in both the control and experimental group .The ABCs scale reveals that the control group's confidence in daily living is lower than that of the experimental group comparing with the pre-test and post-test values.

## Discussion

Using a cane can assist elderly people move around more easily and lower their risk of falling. As an alternative, employing a smart assisted cane with features like warning sensors and visual feedback technology is a superior choice for enhancing mobility and lowering the risk of falling. The medical community should address the five major issues that this study's cane users were found to have: a lack of medical advice when choosing or using a device; incorrect cane height; cane placement in the wrong hand; an inability to maintain a correct alternating gait pattern and poor posture while ambulating[11]. Older adults with mild to moderate dementia as well as cognitively healthy older adults.It requires a lot of cognitive effort to learn to walk with a single-point cane, but AD sufferers are more likely to experience the effects. When walking in a straight line while multitasking or on more complicated courses requiring maneuvering around obstacles, people with AD demonstrated statistically significant boosts in gait variability. Attempting to provide capabilities for distant surveillance, localized signal interpretation, and real-time feedback on cane use to reduce the danger of falling, the SmartCane system integrates developments in the fields of wireless networking, embedded enumeration, and signal processing [5].By classifying whether a person is walking with the correct cane motion and applied forces throughout a stride, the new technology offers local data processing capacity[8]. Obstacles that they encounter when walking put them at risk of injury from falls. The smart cane device will warn blind

individuals of the problems and solve using audio output[9]. Walking and standing postures require quite different approaches to balance maintenance. The intention of standing is to maintain the gravity centroid on the surface that provides assistance. However, walking disturbs the body's equilibrium, and adjustments are needed in response to changes in the gravity line. Gait abnormalities typically begin around the age of 60, although more major changes are seen in people between the ages of 75 and 80[7]. Contrary to the 3-point gait with WSFC 6, the lower extremity muscle activation during the phase of stance was abnormally high in the 2-point gait with WSFC.

Beauchamp et al. investigated how walking sticks affect symmetry when walking. It was shown that utilizing walking sticks improved symmetry when walking. In their investigation of the potential effects of a walking assistance on balance and gait, Bateni et al.[8-9] found that such devices increased mobility and balance.

Amitejash Rout.et.al conducted the study on Smart Quadripod Walking Stick for Visually Challenged and Elderly People .If an impediment is within 50 cm of the smart quadripod walking stick, it will recognise it and give the user haptic input. The smart baton's LED light will illuminate and shine a warning to strollers of its presence, depending on the ambient lighting. When a crisis occurs, the user can push the panic button to send specific phone numbers an SMS giving the stick's GPS locations[10-13].

## Conclusions

The study concluded that smart assistive cane is effective in both the physical and psychological domain of the elderly population .The participant in the smart assistive device did not experience any therapy-related adverse effects during the administration of the gait training.

**Conflict of Interest:** No conflict of interest.

**Source of funding:** self-funded project.

**Ethical Clearance:** The Institutional Ethical Committee issued their approval to the research. Before the randomization and training allocation, all participants gave written informed consent.

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Original Article

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# A Study to Compare the Effectiveness of Serratus Anterior Training Versus Subscapularis Training in Improving Performance in Swimmer's Shoulder

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**Abstract**

**Background:** The purpose of this study was to investigate the effectiveness of 6-week Serratus Anterior training Versus Subscapularis training in improving the performance in a Swimmer's Shoulder.

**Purpose:** To compare the effect of Serratus Anterior strength training versus Subscapularis strength training on shoulder pain in terms of performance in Swimmer's.

**Materials and Methods:** Subjects were randomly assigned into two groups i.e. Group A and B. The subjects were assessed using an assessment form, UQYBT, DASH score, and 50 meters (m) freestyle sprint for disability and evaluate performance before the commencement of treatment and also reassessed after 6 weeks of treatment. The sample of 40 subjects has been randomized into either Group A (Serratus Training) or Group B (Subscapulis Training) in a 1:1 ratio.

**Results:** The study results suggest that Group B has an effect on performance improvement in Swimmers with shoulder pain after a 6-week intervention. The mean 50m sprint scores in Group A before treatment is 29.9960 and it is decreased to 29.0425.

**Conclusion:** Hence, this study concludes that the mean difference of Group B is slightly more effective than Group A in terms of performance in swimmers' shoulders in all standard measures.

**Key Word:** swimmers shoulder, serratus anterior training, subscapularis training, performance.

## Introduction

Swimming is a unique sport combining endurance, strength and control in a non-weight-bearing environment. Elite swimmers may swim up to 14,000 meters(m) each day, which requires more than 2500 shoulder revolutions per day or

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up to 16,000 shoulder revolutions per week.[1, 2] The competitive swimmers are plagued by varied levels of shoulder pain, which may or may not limit their regular activity.[3] The propulsive forces responsible for total body displacement, especially in front crawl, back stroke and butterfly, are mainly produced by the upper limbs, through arm adduction and shoulder internal rotation.

The term "Swimmer's Shoulder" was created by Kennedy and Hawkins to characterize anterior shoulder soreness during and after exercise. At first, it was assumed that the rotator cuff tendons' outlet impingement under the coracoacromial arch was the source of the pain. However, when shoulder discomfort was further investigated, it became clear that there are other factors to consider, including stroke biomechanics and/or shoulder muscle overuse and fatigue, scapula, and upper back and/or glenohumeral laxity with subsequent shoulder instability.[1, 4] In a recent study, 91% out of 80 young elite swimmers (13-25 years old) reported an episode of shoulder pain. 84% showed positive impingement sign, and the 52 swimmers who had magnetic resonance imaging (MRI) testing showed evidence of supraspinatus tendinopathy in 69% of cases.[1,]

## AIM

To compare the effectiveness of Serratus Anterior training versus Subscapularis training in swimmers with shoulder pain in terms of performance in subjects with Swimmer's shoulder.

## Material and Method

It is an experimental study conducted in YMCA Chennai and in the swimming pools in and around Chennai. All subjects were clinically diagnosed as Swimmer's shoulder. Subjects were chosen depending on whether they met the inclusion criteria. Subjects were evaluated using an assessment form, Upper Quarter Y Balance Test (UQYBT), Disabilities of Arm, Shoulder and Hand score (DASH) and 50m sprint for disability and evaluate performance. Subjects were informed about the procedure, merits and demerits of the treatment. Consent is obtained from each patient for voluntary participation. Subjects were randomly assigned into two groups i.e. Group A (n=20)(Serratus Anterior training) and Group B (n=20)(Subscapularis training). Subjects were assessed before the commencement of treatment and also reassessed after 6 Weeks of treatment. This study was conducted from January, 2023 to July, 2023.

The treatment duration was 3 times a week for 6 week, totally 18 training sessions per group.

Material used for this study includes Inch tape, Wooden block, Stopwatch, Goniometer, Pen, paper, TheraBand (Blue colour), Swiss ball, Stepper, Mat, Medicine ball (2lb, 6lb), Trampoline. Similarly parameters used here (Group A) serratus anterior training and (Group B) subscapularis training as independent variable, dependent variable are UQYBT, DASH and 50 meters Sprint test for measuring swimming performance.

**Inclusion criteria:**

- High school, college swimmers with shoulder pain past 3 months, not with a 6 weeks of formal rehabilitation.
- Age 16 to 22 years with minimum 8 hours training per week.
- Positive Hawkins test

**Exclusion criteria:**

- Previous shoulder injury
- upper limb disorders
- Cervical, thoracic conditions and rints[2].

**Procedure**

**Group A: Serratus Anterior Training:**

**Intermediate phase:**

1. **Diagonal PNF using TheraBand:**

The subject was asked to perform a diagonal PNF pattern (shoulder flexion, extension, and external rotation) toward the end of the subject's range of motion.

2. **Shoulder abduction in the plane of scapula:**

The subject arm straight at the side, and ask to turn their palm so that it is facing forward, then to lift their arm out to the side in the scapular plane.

3. **Serratus Anterior punch:**

With the theraband still tied to a fixed surface, turn away from the surface and the Subject hold the band and punches forward.

4. **Dynamic hug:**

With the shoulder abducted at 60º, internally rotated at 45º, and elbow flexed at 45º then they were asked to horizontally flex their shoulder described by their hands (huggingaction) till reaches maximum protraction, then return slowly to the starting position.

5. **Wall slide:**



**Fig 1: Wall slide.**

With the theraband tied, the forearm should remain parallel and in the form of the number 11. Subject protracts the shoulder blades by pushing the upper back away from the wall and sliding up and down against the wall.

**Advance phase:**

1. **Push-up plus:**

From standard push-up position, continue to rise up by protracting scapula and return to starting position.

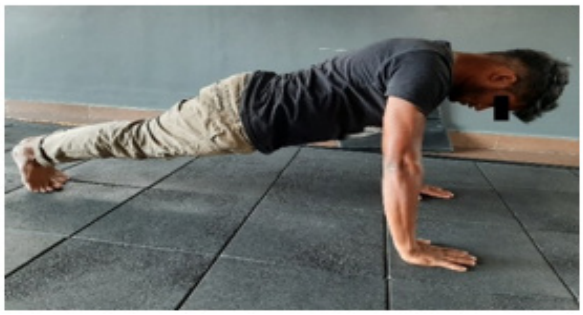


**Fig 2: Push-up Plus**

2. **Plyo push-ups:**

Subject's were advised to lower their body until the chest almost touches the ground. When pushing up, then asked to clap their hands, then return to starting position.

3. **Medicine Ball Reverse Throw and Catch:**

Shoulder abducted to 100º and rotates externally, then asked to throw the medicine-ball reverse and catch.



**Fig 3: Medicine Ball Reverse Throw & Catch**

4. **Step over:**

From high plank position and stepper is placed in front of the subject and asked to step up and down.

5. **Swiss ball walk outs:**

From high plank position with legs supported on a Swiss ball, hands shoulder-width apart, chest near the ground, torso in straight line. The subject was asked to take a step walk-forward for 5 to 7 steps and return to starting position.

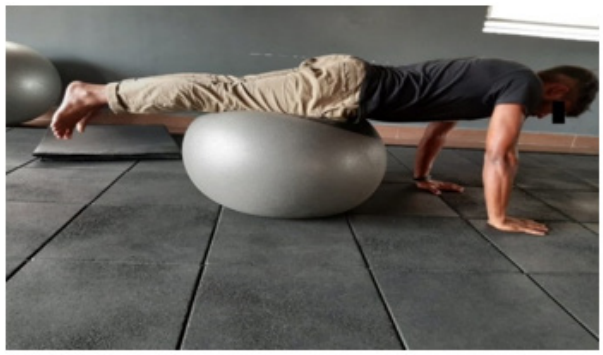


**Fig 4: Swiss ball walk out**

**Group B: Subscapularis Training:**

**Intermediate phase:**

1. **Internal rotation (90º of abduction):**

Theraband still tied, arm abducted 90º, elbow flexed, Subject was asked to internally rotate the arm by pulling the band forward and return to starting position.



**Fig 5: Internal Rotation (90° of abduction)**

2. **Internal rotation (90° of forward flexion):**

Theraband still tied, arm forward flexed 90°, elbow flexed. Then internally rotate the arm by pulling the band forward and inward and return to starting position.

3. **Diagonal internal rotation:**

With elbow flexed 45°, shoulder abducted 90°. Then slowly horizontally flexed, adducted, internally rotated the humerus until the hand reached the anterior superior iliac spine opposite to resistance.

4. **Rhythmic stabilisation:**

Subject in "Statue of Liberty position" and challenged to maintain this position against resistance while throwing and catching in the opposite hand.

5. **Extension from 90° to 0°:**

Subject in standing and grab theraband with arm flexed 90°, internally rotated then pulls the band downwards until hand reaches the thigh.

**Advance Phase:**

1. **Ball throw Rebound:**

With shoulder abducted 90°, elbow flexed 90°, holding medicine-ball of 2lb, then asked to bounce the ball by throwing it against the trampoline.

2. **Wall Dribble:**

Asked to stand by holding medicine-ball of 2lb in hand with shoulder abducted 90°, elbow flexed 90°, band was tied to shoulder height, then Subject dribbles the ball against the wall for 10 to 12 counts.



**Fig-6 Ball throw rebound &Fig-7 Wall dribble**

3. **Overhead throw:**

Standing by facing wall and shoulders 90-90 position, subject throws the ball overhead against the wall.

4. **Side throw:**

Standing side of the wall, grabs the ball of 6lb and throws it against the wall in side way.

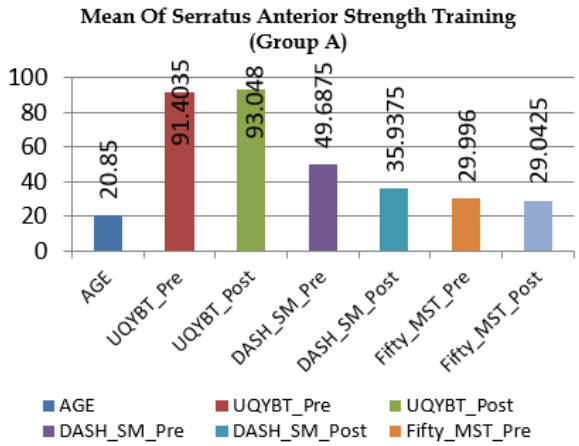
5. **TheraBand diagonal acceleration:**

Standing and grabs theraband with elbow flexed 45°, shoulder abducted 90°, quickly horizontally flexed, adducted, and internally rotated the humerus until the hand reached the anterior superior iliac spine opposite to the resistance.

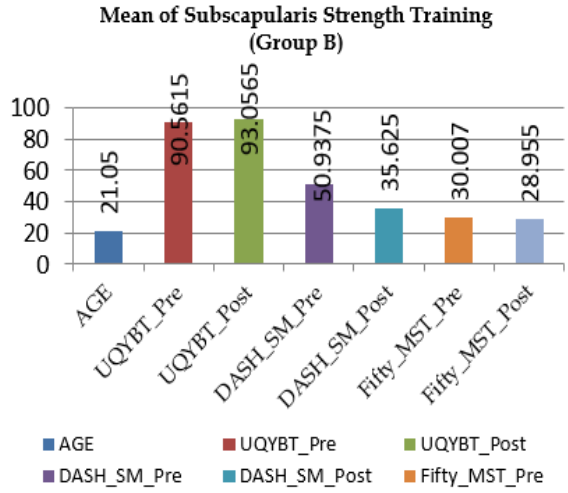
Repeat all the exercise for 3 sets of 10 repetitions per set.

**Data Analysis**

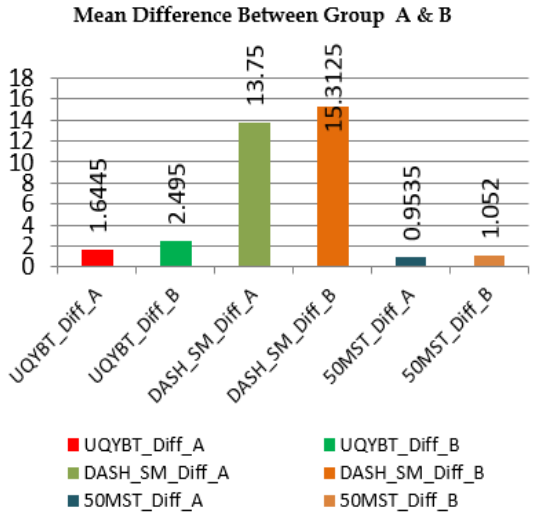
Totally 40 only male subjects involved in this study and randomized into Group A and B in 1:1 ratio. The descriptive statistics for age and for all standard measures (before and after treatment) have been calculated separately for treatment groups.




**Graph No. 1 shows Group A pre and post-test values**




**Graph No. 2 shows Group B pre and post-test values**




**Graph No. 3 shows mean difference between group A and B values**

## Result

The study was conducted on 40 subjects, each group 20.UQYBY Score ($t(38)=3.975, p= 0.000<0.05$) shows a significant difference between the Groups, by mean values, we conclude that the average increase in UQYBT Score due to "Subscapularis Strength Training" (M=2.4950,SD=.77772) was greater than that of "Serratus Anterior Strength Training" (M=1.6445,SD=.55735).

For DASH_SM Score ($t(38)=1.035, p= 0.307>0.05$) shows No significant difference between the Groups, by mean values, we conclude that the average decrease in DASH_SM Score due to "Subscapularis Strength Training" (M=15.3125,SD=5.15986) was greater than that of "Serratus Anterior Strength Train ing" (M=13.7500,SD=4.34908).

For 50MST Score ($t(38)=2.687, p=0.011<0.05$) shows significant difference between the Groups, by mean values, we conclude that the average decrease in this 50MST Score due to "Subscapularis Strength Training" (M=1.0520,SD=.14763) was greater than that of "Serratus Anterior Strength Training" (M=.9535,SD=.07125).

## Discussion

In India, swimming has become a highly competitive sport and, as a result, shoulder overuse injuries are a growing concern. Swimming increases the risk of shoulder tendinitis and tenosynovitis.[5] This study utilized an experimental design to investigate the effectiveness of 6-week Serratus Anterior training Versus Subscapularis training in improving the performance of Swimmer's Shoulder. Validating a strengthening program for high school and collegiate swimmers that modifies suggested specific rehabilitation program for shoulder pain provide coaches and PTs to incorporate into their training and potentially reduce the incidence of shoulder pain during a competitive season.

Swimmers can be identified by the curve of their shoulders and tappers to slim waists and hips. Competitive swimmers swim 10-14km per day, six to seven days per week, which equates to 2500 shoulder rotations every day.

Shoulder pain is directly related to age, training intensity, training interval, and proficiency of swimming with respect to their ranks.[6]

Scov and colleagues performed an EMG study on painful shoulder during front crawl swimming. Their results demonstrated subscapularis had significantly less EMG activity. Also dysfunction of the serratus anterior contributes to impingement syndrome. All the above research implies that subscapularis and serratus anterior play a major in stabilizing the shoulder during front crawl swimming and the fatigability nature of the muscles makes the swimmer more susceptible to impingement.

In the present study, results suggest that Group B has an effect on performance improvement in Swimmers with shoulder pain after a 6-week intervention. The improvement was slightly more significant in group B than in group A. The difference between Group A and B has been found to be a statistically significant in UQYBT score, DASH SCORE, and Performance timing. However, the mean difference of Group B is slightly more effective than Group A in terms of UQYBT Score and Performance timing.

Dr. Ranjeet Singh Sandhu(2017)[8] conducted a study to compare the Effectiveness of Aquatic Exercises Versus Dry Land Concentric Eccentric Exercises on a Swimmer's Shoulder. They concluded that Dry-land Functional training improves the 50m freestyle sprint performance, reduces pain and disability in Swimmers with shoulder pain.[18]In this study the mean difference of 50m freestyle sprint scores results concludes "Subscapularis Strength Training is more effective than "Serratus Anterior Strength Training in improving the performance timing.

Dr. Dabholkar Ajit S et al(2015) conducted an RCT to evaluate the Effects of scapular muscle strengthening on shoulder function and disability in shoulder impingement syndrome. They concluded that strengthening scapulothoracic muscles decreases disability and improves function in patient with SIS. In agreeing with the study, DASH score results shows significant difference within the group but there is no difference between the groups.

Zeynep Hazar et al (2014) studied on UQYBT test on shoulder impingement patients and found that patients with shoulder impingement syndrome will perform worse on the UQYBT in the medial and inferolateral directions. In correlation with this study, swimmers performed worse on UQYBT scores in the medial and inferolateral directions. And post rehabilitation the score improved in both directions in both groups. But the mean difference is slightly more effective in Group B than in Group A.

There hasn't been an interventional study on swimmers' shoulders, despite research being done on the treatment of swimmers' shoulders and the comparison of aquatic and dry land rehabilitation. Therefore, this study implies hosting an advantage in rehabilitation for Swimmer's shoulder athletes as they are bound with time for treating their condition.

**Functional Training in Swimmer's Shoulder:**[7]

The dynamic stabilizers of the shoulder complex must activate consistently and in unison for best athletic performance. Strengthening exercises should replicate the functional requirements associated with sport-specific skills. Unfortunately, most traditional weight-training programs fail to address the dynamic strength and endurance requirements of swimming, thus promoting shoulder dysfunction. Functional exercises were incorporated in daily dry-land training in this study to train specific muscle groups in positions relative to the demands of the sport. Several researchers agree that exercises should be implemented in positions of vulnerability, thus inducing neural adaptations for dynamic restraint.

The objective nature of any swimming race is to complete the race in the shortest possible period. Dry land exercises can help swimmers with both their swim technique as well as their overall endurance. This study emphasized training deep stabilizers of the shoulder that are more susceptible and common causes for impingement in swimmers. The study found that swimmers with Subscapularis training have higher mean values as compared to swimmers with Serratus Anterior training showing statistically significant differences ($p<0.05$) for UQYBT score and 50m freestyle sprint performance. The purpose of the study is to provide a brief and a better idea of the Rehabilitation program of deep stabilizers for athletes with Swimmer's Shoulder.

## Conclusion

The difference between Group A and Group B was found to be statistically significant in terms of

the UQYBT Score and 50MST Score except DASH_SM Score. On the whole, this study concludes that the mean difference of Group B "Subscapularis Strength Training" is slightly more effective than Group A "Serratus Anterior Strength Training" in terms of performance in the swimmer's shoulder in all standard measures.

**Ethical Clearance:** Taken from the institutional ethical committee.

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# A Comparative Study on the Effects of Aerobic Exercises and Extension Exercises in Teachers with Low Back Pain

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**Abstract**

**Background:** Low back pain is a musculoskeletal problem for which teachers are more prone due to their working conditions. Conservative treatments have been proposed for teachers with low back pain such as aerobic exercises and extension exercises. However, there was a lack of studies showing the comparison of effectiveness between aerobic exercises and extension exercises in treating low back pain in teachers.

**Purpose:** To compare the effectiveness of aerobic exercises and extension exercises in reducing pain among teachers with low back pain.

**Materials and Methods:** Based on the inclusion and exclusion criteria, 30 participants who are teachers with Low back pain were recruited, and informed consent was acquired from the subjects. The volunteers were informed about the study's safety and simplicity. The individuals were randomly assigned to one of two groups: the control group (n=15) which received Aerobic exercises and the Experimental group (n=15) which received Extension exercises. All individuals were assessed for pain using Numerical Pain Rating Scale as a pre-test prior to the intervention and again after 4 weeks of intervention. This entire process was performed between November 2022 to April 2023.

**Result:** Statistical analysis was done for all the collected data using paired t-tests and unpaired t-tests. The test shows significant effects ($p<0.0001$) in both groups. The test shows that the subjects who received Extension exercise have had pain relief.

**Conclusion:** The results and the data obtained from this research were statistically classified and can be concluded that Extension exercises had a definite and proven effect on Low back pain.

**Keywords:** Teachers, low back pain, Numerical Pain Rating Scale, Extension exercises.

## Introduction

Different demands placed on school instructors, such as teaching, grading homework, revising exams, and using computers, may be viewed as a risk factor for low back pain. These circumstances and demands include those that involve extended sitting or standing.[1]

Low back discomfort not only denotes a poor quality of life but also lower labor productivity as a result of absences, early retirement, and time off from

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work. The other factor that had a positive impact on low back pain was regular physical activity. Teachers who regularly exercised were 0.52 times less likely to develop LBP than those who did not.[2]

Exercise has a proven track record of reducing chronic low back pain and enhancing function and productivity. Exercise may lessen the severity of back pain, which is an important benefit when treating chronic back pain.[3]

The therapeutic approach of low back pain involves a number of different strategies. More and more people are supporting active therapy approaches, which motivate patients to engage in the healing process. According to current claims, these methods of treatment are successful in reducing discomfort and disability as well as boosting spinal flexibility and endurance.[4]

Aerobic exercise may be essential in the rehabilitation of Low back pain and keeping your low back healthy. Enhanced skeletal muscle oxidative capacity and enhanced neuromotor coordination and control may be a few advantages of Aerobic exercise for those with Low back pain.[5]

Some forms of exercise tend to be beneficial once the pain has become chronic, despite the fact that exercise therapy seems to be ineffective when the pain is acute. Traditional physiotherapy, medical resistance training, stretches, and freely selected exercise are a few examples of these. Particularly, lumbar extension has proven to be successful. [6]

## Aim

To compare the effectiveness of aerobic exercises and extension exercises in reducing pain among teachers with low back pain.er Points.

## Materials and Methods

30 participants who are teachers in nearby schools with Low back pain were recruited, and informed consent was acquired from the subjects. The volunteers were informed about the study's safety and simplicity. The individuals were randomly assigned to one of two groups: the control group (n=15) who received Aerobic exercises and the Experimental group (n=15) which received Extension exercises. All individuals were assessed for pain using Numerical Pain Rating Scale as a pre-test prior to the intervention and again after 4 weeks of intervention from November 2023 to April 2023

**Inclusion criteria:**

- Teachers with Low back pain.
- Age 41-60.

**Exclusion criteria:**

- Back pain due to lumbosacral strain.
- Previous lumbar surgery.
- Pregnancy.
- Spinal pathologies.

### Outcome measures:

Subjects were assessed for their level of pain prior to the beginning of treatment as pre-test and again after the intervention as post-test using Numerical Pain Rating Scale (NPRS).

### Procedure

Based on the inclusion and exclusion criteria, thirty teachers who were experiencing low back pain were selected from the school. The teachers who had Low Back Pain with consent were randomly split into two groups (Group A-15, Group B-15). The pre-test i.e the pain intensity before intervention was administered to all subjects using the Numerical Pain Rating Scale, and the post-test is administered four weeks after the intervention.

**Control group: (group-A) aerobic exercise**:

**Walking:**

- Walk steadily, swing your arms around freely, and try to stand as straight as you can.
- From heel to toe, take a step with your feet in a rolling motion. Wear thick, comfy cotton socks and shoes. Best are sensible, lightweight, comfy shoes with support.

**Jogging:**

- Keep a straight back, tighten your core, and look forward while jogging.
- Keep your shoulders upright and avoid sagging your head.
- While drawing your shoulders back and down, enlarge your chest and maintain it raised.

- Use a calm arm swing while keeping your hands free. The front crossing of your arms is not recommended.

**Cycling:**

- For 5 to 10 minutes, pedal slowly and easily.
- Then increase your speed until you begin to perspire.
- Take an additional five minutes to cool down by pedalling more slowly when you're prepared to finish.

**Protocol:**

- Frequency: The subjects were asked to practice every exercise 3-4 times a week.
- Intensity: exercise enough to reach your target heart rate.
- Time: Each exercise is to be done for at least 20 minutes.

**Experimental group: (Group-B) extension exercises:**

**Pelvic tilt:**

- On the ground, with your knees bent, lie on your back.
- By contracting your abs and raising your pelvis a little, you can flatten your back against the floor. Maintain for up to 10 seconds.

**Cat and camel:**

- Make a camel hump posture by tucking your head and tailbone in and arching your spine. simultaneously, take a deep breath in.

**Cobra stretch:**

- In a prone position, lay down.
- Lay down your entire body on your mat face down.
- Bring your hands up close to your shoulder blades.
- Start raising your upper body.
- To lift heavier objects, flex your lower back muscles.
- Look up and slightly in front of you.

**Standing back extension:**

- Put both hands just above your hips and behind your back.
- Bend backwards gradually.
- If you need more stability, you can lean back against a kitchen counter.
- For up to 60 seconds, maintain the bent back position while keeping an eye on your symptoms.

**Protocol:**

The subjects were asked to practice every exercise twice in total of ten repetitions, 3-4 times a week.

**Data analysis**

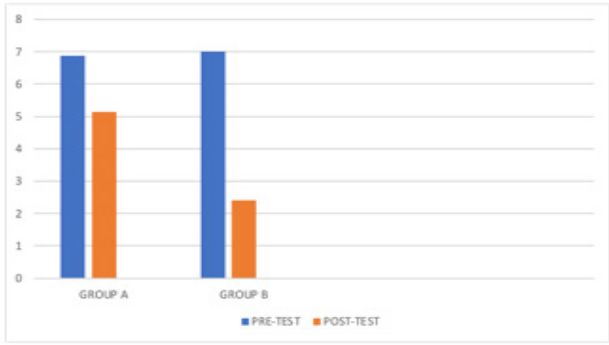



**Fig 1: Comparing pre and post-test of both groups using NPRS**

## Result

Using Numerical Pain Rating Scale (NPRS), (Aerobic exercise) Group A's post-test mean was **5.13**, whereas (Extension exercise) group B's was **3.20**. This demonstrates that Group B (extension exercise) received a higher NPRS score than Group A (aerobic exercise).

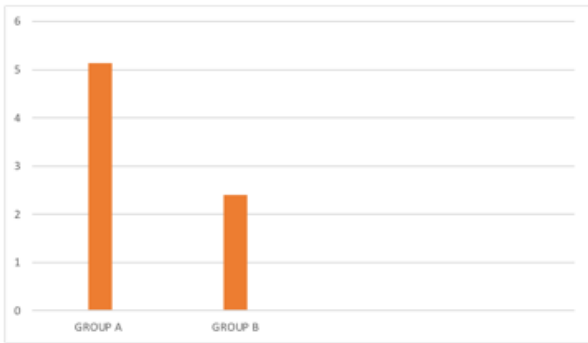



**Fig 2: Comparing post-test of both groups using NPRS**

**Fig-1:** Comparison of pre-test and post-test of NPRS in both the groups, Group A (aerobic exercise) and Group B (extension exercise) using unpaired t-test shows that, mean for group a pre -test was 6.87 post-test was 5.13 and group b pre-test was 7.00 post-test was 2.40.

**Fig-2:** Comparison of post-test of NPRS in both the groups, Aerobic exercise (Group A) and Extension exercise (Group B) Using unpaired t-test shows that, mean for post-test Group A was 5.13 Group B was 2.40. This suggests that group B (extension exercises) performed considerably better than group A (aerobic exercises). This strongly suggests that Extension exercises have a positive effect on reducing the Low Back Pain among the Teachers.

## Discussion

Low back pain is a common issue experienced by many teachers. The nature of their profession often involves prolonged periods of standing, sitting, bending, and lifting, which can put strain on the lower back. It is quite concerning how common low back pain is in teachers. Numerous studies have indicated that teachers are particularly prone to experiencing low back pain. In this project comparing the effectiveness of extension exercises and aerobic exercises for teachers with low back pain, the findings highlighted that extension exercises were more effective in managing their condition.

The purpose of the study is to find the effect of Extension exercises in patients with Low Back pain. Research studies also stated that Extension exercises have significant improvement in patients with Low Back Pain.

Sculco,2001 with a 2.5-year follow-up to an initial 10-week exercise program evaluated the effects of low to moderate aerobic exercises as an adjuvant therapy for LBPP in a neurosurgical practice. This study's objective was to evaluate the influence of both short- and long-term AE on LBPP. In the first 10-week period, mental states, pain/symptoms, and AE were compared to non-exercising controls.[5]

Rainville J, 2004 examined a number of important elements relating to the security and effectiveness of exercises that may aid medical professionals in comprehending the value of it in the treatment of chronic back pain.[3]

Choi SY, 2001 studied whether exercise programs are effective in reducing pain, decreasing depression, improving strength and endurance in the female teachers who have low back pain.[16]

Rittweger J, 2002 investigated if lumbar muscle force could be a reason for the low back pain and found that the lumbar muscle force is not responsible for the low back pain.[6]

Meng XG, 2005 evaluated if aerobic exercise is effective in reducing low back pain and concluded that aerobic exercise is effective in reducing low back pain.[21]

Smith D, 2011 studied if extension exercise is effective in treating low back pain and it came out to be effective in reducing the low back pain. [27]

Browder DA, 2007 did a comparative study on the effectiveness of extension-oriented exercise and trunk stability exercise and concluded that extension-oriented exercise is more effective than trunk stability exercise in reducing low back pain.[26]

Bandpei MA, 2014 investigated teachers' risk factors and prevalence of low back pain (LBP), as well as the relationship between personal and professional traits and LBP occurrence.[1]

Matsudaira K, 2015 tested if a McKenzie method-based standing back extension exercise called "One Stretch" may reduce or eliminate low back pain (LBP) in care workers. On the basis of the study's findings, suggestions can be made for the clinical care of low back pain. Clinicians should think about including extension exercises in the treatment plan for patients with low back pain if it is discovered that they are more helpful at lowering pain than aerobic exercises. In order to ascertain these interventions' long-term effects on pain management and functional improvement in people with low back pain, future research should examine the long-term effects of these interventions beyond the 3-month follow-up period.[8]

## Conclusion

Throughout the research period comparisons of effectiveness between Aerobic exercises and Extension exercises were investigated. Findings of this project indicated that the effectiveness of Extension exercises in reducing the low back

pain among teachers varied greatly to the overall effectiveness of Aerobic exercises in reducing the low pain among teachers. This finding led me to the conclusion that Extension exercise was found to be more successful than Aerobic exercise in reducing pain among Teachers with Low Back Pain.

**Ethical Clearance:** This research was approved by the ISRB committee. ISRB number-03/ 001/2022/ ISRB/ SR/ SCPT.

**Funding:** Self

**Conflict of Interest:** Nil.

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Original Article

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# A Study on the Effectiveness of Task Oriented Strength Training to Enhance Upper Limb Motor Function in Children with Cerebral Palsy

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**Abstract**

**Background:** A wide variety of static, non-progressive motor impairments, such as cerebral palsy, can develop from birth or infancy as a result of damage to the central nervous system's neuromotor components. Regulating motor activity frequently requires communication between the cerebral cortex, thalamus, basal ganglia, brain stem, Cerebellum, spinal cord, and linking sensory-motor pathways. Task-oriented training is utilized as a rehabilitation technique to hone motor skills and as a programme to enhance muscular function or strength. Objective of this study is to compare the effectiveness of Conventional therapy and task-oriented strength training in children with cerebral palsy.

**Purpose:** To compare the effectiveness of conventional therapy and task-oriented strength training in children with cerebral palsy.

**Materials and Methods:** A total of 48 subjects were included into the study based on the selection criteria and informed consent was obtained from the parents of the children. Group A (n=24) will be treated with Conventional shoulder exercises while Group B (n=24) will be treated with task-oriented strength training with weights. Outcome measures include Shoulder ROM and GMFCS Scale. Results should be tabulated and statistically analyzed. Both training programs will be given for 4 weeks, weekly 5 days from November 2022 to April 2023.

**Result:** Statistical analysis made with quantitative data revealed statistically significant differences between group A and group B. The test shows that subjects who received task oriented strength training have better effects in improving the motor function of children with Cerebral Palsy.

**Key Words:** Cerebral palsy, Task oriented training, Weights.

## Introduction

Cerebral palsy (CP) is a common neurological problem in children, and it is used to describe a variety of movement disorders that result in a variety of activity limits. CP is the leading reason for motor disability in children, and it affects around 2 out of every 1000 live births. CP is the most common motor impairment that arises at a young age and affects 1 in 1000 infants.[1] A wide variety of static, non-progressive motor impairments, such as cerebral palsy, can develop from birth or infancy as a result of damage to the CNS neuro motor components. In general, coordination of motor activity is achieved through communication among the cerebral cortex,

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thalamus, basal ganglia, brain stem, cerebellum, and connecting sensory-motor pathways.[2] The specific CP syndrome may only be recognized at 3-5 years of age, despite the fact that suggestive signs and symptoms may be present at a younger age. This is because the clinical characteristics of this entity change over time.[3] The management includes neurological rehabilitation (addressing muscle tone abnormalities and developing physical and occupational treatments) (such as epilepsy, cognitive decline, eyesight, hearing loss, growth, and digestive problems.) in addition to the diagnosis and treatment of comorbidities.[4]

The etiology of CP is intricate. Since the majority of cases of cerebral palsy (CP) were thought to be caused by new born brain hypoxia during delivery or during the postpartum period for more than a century, the occurrence of CP was seen as a barometer of the caliber of obstetric and neonatal care. Nearly 75% of instances of CP appear to be caused by prenatal causes, with new born and neonatal period risk factors accounting for 10% to 18% of cases.[5] Cerebral palsy is mostly diagnosed based on motor function and postural issues that start in early childhood and last all the way to the end of life; these issues are non-progressive but do alter with age.[6]

## Aim

To compare the effectiveness of task-oriented strength training to enhance upper limb motor function in children with CP.

## Material and Method

A total of 48 subjects were included into the study based on the selection criteria and informed consent was obtained from the parents of the children. The subjects were explained about the safety and simplicity of the study. Subjects were randomly allocated into two groups, Group A (n=24) were treated with Conventional shoulder exercises while Group B (n=24) were treated with task-oriented strength training with weights. Outcome measures include Shoulder ROM and GMFCS Scale. Results were tabulated and statistically analyzed. Both training programs were given for 4 weeks, weekly 5 days from November 2022 to April 2023.

**Inclusion Criteria**

- Diagnosis of cerebral palsy.
- Age between 4 and 8 years.
- Ability to walk with walking aids or orthosis.
- Ability to follow simple instructions.

**Exclusion Criteria**

- Illness before or during the study.
- Surgical procedure during/up to 1 year prior to the study.
- Inability to follow commands.
- Medical condition that precluded exercising.

**Outcome Measures**

Subjects were assessed for shoulder flexion ROM prior to their beginning of treatment as pre-test and again after the intervention as post-test,

- Gross motor function classification scale (GMFCS).
- Shoulder Range Of Motion.

**Procedure**

Forty-eight Children diagnosed with cerebral palsy were screened for inclusion and exclusion criteria. The parents were asked to sign the informed consent form. The instructions were told to the participants clearly. The patients were divided into two groups (Group A-24, Group B- 24. The pre and post-test values were measured by Shoulder ROM and GMFCS.

**Control Group: (Group A) Conventional Therapy**

**1. Shoulder Flexion**

- Place your chest to a wall. Walk your fingertips up the wall slowly until you feel a stretch. Maintain the stretch for 30 seconds. Return to your starting point.

**2. Pendular Exercise**

- Lean forward with one hand on a table or chair for support, keeping your back straight and your legs locked.
- Allow the arm to dangle freely, then gently swing the free hand back and forth then side to side and in circles. Repeat on the opposite side.

**3. Crossover Arm Stretch**

- Place one straight arm against the chest. Hold the arm above the elbow with the other hand.

Hold this position for 30 seconds, feeling a stretch in the back of the shoulder. Relax and do it again.

**4. Elbow Flexion**

- Hold two weights in each hand while standing erect. Pull the weight up to shoulder level while keeping the elbow tight to the body.
- Hold for 2 seconds before returning to the starting position in a controlled manner.

**Protocol**

- The subjects were made to perform each exercise twice, for a total of ten repetitions, 4-5 times a week.

**Experimental Group: (Group B) Task Oriented Strength Training**

**1. Ball Games**

- The subjects were asked to wear the weight cuffs and then asked to perform simple ball throwing and ball catching activities.

**2. Drums Beating**

- The subjects were asked to wear the weight cuffs and asked to perform drum beating using both the hands for 5-10 mins.

**3. Building Blocks**

- The subjects were asked to wear the weight cuffs and then asked to build 7-10 blocks.

**4. Touch and Count the Numbers**

Numbers were written on the wall in increasing order, and they were asked to count and touch the numbers one by one with the weight cuffs worn on their wrists.

**5. Removing and Pasting Stickers**

- With weight cuffs, subjects were asked to remove the stickers and asked to paste it in a notebook.

**Protocol**

- The subjects were instructed to perform each task, for a total of ten repetitions, 4-5 times a week.

**Data Analysis**

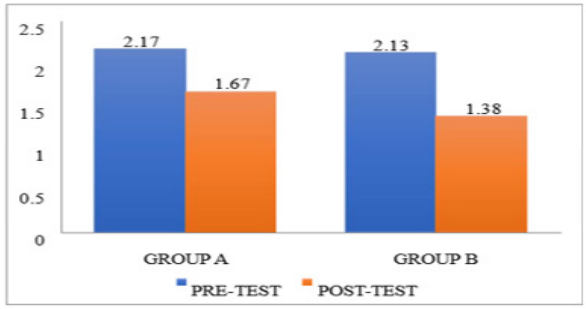



**Fig-1 Comparing pre and post-test of both groups using GMFCS**

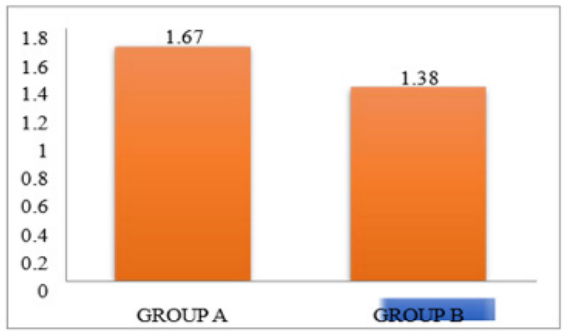



**Fig-2 Comparing post-tests of both groups using GMFCS**

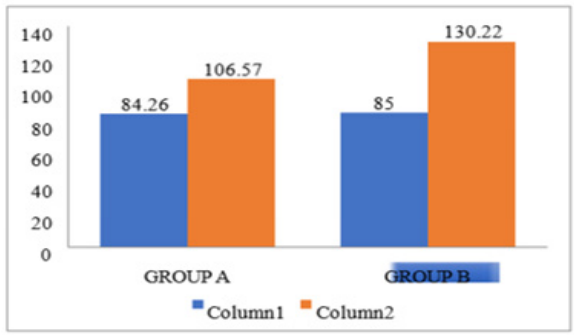



**Fig-3 Comparing pre and post-test of both groups using Shoulder ROM**

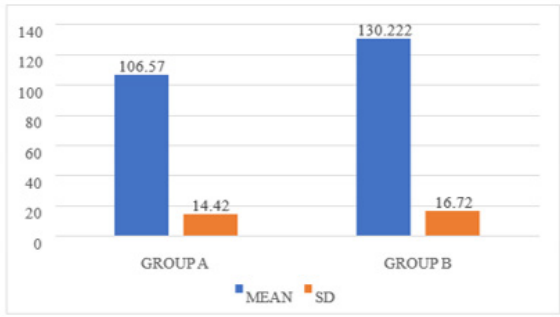



**Fig-4 Comparing post-test of both groups using Shoulder ROM**

## Result

Based on the difference in mean of both the groups. GROUP A (Conventional Therapy) and GROUP B (Task Oriented Strength Training ) the group which received Task Oriented strength training (group-b) were found to be having a lesser pain score than the group which received conventional therapy (group-a) post the intervention.

The result of study in Fig-1 Comparison of pre-test and post-test of GMFCS in both the groups (Group A- Conventional therapy, Group B Task oriented strength training) using unpaired t-test shows that, mean for group a pre -test was 2.1.7 post-test was 1.67 and group b pre-test was 2.13 post-test was 1.38.

Fig-2 Comparison of post-test of GMFCS in both the groups conventional therapy (Group A) and task oriented strength training (Group B) Using unpaired t test shows that, mean for post-test Group A was 1.67 Group B was 1.38.

Fig-3 Comparison of pre-test and post-test of Active Shoulder Flexion ROM in both the groups (Group A- Conventional therapy, Group B Task oriented strength training) using unpaired t-test shows that, mean for group a pre -test was 84.26 post-test was 106.57 and mean for group b pre-test was 85.00 and post-test was 130.22

Fig-4 Comparison of post-test of Active Shoulder Flexion ROM in both the groups conventional therapy (Group A) and task oriented strength training (Group B) Using unpaired t-test shows that, mean for post-test Group A was 106.57 Group B was 130.22 .

And this suggests that group B (Task Oriented Strength Training) performed considerably better than group A (Conventional Therapy). This strongly suggests that Task oriented strength training is effective in upper extremity function in children with CP.

## Discussion

Cerebral palsy (CP) is a neurological disorder that impairs mobility and muscle tone. In many cases, the exact etiology is unknown, but the illness occurs when parts of the brain that control motor function develop abnormally or are damaged. CP affects about three out of every 1,000 live births. Children with CP typically exhibit evidence of motor delay before the age of two. CP is frequently not formally diagnosed until the age of two or three. Babies with cerebral palsy are frequently slow to reach developmental milestones such as rolling over, sitting, crawling, or walking. Certain reflexes that generally vanish in early infancy may also be present. TOT is a new rehabilitation training method based on motor control theory that emphasizes the goal of mimicking functional activities and considers the effect of the environment. Therapists provide specific tasks or activities for children with CP to accomplish in order to enhance their motor skills, based on individual abilities and training goals.

In 2009,Yasser Salem, Ellen M Godwinet al., conducted a study on Effects of task-oriented training on mobility function in children with cerebral palsy and concluded that there is a connection between using a task-oriented strength training programme and having successful functional results. The findings imply that a programme of task-focused strength training may be advantageous for children with cerebral palsy.[6] In October 2008, Eek MN, Tranberg et al., Treadmill exercise is helpful in enhancing gait and endurance in kids with CP, depending on the modalities used. In extremely young children with CP, treadmill exercise can be beneficial with some body weight support. .Aerobic endurance can be improved through endurance training. As long as the training program itself, effects tend to persist very briefly. 75% of one's maximum heart rate seems to be a safe training heart rate. Both parents and children with CP report experiencing more well-being after receiving massage. The best environment for balance training is one that is task-specific.[9] In May 2009 Bialik GM, Givon U. Reviewing the literature reveals that there is still much to learn about the neurological findings and limitations of CP. This might be feasible in the future with improved technology and knowledge of the nature of CP.[4]

In Aug 2004 Shapiro BK.A constructed the definition of cerebral palsy. A set of youngsters who were of interest to the researchers who created the criteria are defined by the interaction of the dimensions of severe disability non progressive lesions, and persistence. The range of motor

abnormalities that can exist is not fully covered by the concept of cerebral palsy. It highlights a specific area of the spectrum of motor dysfunction and establishes a category whose boundaries are established by a variety of motor dysfunctions.[2] In Mar 2004 Shevell MI, Bodensteiner JB. For the parents of children with physical and intellectual disabilities aged 3 to 6 years, ADLIC-D demonstrated acceptable reliability and validity. Through a detailed analysis of the functional skills required to carry out ADL, this instrument can serve as a guide for rehabilitation therapies in the clinical and research domains. [3]

## Conclusion

Findings of this project indicated that the effectiveness of Task oriented strength training is effective in upper motor extremity function in children with CP varied greatly to the overall effectiveness of Shoulder ROM. This finding led me to the conclusion that Task oriented strength training is effective in upper extremity function in children with CP.

**Ethical Clearance**: This research was approved by ISRB committee ISRB number -03/002/2022/ ISRB/SR/SCPT

**Funding:** Self.

**Conflict of Interest:** Nil.

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Original Article

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# A Comparative on the Effects of Thoracic Squeeze Technique Versus Manual Diaphragm Release Technique on Sputum Clearance among Patient with Chronic Obstructive Pulmonary Disease

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**Abstract**

**Background:** The COPD, a prevalent and manageable condition, leads to diminished airflow and tissue damage. It is associated with structural lung problems caused by prolonged inflammation due to continuous exposure to harmful particles or gases, particularly from cigarette smoke.

**Purpose:** To compare the effectiveness of thoracic squeeze technique and manual diaphragm release technique on sputum clearance among patient with COPD.

**Materials and Methods:** A total of 30 participants were selected according to inclusion and exclusion criteria were deliberately sampled. Group A (n=15) received thoracic squeeze technique and the Group B (n=15) received manual diaphragm release technique. All individuals were assessed for COPD assessment test as a pre-test prior to the intervention and again after 6 weeks of intervention. The entire process was performed from November 2022 to April 2023.

**Result:** Statistical analysis was done for all the collected data using paired t- tests. The test shows significant effects ($p<0.0001$) in both groups. The test shows that the subjects receiving thoracic squeeze technique have improved sputum clearance among patients with COPD.

**Conclusion:** The results and the data obtained from this research was statistically significant and concluded that there was a definite and positive effect of thoracic squeeze technique on sputum clearance. This can be recommended in Pulmonary Physiotherapy Practise.

**Key Words:** COPD, COPD Assessment Test, Thoracic Squeeze Technique, Manual Diaphragm Release Technique.

## Introduction

COPD, a prevalent and manageable condition, leads to diminished airflow and tissue damage. It is associated with structural lung problems caused by prolonged inflammation due to continuous exposure to harmful particles or gases, particularly from cigarette smoke. It can happen to have signs that range from asymptomatic to respiratory failure.[1]

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Chronic inflammation reduces pulmonary recoil and contracts the airways. Coughing, dyspnea, and sputum production are common symptoms. Emphysema, a structural abnormality observed in COPD, is characterized by the damage of the alveolar air sacs, the lungs' surfaces responsible for gas exchange, resulting in obstructive physiology. The inflammatory response in emphysema is triggered by irritants like smoking.[2]

The squeezing technique, alternatively referred to as manually assisted coughing, is a beneficial physiotherapy method that involves applying manual pressure to the thorax during exhalation, followed by releasing it at the end. This technique aids in the mobilization of pulmonary secretions, facilitates active inhalation, and enhances airflow within the alveoli. Activate the common cough mechanism. This technique involves placing your hands on the bottom one-third of your chest.[3]

The Manual Diaphragm Release Technique (MDRT) is a therapy aimed at directly stretching the muscle fibers of the diaphragm. Despite its widespread use in various treatment settings, there is a lack of comprehensive evaluation regarding the effectiveness of the MDRT. Therefore, the aim of this study was to evaluate the influence of the MDRT on respiratory performance in individuals diagnosed with COPD.[4]

It has the potential to improve chest wall flexibility and thoracic excursion, leading to enhanced exercise capacity and lung function. Evidence has shown that performing stretching exercises on the respiratory muscles can enhance ventilation in individuals with COPD. This is achieved by improving the ability of the chest wall to expand and accommodate greater airflow.[5]

The practice of stretching the respiratory muscles brings about positive effects on vital capacity, chest wall mobility, and alleviation of dyspnea, resulting in the reduction of COPD-related consequences.[6]

## Aim

To compare the effectiveness of the thoracic squeeze technique and manual diaphragm release technique in promoting sputum clearance in patients with chronic obstructive lung disease.

## Materials and Methods

30 participants with chronic obstructive pulmonary disease were recruited based on the inclusion and exclusion criteria, and informed consent was obtained from the subjects. The subjects were made aware of the study's safety and simplicity. Individuals were randomized to one of two groups at random: group A (15 subjects) got thoracic squeeze method and group B (15 subjects) received manual diaphragm release technique. All participants underwent a COPD assessment test (CAT) as a pre-test prior to the intervention and again after 6 weeks from November 2022 to April 2023.

**Inclusion criteria:**

- Subjects who have been diagnosed with (COPD)
- Age between 40 - 60 years.
- Both male and female.

**Exclusion criteria:**

- Asthma.
- lung cancer, pulmonary fibrosis, bronchiectasis.
- Respiratory infections such as Pneumonia, Bronchitis
- heart failure or end stage renal failure

**Outcome Measures:**

COPD Assessment Test:

The COPD Assessment Test (CAT) is a self-administered questionnaire designed to assess the impact of chronic obstructive pulmonary disease (COPD) on an individual's health status. It provides a standardized way to measure the overall health and well-being of COPD patients.

**Procedure**

For this study, 30 participants meeting the inclusion and exclusion criteria were deliberately sampled. The individuals were randomly assigned to one of two groups: Group A (n=15) received thoracic squeeze technique and the Group B (n=15) received manual diaphragm release technique. All individuals were assessed for COPD assessment test as a pre-test prior to the intervention and again after 6 weeks of intervention.

**Group A Thoracic Squeeze Technique:**

Applying thoracic squeeze technique for chronic obstructive pulmonary disease involves a specific technique to ensure optimal treatment delivery. Here is a step-by-step guide on how to apply thoracic squeeze technique for COPD.

Have the patient sit upright on a chair or bed, with their feet flat on the floor. Position yourself behind the patient, standing or sitting. Place your hands on either side of the patient's ribcage, just below the armpits. Ask the patient to take a deep breath in. As the patient begins to exhale, gently apply pressure with your hands, squeezing the rib cage together. Maintain the pressure for a few seconds, allowing the patient to continue exhaling. Release the pressure as the patient starts to inhale again.

**Treatment Duration:**

This technique is performed for about 10 to 15 minutes per session, and multiple sessions may be done throughout the day.

**Group B Manual Diaphragm Release Technique:**

Manual diaphragm release therapy is employed as a therapeutic intervention for individuals diagnosed with chronic obstructive pulmonary disease (COPD). This treatment involves employing precise breathing techniques customized to aid in the movement and elimination of mucus from the respiratory pathways. The instructions presented below offer a detailed visual guide on the proper implementation of the manual diaphragm release technique for patients diagnosed with COPD.

**Diaphragm Release:**

With your hand on the upper part of your abdomen, gently apply light pressure upward towards your ribcage. You should feel a slight resistance from your diaphragm.

As you exhale, encourage your diaphragm to relax and release tension by applying gentle upward pressure with your hand.

Avoid excessive force or discomfort.

As you inhale, allow your diaphragm to naturally descend and expand against the pressure of your hand.

Repeat this process for several breaths, gradually releasing any tension or tightness you may feel in the diaphragm.

**Treatment Duration:**

Administer manual diaphragm release technique for the recommended treatment duration, typically ranging from a few minutes to several minutes per session.

**Data Analysis**

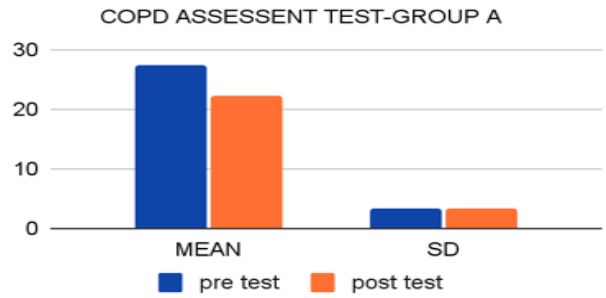



**Fig-1: Comparison between pre and post-test values of COPD Assessment Test (CAT) Group A: Thoracic Squeeze Technique on sputum clearance**

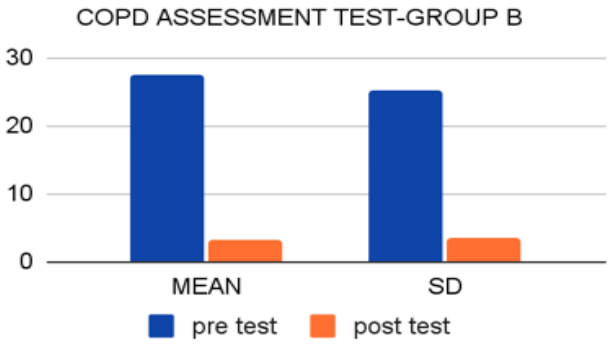



**Fig-2: Comparison between Pre-test and Post-test values of COPD Assessment test Group B : Manual diaphragm release technique on sputum clearance**

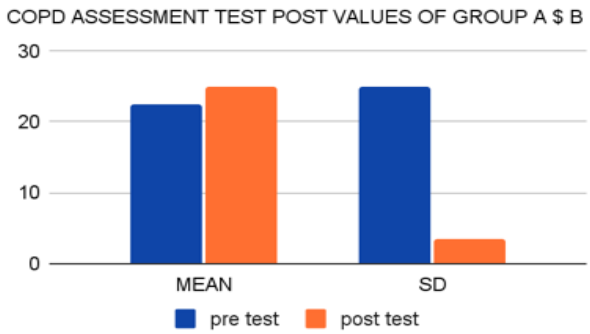



**Fig-3: Comparison of post-test values in both the Groups using COPD Assessment Test.**

## Result

After statistical analysis A considerable distinction between the outcomes of the pre- and post-tests was found in the quantitative data. The test shows that the subjects receiving Thoracic squeeze technique have improved sputum clearance among chronic obstructive pulmonary disease patients.

Comparison of post-test of Group A and Group B revealed that the mean value of COPD Assessment Test (CAT) was 22.40 in

pre-test and post-test was 25.07. SD Value of COPD Assessment Test (CAT) was 3.31 in pre-test and post-test was 3.37. T value 2.185 P value.

## Discussion

COPD can affect people of all ages; it is more prevalent among older individuals. The risk of developing COPD increases with age, and the majority of cases are diagnosed in individuals over the age of 40. COPD often results from extended exposure to irritants like cigarette smoke, air pollution, and workplace hazards, without experiencing an episode for the preceding six weeks. It is often associated with a combination of two primary conditions: chronic bronchitis and emphysema.

The purpose of the study was to find the effectiveness of thoracic squeeze technique and manual diaphragm release technique on sputum clearance among patients with COPD. Research studies also stated that thoracic squeeze technique has significant improvements in patients with COPD.

Fink et al. (2003) identified the Thoracic Squeeze Technique (TST) as one of the techniques. It is also a new and successful physiotherapy practice that may be used safely on non-hospitalized patients. TST is a sophisticated technique that entails gently continuous chest compressions followed by complete release.[6]

Gonz'alez-'Alvarez FJ et al (2020) The diaphragm stretch technique was employed to quantify rib cage and abdominal excursion in healthy volunteers, and a significant increase at the xiphoid level was identified. Yelvar YDG used the Redoming of diaphragm technique to investigate the immediate effects of manual therapy on inspiratory muscle strength and respiratory functions in patients with known COPD but no current or ongoing exacerbation, which resulted in improved pulmonary function and inspiratory muscle strength.[3]

Rocha et al (2005) Manual diaphragm release technique improved diaphragmatic mobility, 6-minute walking distance, and inspiratory capacity in people with clinically stable COPD.[5]

## Conclusion

The results and the data obtained from this research was statistically classified and can be concluded that there was a definite and positive effect of thoracic squeeze technique on sputum clearance. This can be recommended into Pulmonary Physiotherapy Practise.

**Ethical Clearance:** This research has been approved by the ISRB ethical committee. ISRB NUMBER:03/003/2022/ISRB/SR/SCPT.

**Funding:** Self

**Conflict of Interest:** Nil.

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Original Article

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# A Study to Compare the Effectiveness of Structured Aerobic Exercises and Core Strengthening Exercises in Women with Primary Dysmenorrhea

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**Abstract**

**Background:** Dysmenorrhea is a menstrual abnormality which results in severe cramps in the lower back, abdomen, and the legs even in the presence of no pathology of the pelvis. Thus, an early diagnosis and management is necessary to prevent discomfort.

**Purpose:** To study the effectiveness of structured aerobic exercises and core strengthening exercises in women with primary dysmenorrhea.

**Materials and Methods:** A total of 74 volunteers who gave their consent were divided into two groups, and all were given a thorough explanation of the procedures. One group was given structured aerobic exercises that included stretching, warmup, cool down and aerobics for 45 mins/Day for 4 days a week and the other group was given core strengthening exercises for the same duration. Pre and post intervention assessment was done using WaLIDD. Study period : September 2022-May 2023.

**Result:** The data was statistically examined using paired and unpaired t test. The calculated "t" values for the groups were 15.5710 and 18.8766 respectively and p value was <0.0001 for both the groups indicating the result is significant Group A showed a better result compared to Group B.

**Conclusion:** The study concludes that structured aerobic exercise proves to be more effective for better and quicker recovery from primary dysmenorrhea.

**Key Words:** Dysmenorrhea, Core strengthening, Aerobic exercise, WaLIDD, Menstruation.

## Introduction

One of the most prevalent problem faced by women who have attained reproductive maturity is dysmenorrhea during their menstrual cycle, which is characterised by pain in the lower abdomen, back and legs.[1] Primary dysmenorrhea is said to occur when there is pain in the abdomen which is not caused by any underlying pelvic uterine or pelvic diseases. The pain experienced is often sporadic in nature[2.] It usually begins three years after menarche[3] The cause for severe pain and discomfort is due to the expulsion of prostaglandin by the hormone progesterone, which occurs during the ovulatory phase.[4] Moreover this pain or discomfort generally begins a few hours

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or so after menstruation and can persist anywhere from 48-72 hours.[5]

The treatment works by changing the pain mechanism. Some preferred medications include paracetamol, aspirin and NSAIDs which work by inhibiting prostaglandin production[6] . A much better alternative with fewer side effects includes exercise.

Exercise can be described as any form of physical endeavor that demands physical effort in order to build or maintain fitness. It is one of the most effective alternative approaches to alleviate dysmenorrhea discomfort. The decrease in pain is potentially related to a spike in endorphin levels and increase in blood circulation.[7,8] Apart from aerobics which target your overall body, isolated target muscle exercises like strengthening the core muscles, which when sufficiently strengthened are rendered capable to bearing the stress of menstrual pain[7] Therefore, investigating the effectiveness of structured aerobics and core strengthening exercises on reducing or aiding in the betterment of dysmenorrhoeal pain in women suffering from this condition will be the main goal of this study.

## Aim

To study the effectiveness of structured aerobic exercises and core strengthening exercises in women with primary dysmenorrhea.

## Materials and Methods

It was an experimental study conducted from September 2022 till May 2023 on 74 participants from Saveetha College of Physiotherapy and Zuari clinic using Convenient sampling. The participants were separated into two equal groups based on random allocation.

**Inclusion criteria:**

- Age: 18-25
- Females with moderate dysmenorrhea (WaLliD score 5-7)
- Regular Menstrual Dysmenorrhea in at least last 2 or more cycles

**Exclusion criteria:**

- Any other menstrual, medical or gynecological conditions
- participation in any physical activity program or sports program
- History of taking any medications or alternate treatment for dysmenorrhea.

**Outcome measure:**

Working ability, Location, Intensity, Duration, Dysmenorrhea scale (WaLIDD)

Each domain's variable provides a specific score between 0-3 and the final score is between 0-12 points and the scoring is as follows-:

0: Without Dysmenorrhea

1-4: Mild Dysmenorrhea

5-7: Moderate Dysmenorrhea

8-12: Severe Dysmenorrhea

**Procedure**

After acquiring participants that fit the selection criteria, 74 females between the ages of 18-25 years were selected from Saveetha College of Physiotherapy, Chennai and Zuari Clinic, Mapusa Goa. Instructions were given to the participants and their consent was obtained. Following that, they were placed into two separate groups, namely *Group A* and *Group B*, each having 37 participants. Demographic information, as well as WaLIDD scores, were collected via

Google forms to measure the degree of pain at the start and end of the eighth week.

**Group A:** Structured aerobic workouts were assigned to Group A. A structured exercise Protocol was made, and the participants had to follow it 4 times a week for 45 mins.

**Exercise Protocol:**

1. Stretching(10mins)

- neck stretches along with rotation.
- biceps and triceps stretch
- pectoralis stretch
- side bending
- Toe touch while standing and while sitting.

These exercises were repeated about 6-8 times each and held for 10-15s.

2. Warm Up (10mins)

- mild jump, moderate jump, high jump,
- jumping jacks,
- standing glute kick or butt kick
- high knee jumps

These exercises were repeated about 8 times each.

3. Aerobic Exercise (15mins)

- dance marching front, back and side to side
- jumping jack
- side leg raise
- forward leg raise touch.
- Cross toe touch
- Forward Lunges

The workouts were repeated for about 8-10 reps each at an intensity of 70-80% of maximum heart rate, using Borg's Scale (RPE) and subsequently the intensity was increased.

4. Cool Down(10mins)

- Slow marching
- cobra stretch
- butterfly stretch
- child pose
- breathing exercise

These workouts had to be repeated at least 5 reps each.

**Group B:** Core conditioning sessions were performed 4 times a week for 45 mins except on menstrual periods days, for eight weeks. with 20 repetitions x 3 sets and a 10-20 second rest interval between each one. A quick warm up was done before the workout which followed a cool down.

**Exercise Regimen**:

1. Criss Cross crunch:

Procedure: Begin by sitting on your buttocks with your lower back contacting the ground. Lift one leg off the ground and extend it out, then lift the second leg and bend your knee towards your chest, keeping your feet off the ground and your hands just brushing your ears. Bring your elbow to contact the other knee while you do this.

2. Abdominal curl:

Procedure: Position yourself flat on your back and your legs bent. Flex the elbows and position it behind your head. Exhale and lower your body towards your knees.

3. Pelvic bridge:

Procedure: Position yourself with your back flat over a mat. Bend the knees and place them on the mat firmly. Ensure that the hips are wide apart and have the spine in a neutral posture. Place your arms by the sides throughout the workout. Then by pressing your heel on the mat, elevate your pelvis and activate your glutes. Your body should form a line from the chin to the knee while resting on the shoulders. Inhale and drop your pelvis.

4. Plank

Procedure: Lie down flat on your stomach and then with all the weight on your elbows and toes, raise your body upwards

5. Cat and Camel

Procedure: Come onto your hands and knees, making sure your hands are under your shoulders, your knees are under your hips and your back is in a neutral position. Take a deep inhale through your nose while forming a hump in your back and exhale through your mouth while curving your back for 5 seconds.

**Data Analysis**

The acquired data was compiled and evaluated using descriptive and inferential statistics. The mean and standard deviation (SD) of all parameters were computed. The Paired t-tests were used to assess the efficacy of the interventions between the pre-versus post-training groups and unpaired t-test was used to analyse the post treatment outcomes between the groups.

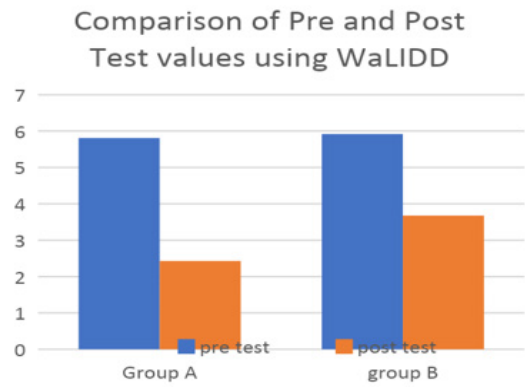



**Fig- 1 Comparing pre and post-test values using WaLIDD(paired t test)**

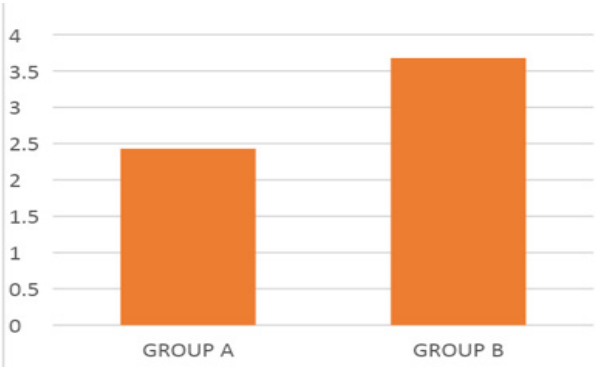



**Fig - 2 Comparing post-test values of both groups using WaLIDD(unpaired t test)**

## Result

The paired t-test and unpaired t test were used to statistically examine the values, which indicated a statistically significant difference between GROUP A and GROUP B, as well as within the group. WaLIDD score post-test mean is 2.43 in GROUP A and 3.68 in GROUP B. Therefore when comparing the pre and Post assessment of both groups, Group A (structured aerobic exercise) showed a comparatively better decrease in pain.

## Discussion

The goal of the study was to see how beneficial physiotherapy in the form of structured aerobic exercise was for primary dysmenorrhea in the above demographic. As said by *(Elizabeth Ferris Rowe et al.,)* the most common cause of pelvic pain in women is primary dysmenorrhea which may be very severe and may lead to absenteeism thereby having a negative influence on their daily life. Therefore, primary dysmenorrhea necessitates immediate diagnosis and treatment since it results in discomfort in women worldwide. [17] Hence The study focuses on finding the effectiveness of structured aerobic training and core muscles strengthening. The above study revealed through statistical analysis that the mean and standard deviation of both the groups in pre intervention state was 5.81 and 5.92 respectively. And that of the post intervention state was 2.43 and 3.68 respectively. Both the groups show a significant decrease in the post intervention state and both may be effective in managing dysmenorrhea pain. However, the difference between both the groups is quite notable revealing that structured aerobic exercises proved to be much more effective in treating dysmenorrhea pain when compared to core conditioning exercises. The p value was <0.0001.

The pain felt during the menstruation period occurs through the period of fertility and it stops at the period of menopause. This pain then starts to establish itself throughout the luteal stage monthly in the form of complex physical and psychological disorders. About 75% to 90% of the women experience this. [18] The main reason for pain during primary dysmenorrhea is due to the effect of prostaglandins which will be present in high quantities in the period blood.[12] Prostaglandins are vasoconstrictors in nature that will lead to reduced blood flow to the uterus. Moreover, due to the already reduced levels of progesterone during menstruation there will be an increased secretion of prostaglandins.[8] Which result in increased contraction and load on myometrium and Results in an increased degree of pain, which will finally result in the primary dysmenorrhea.[13] However when you perform Exercises, this process is counteracted upon. By a release of several neurotransmitters like endorphins, dopamine,estrogen which help to suppress the prostaglandins thereby, help to increase the pain threshold.[14,15] Exercise may also serve as a distraction from intrusive thoughts hence promoting good mental health.[18]*(Hassan Nagy, et al.,)* adds that for better health outcomes and to lessen the severity of Dysmenorrhea in the long run, keeping a healthy lifestyle and following a diet rich in vitamins and minerals, as well as various types of aerobic activities is usually preferred.[9]

However, *(Armour M et al 2019)* adds that lower-intensity exercises such as yoga and Pilates are effective alternatives.[10] Some other exercises that are beneficial are Core Strengthening Exercises which strengthens the musculature around the lumbar spine, These aid in the enhancement of blood circulation, resulting in a reduction in cramping.[8] The core conditioning also plays a major role. They said in reducing back pain and improving the strength of the back muscles.[16] Hence core conditioning has aided in reduction of pain and improvement of quality of living to a certain degree. In addition, aerobics have been shown to increase metabolism and blood circulation in many previous studies.

Exercises have been shown to improve the health conditions in women suffering with dysmenorrhea.[8] *(Rutkowska-Kucharska A et al.,)* proposed that a four-to-eight-week intrinsic exercise regimen is particularly beneficial in controlling symptoms corresponding to primary dysmenorrhea.[11] However *(Gemma*

*Mathewmann et al.,)* also did a study which stated the benefits of exercise and how it is an effective treatment for primary dysmenorrhea. However she also stated that more in depth studies are required. As a result ,structured aerobic exercises on a regular basis can assist to reduce and prevent the occurrence of pain and discomfort amongst women suffering with primary dysmenorrhea.

## Conclusion

In accordance with the findings from this research study, it is reasonable to infer improvements in core exercises strengthening and structured aerobic exercises. However structured aerobic exercises show an extremely significant improvement when compared to core strengthening exercises. Whenever given for over a long period of time along with lifestyle modifications can result in a good impact on general health and can provide permanent pain relief.

**Ethical clearance:** Taken from the institutional ethical committee. ISRB number- 03/004/2022/ ISRB/SR/SCPT

**Source of Funding:** Self

**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# Effect of Aerobic Exercises and Strengthening Exercises in Improving Functional Mobility in Down Syndrome Population

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**Abstract**

**Background:** When compared to children without Down syndrome (DS), children with DS exhibit qualitatively different movement patterns and a considerable delay in the development of motor abilities. Due to their difficulty maintaining proper body alignment and aberrant walking patterns, children with DS are more likely to fall. Strengthening and aerobic exercise are part of the Down syndrome therapy programme.

**Purpose**: To evaluate the effectiveness of aerobic exercises and strengthening exercises in Down Syndrome Population **.**

**Methodology:** Twenty down syndrome patients were randomly divided into groups A and B. Aerobic exercise was given to ten subjects in group A, and strengthening exercise was given to ten subjects in group B. The Dynamic Gait Index Scale was employed as an outcome measure and was pre-assessed on Day 1. For four weeks of treatment, each group had two sessions per day, followed by a post-assessment of the outcome measures.

**Results:** Group A experienced an increase in the dynamic gait index scale. The Group A showed improvement in the Dynamic gait index scale after training, which was statistically significant ($p<.01$)

**Conclusion:** The results obtained from this research were statistically classified and can be concluded that there was a definite and positive effect of strengthening exercise in improving functional mobility in Down syndrome population.

**Keywords:** Aerobic exercise, Strengthening Exercise, Down Syndrome, Functional mobility and Core stability.

## Introduction

Down's syndrome (DS) is a genetic disorder brought on by the presence of all or a portion of an extra 21st chromosome.[1] in 700–1000 live births, this occurs just once.[2] Children with DS show motor dysfunction due to hypotonia, ligamentous laxity, co-contraction of agonist and antagonist muscles, as well as balance and postural issues.[3] Children with DS may experience movement limitations and difficulty maintaining antigravity conditions as a result of these

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deficiencies, which may also contribute to delayed motor developmental milestones.[4]

Children with DS have been found to have balance issues and postural difficulties. Young children with DS show postural control system abnormalities, which may lead to functional balance issues.[5]

Exercise programmes can enhance physical abilities, foster social interaction, and boost health. Improved mobility, balance, coordination, and greater strength and endurance are all physical activities for those with Down syndrome.[6,7] They could consist of balance, cardio, and strengthening activities. Resistance is a component of strengthening exercises like weightlifting or using resistance bands. For instance, lunges, squats, pull-ups, push-ups, and dead lift.[6] Increasing dynamic balance and muscle coordination between the lower and upper limbs, as well as lowering injury risk and muscle imbalances, may be accomplished with the use of core stability. [8,9]Activating deep abdominal muscles, enhancing lumbar spine stability, and enhancing physical function are all benefits of performing core stability exercises on patients. stability has a good impact on performance, lumbar spine stability, pain alleviation, and abdominal muscle activation.[10,11]

## Aim

To evaluate the effectiveness of aerobic exercises and strengthening exercises in Down syndrome Population.

## Materials and Methods

It was an Experimental Study Conducted on 20 participants from G.V School from Chidambaram using Convenient sampling. The participants were separated into two equal groups based on inclusion criteria. Study was Conducted from October 2022 to July 2023

**Inclusion criteria:**

- Young individuals with Down syndrome between the ages of 14 and 22
- Who didn't suffer from intellectual difficulty
- Could stand and walk independently

**Exclusion criteria:**

- An untreated congenital heart problem
- Idiopathic Arthritis
- Hearing and vision problems
- Lower limb musculoskeletal anomalies

**Outcome measure:**

- DGI Scale

**Procedure**

Down Syndrome children were recruited from G.V SCHOOL with prior permission of patients having ability to perform & participate in this study. They were explained about the safety and simplicity of procedure and informed consent was obtained. In This Study 10/group was selected based on the inclusion and exclusion criteria. Pre – test was conducted to assess the functional mobility by using Dynamic Gait Index Scale (DGI). The Total number of subjects 20 were divided into 10 subjects for the experimental group (GROUP A), were given Strengthening Exercise. 10 subjects for the conventional group (GROUP B), were given Aerobic Exercise. Then the Treatment was given to the patient for 4 weeks, 2 sessions in a day and completed the treatment then assessed the post-test.

**Group A:** The experimental group was given Strengthening exercise of 2 sets each day and each set consists of 10 repetitions. For four consecutive weeks, this treatment method was used five days a week. Patient was given rest after each session. After 4 weeks post-test values for DGI scale were taken down, tabulated and then statistically evaluated for results.

**First Week:**

**Core Stability Exercises**

- Laying down and performing three sets of 20 reps of contracting your abdominal muscles
- Spending three sets of 20 repetitions on your back while squeezing your abs.
- Squats with abdominal contractions (three sets of 20 reps each).
- three sets of 20 repetitions each of contracting the abdominal muscles while lying on one side with the other leg bent at the knee and pressed against the abdomen.
- For each of the six repetitions and the ten-second wait, perform a side-by-side bridge.

- Pulling the limbs forward while supine and tightening the abdominal muscles while maintaining close contact with the floor (3 sets of 20 reps each).

**Second week:**

- Arm Curl and Triceps pushdown
- (Three sets of 10 repetitions)
- Leg Curl and leg press (three set
- of 10 repetitions)
- Leg lifting in side-lying, prone
- and supine positions.
- chest press

**Third Week:**

- Leg raised and dragged outward and backward while in the squat posture ( three sets of each leg with 10 reps)
- push-ups on the wall (three sets of 10 repetitions)
- curl –ups, (three sets of 10 repetitions)

**Fourth Week:**

- Bearing weights in your hands while performing the aforementioned exercise (3 sets of 15 repetitions each).
- Using Cuff weights, flex and abduct the shoulders.
- six times for each side of the body while lying on the side with the lifted leg, followed by a 10-second pause.

**Group B:** The aerobic exercise programme for group B lasted 30 minutes, five days week, for four weeks. Walking under supervision with a moderate effort level was the exercise's goal. Group B carried on as usual and did not engage in any specific activity. It is essential to ensure that the activity is done at a comfortable pace and intensity. In addition, it is essential to start slowly and gradually increase the intensity and duration of the activity over time.

**Aerobic exercise:**

Walking – 30 minutes

**Data Analysis**




**Fig 1: Group A and Group B Pre-test and Post test values for Down syndrome**

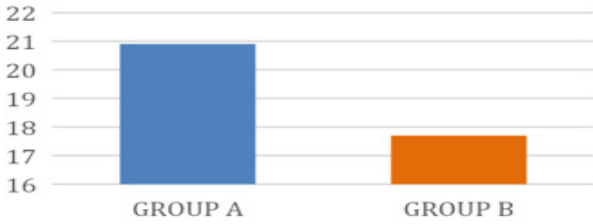



**Fig 2: Group A and Group B Post test values for Down syndrome**

## Result

Statistical analysis of quantitative data showed statistically significant differences not Only in GROUP A but also in GROUP B. The GROUP A DGI post-test mean value was 20.90(+0.88), whereas the GROUP B was 17.70 (+0.82). This indicates that the GROUP A DGI score was significantly higher than the GROUP B, with a $P< 0.0001$.

Statistical analysis of the DGI post-test results revealed that the GROUP A AND GROUP B showed similar statistically significant differences. As a result, GROUP A exceeds GROUP B statistically.

## Discussion

The objective of the current study is to examine the effects of strengthening training and aerobic exercise on functional mobility in individuals with Down syndrome. For four weeks, this comparison is demonstrated.

Dynamic Gait Index Scale was used to evaluate the outcomes both during and after therapy. Strengthening exercise had significantly better effects

than aerobic exercise. When the responses were compared between two groups the result showed a significant difference in strengthening groups than in aerobic exercise. When the response was compared between two groups the result showed a significant difference in strengthening group than in aerobic exercise.

In the Aerobic group the pre-test values of DGI were 10.70 (+ 1.95). After treating the subject with strengthening exercise, the mean value of DGI is increased to 17.70 (+0.82) which shows statistically significant difference with the groups.

In the strengthening group, the pre-test values of DGI were 10.5(+1.58). After treating the subject with strengthening exercise, the mean value of DGI is increased to 21.10 (+0.88) which shows statistically significant difference with the groups.

Based on the statistical analysis, both groups showed improvements in DGI. However, subjects in the strengthening group who received strengthening exercise showed better improvement in DGI than the subjects in the aerobic exercise who received aerobic exercise.

An early study by Sobhy M. Aly1 and Asmaa A. Abonour 2016. Children with Down syndrome who have balance issues can benefit from core stability training to improve their balance and lower their chance of falling and getting hurt, which will enhance their quality of life. Training in core stability can be utilised to enhance performance and reduce injuries. Core stability training has a significant impact because it enhances the neuromuscular system's functionality, which leads to optimal lumbar-pelvic-hip chain mobility, good acceleration and deceleration, appropriate muscular balance, proximal stability, and good function These will lead to the muscles in the lower extremities that control movement becoming stronger. Exercises for core stability should be included in the rehabilitation plan for kids with Down syndrome. [12]

An early study by Adela Castaneda et at in this study he did a study on aerobic training and resistance exercise in down syndrome. Together, these results show that weight training and aerobic exercise programmes are useful exercise regimens for adults and children with DS.[13]

An early study by Sahel Hemati Garekani 2020The results. Together, these results show that weight training and aerobic exercise programmes are useful exercise regimens for adults and children with DS.[14]

An early study by Eduardo Fernandes da Fonseca, 2022.) focused on the methodology, implementation, and safety of this training modality, effects of resistance training (RT) for people with Down syndrome (DS) The author suggests using RT as well as combining it with various forms of exercise (such as aerobic, balance, plyometrics, and isometrics), taking into account the volume and intensity, as well as the duration of training, and the type of exercise used (such as machine exercise, bodyweight exercises, and/or free weights). [15]

## Conclusion

According to the research, Strengthening Exercises outperforms aerobic exercise in terms of enhancing the functional mobility in the down syndrome population. The outcomes of this study were statistically significant, and it is reasonable to create the conclusion that strengthening exercise significantly and effectively improved functional mobility in Down Syndrome.

**Ethical Clearance:** Taken from the Institutional ethical committee. ISRB number - 03/005/2022/ ISRB/SR/SCPT

**Funding**: Self

**Conflict of interest:** No conflict of interest during this research.

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Original Article

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# Effectiveness of Eccentric Strengthening Exercises and Concentric Strengthening Exercises with IFT in Alleviating Symptoms Associated with Osteoarthritis Knee Patients

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**Abstract**

**Background:** The most prevalent condition that affects the articular cartilage and subchondral bone is osteoarthritis of the knee. Most cases of knee osteoarthritis are seen in the medial tibiofemoral compartment. There is currently no complete recovery for knee osteoarthritis.

**Purpose:** The purpose of this study is to evaluate the effect of eccentric strengthening exercise and concentric strengthening exercise with IFT in alleviating symptoms associated with OA knee patients.

**Materials and Methods:**36 patients with osteoarthritis of the knee are included in the trial. Before beginning the study, an informed permission form was obtained from the subjects. Using the WOMAC scale, the pre- and post-test values were calculated.The Concentric group with IFT and the Eccentric group with IFT were created. The subjects received concentric exercises and eccentric exercises for 3 days a week and it was continued for 4 weeks. For each session,3 sets and 10 repetition was given.

**Result:** The collected data was statistically analysed using a paired and unpaired t-test. When comparing the eccentric group with the concentric group, the eccentric group indicates significant ($p<0.0001$)effect in lowering the pain and improving the function of the knee as assessed by WOMAC scale.

**Conclusion:** According to the research, eccentric strengthening exercises combined with IFT are superior than concentric strengthening exercises for lowering pain and enhancing patients' functional activity.

**keywords:** Eccentric strengthening exercise, Concentric strengthening exercise, IFT, WOMAC scale, Osteoarthritis knee

## Introduction

The most prevalent joint condition is degenerative joint arthritis.[1] It has been demonstrated that one intrinsic element that has an impact on how well the knee joint operates is the quadriceps muscle strength.[2] Leg muscle weakness, particularly in the quadriceps, is present in osteoarthritis of the knee patients.[3] It is brought on by metabolic stressors that impact the subchondral bone as well as the

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articular cartilage.[4] Osteoarthritis can be classified into two categories: primary osteoarthritis and secondary osteoarthritis. With an aging population, an increase in the incidence of sedentary lifestyles, and an increase in life expectancy, musculoskeletal disorders like osteoarthritis are projected to represent an increasing economic burden.[5] There is no full recovery from the ailment, and approximately one-third of persons with knee osteoarthritis will see a decline in their structural health, with many of them ultimately needing knee replacement surgery.6 The medial tibiofemoral compartment is where knee osteoarthritis is most common to occur.[7]

Articular cartilage weakening, ulceration, and localized disintegration are pathological alterations seen in late osteoarthritis. Inflammation of the synovium can also happen.[8] Additionally, joint stiffness and a reduction in range of motion (ROM) for daily tasks are frequently brought on by muscular weakening in the knee OA.[9] Pain is a common clinical sign, especially after heavy lifting and prolonged exertion. when stiffness is felt following inactivity.[10]

The severity of quadricep muscular insufficiency is correlated with gonalgia and functional impairment.[11.] These two elements have been demonstrated to be improved by exercise and muscle growth. On the other hand, we are dubious of the best technique for muscular development.[12] For the past few years, federal research projects have focused on identifying the processes underlying the benefits of physical activity for health and the prevention of disease states.[8] It is known that eccentric and concentric muscle motions are used in RT exercises from a mechanical perspective. For standing up, getting out of a chair, and mounting stairs, concentrated motions are necessary. Despite the fact that RT is routinely used to treat knee OA.[8]

Eccentric exercise actions have low energy cost, high force production, and hypertrophic effects, and they also have a beneficial impact on fall risk and physical function.[5] It is said that exercise regimens with a high enough intensity are an efficient way to help healthy persons increase their muscle strength and endurance.[5] In OA, eccentric resistance exercise may be more effective than concentric training at increasing volitional drive and reducing corticospinal inhibition to muscle.[6]

## Aim

To evaluate the effect of eccentric strengthening exercise and concentric strengthening exercise with IFT in alleviating symptoms associated with osteoarthritis knee patients.

## Materials and Methods

A total of thirty-six subjects were selected from Rajesh Physiotherapy Clinic, Nagercoil.Convenient sampling method was used to gather the sample.The study was done for four weeks in the month of july 2023.

**Inclusion criteria:**

- Both men and women**.**
- Age between 40 to 60 years
- WOMAC score between 75 to 90

**Exclusion criteria:**

- Subjects with recent trauma over the knee**.**
- Any other chronic musculoskeletal and neurological disorders
- Chondromalacia
- Recent surgery to the knee.
- Lumbar radiculopathy

**Outcome measures:**

Western Ontario McMaster Universities Arthritis Index (WOMAC) were used as outcome measures which measures pain, stiffness and physical function respectively.

**Procedure**

Total of 36 participants were selected according to the inclusion and exclusion criteria and the participants were explained about treatment safety and simplicity of the procedure and written consent was obtained. Subjects willing to participate were randomly allocated into two main groups Eccentric strengthening group with IFT and Concentric strengthening group with IFT. All subjects were undergone pre-test measurement with WOMAC scale and same repeated for post-test at the end of 4 weeks.

**IFT:** IFT electrodes were placed over the knee using a premodulated bipolar method with the

carrier frequency of 4kHz.Two electrodes were placed over the knee.IFT was given approximately for 20 minutes.The intensity must be maintained at a strong but comfortable level.

**Concentric group with IFT:** Subjects in Concentric group began with their Concentric strengthening exercises and also IFT is applied to the patients for 20 minutes. The Concentric exercises includes:

- Long arc quadriceps exercises
- Standing leg curl

**Long arc quadriceps exercise:**

The patient is asked to sit at the edge of the chair with their knees flexed to 90 degree for long arc quadriceps exercise, Fully extend the knee joint during the long arc quadriceps exercise,the leg was raised.At each session,the patient is instructed to complete 3 sets of 15 repetitions.

**Standing hamstring curl:**

The patient was asked to be in a standing position. The patient was instructed to flex their knees. At each session, the patient is instructed to complete 3 sets of 15 repetitions.

**Eccentric group with IFT:**

Subjects in eccentric group began with their Eccentric strengthening exercises and also IFT is applied to the patients for 20 minutes.

The eccentric exercises includes:

- Eccentric squat exercise
- Single leg eccentric step down

**Eccentric squat exercises:**

Ask the patient to slowly flex their knee joint to 90 degrees of flexion. They were then instructed to use both legs to slowly return to the beginning position. At each session patients performed eccentric squats in 3 sets of 15 repetition.

Single leg eccentric step down:

Ask the patient to keep the hip straight and ask them to slowly bend the planted knee, lowering the other leg towards the ground. At each session, the patient was instructed to perform the single leg eccentric step down for 3 sets and 15 repetitions.

**Data Analysis**

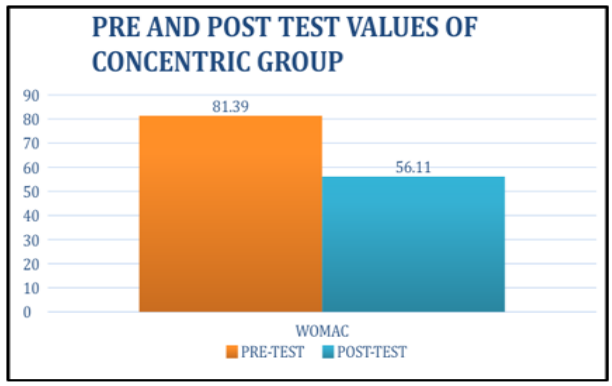



**Fig 1: Shows the comparison between pre-test and post-test of concentric group-WOMAC scale**

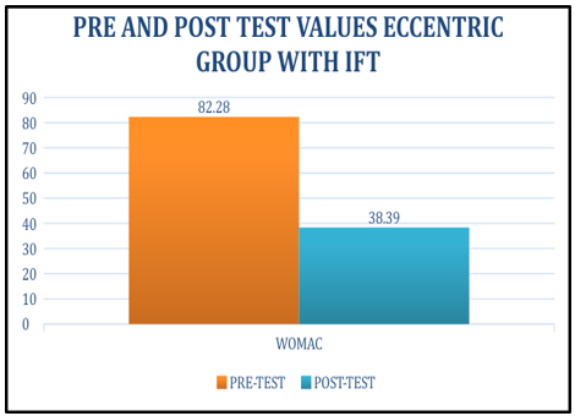



**Fig 2: Shows the comparison between pre and post-test values of eccentric group -WOMAC scale**

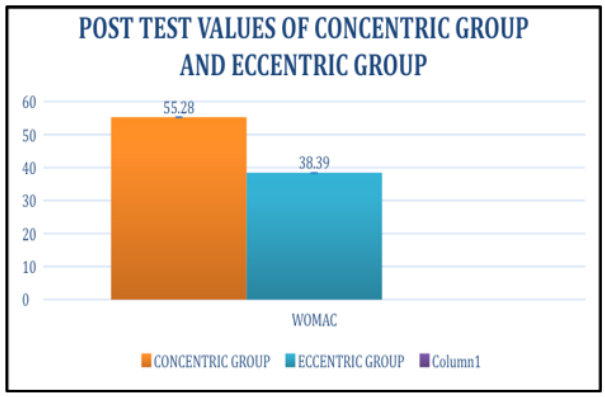



**Fig 3: Shows that eccentric strengthening group is more effective than concentric strengthening group in reducing pain and in improving functional activity-WOMAC scale.**

## Result

Statistical analysis of quantitative data showed statistically significant differences not only in the

Eccentric group but also in the Concentric group. The WOMAC pre-test mean value in Concentric group was 81.39(+3.47) and the post-test mean value was 56.11(3.25).The T-value of concentric group was 26.2566 and the P value (<0.0001) which is statistically significant(Table-1).The WOMAC pre-test mean value in Eccentric group was 82.28(+4.50) and the post-test mean value was 38.39(+2.38).The T-value of Eccentric group was 64.9376 and the P-value(<0.0001) which is statistically significant(Table-2).The WOMAC post-test mean value in concentric group was 56.11(3.25) while it was 38.39(2.38) in Eccentric group. This indicates that the concentric group WOMAC score was significantly higher than the Eccentric group, with p<0.0001(Table-3). Statistical analysis of the WOMAC post-test results revealed that the Concentric and Eccentric group showed similar statistically significant differences. As a result, the Eccentric group exceeds the concentric group statistically.

## Discussion

The goal of the present study is to compare the effectiveness of concentric strengthening exercises and eccentric strengthening exercises with IFT in alleviating symptoms associated with OA knee patients. This comparison is demonstrated for a duration of 4 weeks.

An early study by Nigobamm Amit Kumar en et al (2015) has conducted study on isometric exercise versus combined concentric-eccentric exercise training in patients with osteoarthritis knee in terms of lowering pain and functional impairment, both groups made significant improvements. The mean ratings of knee osteoarthritis patients in Group B, in contrast to Group A, revealed a significant reduction in pain and functional impairment. The results suggest that combined concentric-eccentric workouts are more effective at lowering pain and functional impairment in knee osteoarthritis than isometric exercises. In this study total of 36 participants with OA knee were selected and divided into eccentric group(eccentric strengthening exercises) and concentric group(concentric strengthening exercises) concludes that eccentric group is more effective than concentric group in reducing pain and improving functional activity.[15]

An early study by Marie Charlotte Trojanien et al (2022) was conducted on concentric or eccentric physical activity for patients with symptomatic OA of the knee using WOMAC score for physical function was only significantly improved by concentrated activities has concluded that there was no discernible difference between the groups. Compared to concentric workouts, eccentric exercises helped patients to achieve larger improvements in performance and muscle volume, particularly of the vastus medialis.This study concludes that in reducing pain and improving functional activity eccentric strengthening exercise is more beneficial than concentric strengthening exercise.[11]

An early study by Kevin R V incenten et al (2019) conducted on eccentric and concentric resistance comparison for knee osteoarthritis has evaluated that the effectiveness of ECC RT over conventional CNC RT on knee pain, perceived function, and leg maximum strength over a 4-month period in comparison to a control group. With both resistance exercise programs, maximum strength increased, although the CNC RT group experienced a faster rate of strength improvement. The ECC RT was safe and well-tolerated. These results suggest that, when compared to CNC RT for 4 months, ECC RT offers equal strength advantages to strength or pain reduction. This study was done for four weeks in OA knee patients between two groups : eccentric group(eccentric strengthening exercise) and concentric group(concentric strengthening exercise).The outcome measure was taken by WOMAC questionnaire and concludes that eccentric strengthening exercises good at improving functional activity and in reducing pain.[12]

Ehab Ali Abdallah en et al 2023 has conducted study on effectiveness of eccentric strengthening exercises on pain and functional abilities in patients with knee OA and concluded that Studies have demonstrated that eccentric and concentric workouts strengthen the flexion and extension muscles while also enhancing function and reducing pain. Eccentric muscles must be engaged for the majority of daily activity in order to provide support and absorb shock. More torque is produced when a muscle contracts eccentrically as compared to concentrically. Therefore, unexpected eccentric exercises run the

risk of injuring muscles or causing delayed pain. In this study WOMAC questionnaires were taken as an outcome measure for OA knee patients. The eccentric strengthening exercise was given to one group and concentric strengthening exercise was given to another group. This study concludes that eccentric strengthening exercise was more beneficial than concentric strengthening exercise.[13]

Hafiz Hamza Saeedenen et al 2021 conducted study on eccentric versus concentric isotonic resistance training of quadriceps muscle for treatment of knee OA and discussed that the functional capability of the knee and muscular strength were both positively impacted by the programs used in this study. Because extending contractions were more advantageous than shortening contractions, IERT programs for strengthening muscles were more successful than ICRT programs. In this study the improvement of functional activity and reduction of pain in OA knee were discussed. As discussed in the above study, extending contractions were more beneficial than shortening contractions. Therefore , eccentric strengthening exercise is more successful in reducing pain and in improving functional activity than concentric exercises.[14]

## Conclusion

The study found that the symptoms of OA knee are lessened by both eccentric and concentric strengthening exercises. According to the research, eccentric exercise outperforms concentric exercise in terms of easing symptoms and enhancing functional activity in OA knee patients. Eccentric exercises can help osteoarthritis patients with their knee discomfort by reducing their pain and improving their functional activity**.** Awareness programs can be conducted about the eccentric exercises to reduce pain and improve functional activity in osteoarthritis knee patients.

**Ethical Clearance:** Approved by Institutional Scientific Review Board. ISRB number - 03/ 007/ 2022/ ISRB/ SR/SCPT

**Funding:** Nil

**Conflict of Interest:** Nil

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Original Article

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# Compare the Effectiveness of Interferential Therapy with Mckenzie Versus TENS With Mckenzie to Reduce Low Back Pain

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**Abstract**

**Background:** Low back pain is not an illness but rather a collection of symptoms that are typically acute and self-limiting. It has an impact on work performance and general wellbeing. The most commonly used modalities of LBP are Interferential therapy and TENS. Hence this research work is done to check the effectiveness of IFT with McKenzie and TENS with McKenzie for reducing low back pain.

**Purpose:** To compare the effectiveness of IFT and TENS combined with McKenzie to reduce low back pain.

**Materials and Methods:** 60 subjects were selected based on selection criteria.. The subjects were assessed using VAS and OSWESTRY Low back pain disability questionnaires . The subjects selected were divided into two groups. IFT group(n=30) received IFT for 20 minutes per day combined with McKenzie exercises TENS group (n= 30) received TENS for 20 minutes per day combined with McKenzie exercises. These interventions were given for 4 days per week for 2 weeks. Study period: October 2022 to July 2023.

**Result:** The pretest and posttest values were analyzed and results suggest that the IFT group has significant improvement when compared with the TENS group with p value <0.0001.

**Conclusion:** The study concludes that the IFT with McKenzie and TENS with McKenzie is effective for patients with low back pain but IFT with McKenzie seems to be more effective than TENS with McKenzie.

**Keywords:** Low back pain IFT, TENS, McKenzie, VAS, OSWESTRY Low back pain disability questionnaire.

## Introduction

Low back pain is commonly defined as tension of muscle or tightness below the costal margin. Pain and disability are the most common symptoms of low back pain without specific pathology.[1] Low back pain may either be nonspecific or mechanical Mechanical low back pain emerges from spine, intervertebral disc or around soft tissues in the spine.[2] Low back pain is commonly associated with anxiety, depression, and whole-body vibration. It is the leading cause of activity restriction[3] The global annual incidence of LBP in adults is estimated to be 15%, with a point prevalence of 30%. Men and women are both affected by LBP.[4] Postural low back pain has a notable impact on

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public and occupational health particularly in the information technology.[5] Low back pain affects one's on QOL and reduces productivity at work.[6] Low back pain is higher in prevalence in teachers due to prolonged period of standing and sitting. LBP is not an illness, its a collection of Symptoms that are typically acute and self limiting.[7] Back pain caused by a specific pathology, such as compression of nerve, fracture of vertebra, tumor, etc is referred to as specific LBP.[8] Some studies show the increased potential and low benefit of pharmacological care for acute and chronic low back pain Surgery has a limited role in chronic non-specific low back pain.[9] In the treatment of non-specific LBP, home exercise advice may be especially beneficial. In the subacute low back pain graded activity program improves the absenteeism outcome.[10] The primary goals of low back pain treatment are to decrease pain and improve functional ability, which can be achieved through exercises. In few patients, the pain causes significant limitations in physical ability and makes exercise difficult and be able to carry out their activities if their pain is under control. This provides support for the use of electrotherapy.[11] McKenzie therapy is most effective in pain reduction and improving the ability.[12] The McKenzie method is found to be more effective in pain reduction. The McKenzie method's core component of treatment is exercise, which consists of prolonged position or frequent motions.13 The most commonly used modalities for pain management are IFT and TENS. TENS is a type of stimulation with low frequency and IFT is a medium-frequency alternating current.[15] Many studies have been carried out to find the effect of TENS and IFT in the treatment of chronic LBP. Hence this research work is hypothesized to compare the effect of IFT with McKenzie and TENS with McKenzie in terms of pain reduction that is caused due to LBP.

## Aim

To compare the effectiveness of IFT and TENS combined with McKenzie to reduce low back pain.

## Material and Method

IFT apparatus, TENS apparatus, electrode pads, electrode gel ,micropore, cotton. The study was conducted on 60 subjects with a non-specific low back pain age group between 20 and 40 years for 2 weeks from Shanthi Physiotherapy clinic. Convenient sampling was used in this study. Study period: October 2022 to July 2023.

**Inclusion criteria:**

- Suffering from nonspecific low back pain
- Prolonged sitting (>3 hours)
- Both male and female
- Age group between 20 and 40
- pain due to prolonged standing
- pain that worsens during movement
- VAS score between 5 to 10
- ODI more than more than 40%
- Subjects who are willing to participate in the study

**Exclusion criteria:**

- Radiating pain
- Pregnancy
- sensory disorders
- Open wounds at the site of application of electrode
- Internal screw fixation in lumbar spine
- Tumor
- Congenital disorder of spine.

**Outcome measures:**

Assessment was done before and after the end of 2 weeks of study.

- VAS
- OSWESTRY Low back pain disability questionnaire.

**Procedure**

A total of 60 subjects were selected based on the selection criteria. The detailed procedure was explained and informed consent was obtained from the subjects. All the subjects were assessed using the VAS and asked to fill the OLBP disability questionnaire before and after the end of the treatment. 60 subjects were divided into two groups each group with 30 participants. IFT group (n=30). Subjects in IFT group were given Interferential therapy combined with McKenzie .TENS group (n=30) .Subjects in TENS group were given TENS along with McKenzie. The

subjects received Interferential therapy for 20 minutes per day along with McKenzie exercises(extension exercises -lying flat in prone position, prone on elbows, prone press up, standing lumbar extension) for 10 reps × 2 sets / day, 4 days in a week for 2 weeks. The subjects in the TENS group received TENS for 20 minutes per day along with McKenzie exercises, 4 days in a week for 2 weeks.

**IFT Group:** The subjects in the IFT group were given IFT combined with McKenzie low back exercises. The complete procedure was explained to the subjects before starting the treatment. Safety measures were assured to the subjects. Subjects were positioned prone lying on the couch. The IFT apparatus is turned off and the electrodes are cleansed before the treatment. Electrode gel is applied to the electrodes. The apparatus is turned on and is applied to the subjects using the micropore. Four electrodes are applied at the lower back in a clover leaf pattern which is perpendicular to each other. The duration is adjusted to 20 minutes. Intensity is raised to the subject's tolerance level which passes through the electrodes with frequency of 4000 HZ, beat frequency 100 Hz, sweep 50 Hz. The cables are disconnected after the treatment.

**TENS group:** Position of the subject: prone lying on the couch. The subjects in the TENS group received TENS along with McKenzie. The electrode gel is applied to the electrodes and placed 1 inch apart at the lower back region surrounding the area of the pain of the subjects with the machine turned off. The treatment is started with low intensity, and it is raised till the subject feels a tingling sensation with a frequency of 100 Hz. The intensity is adjusted to the subject's tolerance level. The duration of treatment is adjusted for 20 minutes.

**McKenzie exercises for both groups:**

Assessment is done on the subjects by collecting details such as history of symptoms, aggravating factor, relieving factor then the subjects were asked to perform sustained movement to find effect on their symptoms. McKenzie extension exercises were performed by the subjects.

Prone lying: The subject was instructed to lie in a prone position with their head turned to one side, arms by their sides. Instructions : Lie flat on your stomach with your arms close to your body and your head turned to one side. Hip should not be flexed. Take a deep inhalation , then relax for 5 minutes. Repeat for 2 times in a day. Then progress to be prone on the elbow, for the subjects who were unable to progress prone on the elbow are asked to rest for a day and then do the progression.

Prone on elbow: Instructions: Lie on your stomach by placing elbow under the shoulder, resting on your forearm. Subject is asked to take a deep breath and rest for 5 minutes, then progress to prone press ups.

Prone press up: Subject is asked to lie in a prone position with hands palms under the shoulder. The upper half of the body should be raised by straightening the arms. Lower body should be relaxed. Instruction: Raise your upper body slowly in pain free range, elbow and shoulder should be placed in the same line. Then the subject is asked to return to the starting position. 10 repetitions 2 sets per day. Progression done by applying overpressure at the back. Pressure is applied by using body weight through the arms , symmetrical pressure is maintained while the subject performs extension.

Standing extension: The subject is asked to stand in a neutral position placing hands at the back. Gradually bend the back as far as possible, hold for a second or two and then ask to return to the normal position.

**Data Analysis**

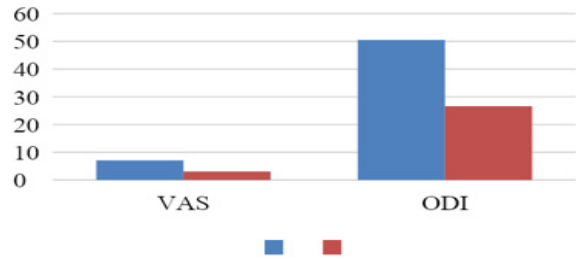



**Fig - 1: Comparison between pretest and posttest values of IFT group- VAS and OLBP disability questionnaire**

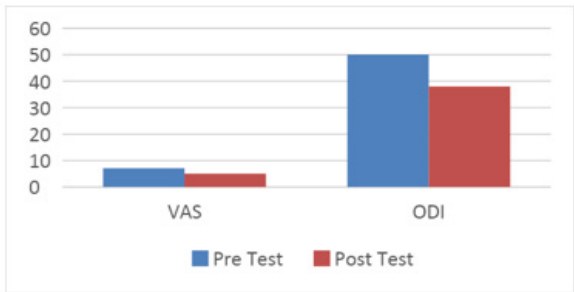



**Fig - 2: Comparison between pretest and posttest values of TENS group - VAS and Oswestry Low back disability questionnaire**

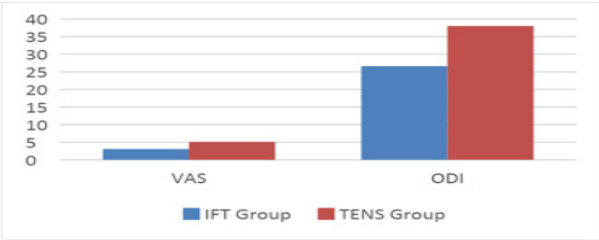



**Fig - 3: Comparison between posttest values of IFT group and TENS group -VAS and Oswestry Low back disability questionnaire**

## Result

Fig 1: compares the pretest and posttest values of the IFT group using the VAS and OLBP disability questionnaire. The pretest and post test values of the IFT group using VAS score were mean value of 7.13 ± 3.07, SD value of 0.82 ± 0.78, and p value less than 0.0001. As a result, with p value <0.0001 the findings are judged statistically significant.

The pretest and posttest values of the IFT group using OLBP was mean value of 50.47 ± 26.63, SD value of 7.60 ± 9.18, and p value less than 0.0001. As a result, with a p-value < 0.0001, the findings are judged statistically significant.

Fig 2: compares the pretest and posttest values of the TENS group using VAS and OLBP disability questionnaire. The pretest and posttest values of TENS group using VAS and OSWESTRY LBP disability questionnaire were mean value of 7.10 ± 5.10, SD of 0.76 ± 0.76, and p value less than 0.0001 As a result, with a p-value of 0.0001, the findings are judged statistically significant.

The pretest and post test values of the TENS group using the OLBP disability questionnaire was mean value of 50.10 ± 38, SD of 7.34 ± 8.50 and p value less than 0.0001. From this result the findings are statistically significant.

Fig 3: compares the posttest values of IFT group and TENS group using VAS and OSWESTRY LBP disability questionnaire. As a result, with p value less than 0.0001, the findings are judged as significant.

The paired t-test and unpaired t-test were used to statistically analyze the values. A statistically significant difference was found between the IFT group and TENS group as well as within the group, according to the statistical analysis performed on the quantitative data. In the IFT group the post-test mean values for VAS and OLBP disability questionnaires are 3.07 and 26.63 while in the TENS group, the values are 5.10 and 38. This demonstrates that the IFT group's results a reduction in low back pain is noticeably superior.

## Discussion

The goal of the current study is to compare the effects of Interferential therapy with Mckenzie versus TENS with Mckenzie exercise to reduce low back pain. The comparison is demonstrated with a duration of two weeks. The results were measured using the VAS and the Oswestry LBP disability questionnaire in pre and post treatment. Beneficial effects were significantly greater in the IFT group than the TENS group.

Based on the statistical analysis, both groups showed improvement in VAS and ODI. However, subjects in IFT subjects who received IFT with McKenzie exercise showed better improvement in VAS and ODI than the subjects in the TENS group who received TENS with McKenzie

An early study conducted a trial to find the effects of TENS and IFT to reduce nonspecific CLBP and found that both the treatment modalities were equally effective in the treatment of chronic nonspecific low back pain[11]. Another study on the effect of IFT along with extension exercises to reduce pain among patients with chronic low back pain and found that the treatment procedure was very much effective in reducing the pain, and improving spine extensor muscles strength in people with CLBP.[12] Whereas the specific trunk exercise in the recent study found it reduced the intensity of low back pain.[13] On the other hand, Mckenzie method is beneficial in treating acute low back pain condition and found that including McKenzie method-based treatment program to subjects with acute LBP receiving care had no effects on pain, disability or risk of developing persistent symptoms[15] An early study by Sayed Tantawi et al., for investigating the impact of IFT on pain, ROM and quality of life in patients with chronic non-specific low back pain and found that IFT stimulation penetrates deeper into the tissues, resulting in significant and

long-term pain reduction, as well as improvements in functional ability and it is considered as an effective method to decrease pain and improve the patients QOL [6].

## Conclusion

The study concludes that the Interferential therapy along with McKenzie and Transcutaneous Electrical Nerve Stimulation along with McKenzie both are effective in reducing low back pain but IFT with McKenzie seems to be more effective when compared with TENS with McKenzie.

**Ethical clearance:** Taken from Institutional ethical committee. ISRB number-03/008/2022/ ISRB/SR/SCPT

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Original Article

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# Effectiveness of Blood Flow Restriction Training on Increasing Strength in Post Surgery Rehabilitation of Anterior Cruciate Ligament (ACL) Compared with Traditional ACL Rehabilitation Protocol

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**Abstract**

**Background:** Patients who have anterior cruciate ligament restoration surgery endure a severe loss of strength in their lower limbs as a result of muscle atrophy and arthrogenic inhibition. A relatively novel method for either preventing muscle atrophy or maybe inducing muscular growth is blood flow restriction (BFR) training.

**Purpose:** The Purpose of the study is to determine effectiveness of blood flow restriction training in post-surgery rehabilitation of anterior cruciate ligament compared with traditional ACL rehabilitation protocol.

**Materials and Methods:** Total of 50 samples was selected based on inclusion and exclusion criteria. The subjects were separated as Group A and Group B where group A (n=25) is provided with blood flow restriction training and group B (n=25) is provided with strengthening exercise. Results were statistically analysed and tabulated.

**Result:** The study found that there is significant improvement on anterior cruciate ligament surgery in post rehab using NPRS and Range of motion. The results concluded that the improvement in blood flow restriction training was extremely statistically significant.

**Conclusion:** Blood flow restriction training was found to be more effective than strengthening exercise for the treatment of post rehabilitation of anterior cruciate ligament surgery.

**Keywords:** Anterior cruciate ligament, blood flow restriction training, Numeric pain rating scale , Range of motion, strengthening exercise

## Introduction

Patients who have anterior cruciate ligament restoration surgery endure a severe loss of strength in their lower limbs as a result of muscle atrophy and arthrogenic inhibition [1] The anterior cruciate ligament (ACL) is the knee ligament that is most frequently injured and one of the orthopaedic injuries that is most extensively investigated, postoperative rehabilitation strategies have developed over the years. Over this time, medical professionals have switched from their previous strategy of complete immobilization and little muscle activity to one that emphasizes enhanced muscle activation and range of motion (ROM)

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immediately after surgery[2]. Patients who undergo anterior cruciate ligament repair (ACLR) surgery significantly lose strength in their lower limbs as a result of muscle atrophy and arthrogenic inhibition. After surgery, there is significant knee flexor and extensor muscle weakness for the first 12 weeks, which affects quality of life and lower limb function. After ACLR surgery, muscle weakness can linger for years and is linked to persistent function decreases, a high risk of re-injury, and joint deterioration [3] The restricted weight bearing and unloading environment of ACL rehabilitation, the consequences of muscular atrophy are unavoidable. This is particularly apparent following surgery due to Tendon strains, cartilage damage, bone bruising, and meniscal injury are all signs against using excessive loads to increase strength and muscle hypertrophy[4]. The exercise programme for recovering from an ACL injury moves slowly and includes ROM, weight-bearing, isokinetic muscle activation, proprioception, and functional exercises. It is done in conjunction with physical therapy. However, in those with weak quadriceps and muscular function, using high-intensity loads or completing challenging workouts for speedy recovery may increase the risk of re-injury and arthritis. Therefore, even at modest intensities, there is a need for effective treatments[5]. The management of this problem depends on an early diagnosis of ACL injury, extensive rehabilitation programs, and preventative strategies. The literature is well aware of the associated repercussions, including recurring bouts of knee instability, injury to related knee structures such as the menisci, cartilage, and bone, following degenerative changes, and a reduced capacity to recover to pre-injury levels of activity [6]**.** A relatively novel method for either preventing muscle atrophy or maybe inducing muscular growth is blood flow restriction (BFR) training [7.] Evidence suggests that this method of training can offer an exceptional, advantageous form of exercise, even in therapeutic settings, since it results in favourable training adaptations that are comparable to daily physical activity (10–30% of maximum work capacity). Recent research has revealed that modest vascular restriction during exercise can cause muscle hypertrophy at intensities as low as 20% of one's maximum heart rate[8]. BFR therapy prevents the usual muscle atrophy that is frequently seen after reconstructive knee operations by allowing physicians and patients to operate in a low-load bearing setting while still being able to achieve the essential musculoskeletal strengthening[9]. Over the past 20 years, it has been shown that resistance training at low loads (20–30% 1-RM) in combination with blood flow restriction (BFR) to the working muscle can enhance muscular strength and growth[10].

## Aim

To find the effectiveness of blood flow restriction training in post-surgery rehabilitation of anterior cruciate ligament compared with traditional ACL rehabilitation protocol**.**

## Materials and Methods

Requirements of material in the study are BFR cuff, Goniometer.This research is an experimental study. The study was conducted with a sample size of 50 participants. The participants were selected from Saveetha college of physiotherapy outpatient department OPD according to inclusion and exclusion criteria. Participants received an extensive overview of the method, and a formal informed consent form was acquired. The study was done between December 2022 to March 2023

**Inclusion criteria:**

- subject of the age group of 18 to 40,
- Females > Males.
- Post-ACL reconstruction surgery,
- stable and controlled knee

**Exclusion criteria:**

- pain more than 8 in NPRS scale,
- severe cardiovascular disease,
- congenital deformity,
- patients who are not willing to participate.

**Outcome measure:**

- Numerical pain rating scale (NPRS)
- Range of motion using goniometer

**Procedure**

This study was conducted as an experimental study, randomly selecting patients selected based on

inclusion and exclusion criteria. Subjects between 18 to 40 years of age, both male and female volunteers, non-smokers, patients with no neurological impairment and were free of cardiac, pulmonary or metabolic conditions were included in the study. Patients were informed about the rehabilitation program prior to the surgery. Patients were taken from Saveetha College of physiotherapy (scpt) OPD, Saveetha medical college and hospital Thandalam Chennai. Subjects were randomly divided into two groups; group A patients were given blood flow restriction training and group B patients were provided with strengthening exercise. Before and after intervention patients were assessed using the NPRS scale to identify the intensity of pain, and analysed ROM using a goniometer. Patients who were getting rehabilitation in our Physiotherapy department between February to March 2023 were prospectively enrolled in the study. The informed consent was given to the patient before the treatment began and explained about the procedure.

**Traditional Rehabilitation Protocol**

Traditional post-operative management mainly consist of restoring tibiofemoral joint PROM, passive glides of patella, control of enema, hamstring & quadriceps isometrics, ankle strengthening, progressive weight bearing of the operated leg given for 8 weeks, where treatment started on day 2 postoperatively till week 8[11,12].

**1. Quadriceps isometrics:**

Patients were instructed to lie in supine position. Underneath the affected knee, a small rolled towel was placed. Ask the patient to push the back of the knee into the rolled towel and encourage them to tense the quadriceps muscle on top of the leg. The patients were told to contract for five seconds, and then relax gradually.

**2. Straight leg raises:**

To effectively strengthen the quadriceps, the Straight Leg Raises (SLR) exercise can be done under certain duration constraints. Incorporating duration into the activity can be done in the following ways.

**Procedure:**

- Lie on a mat or other solid surface on your back to start.
- Extend the opposite leg straight out in front of you while bending one knee and keeping the foot flat on the ground.
- Tighten the quadriceps muscle (front of the thigh) of the extended leg.
- Hold the raised position for a predetermined amount of time, usually 2-3 seconds to begin with.
- Slowly elevate the extended leg off the ground, keeping it straight, until it is at the same height as the bent knee or as high as comfortable.
- Remain in the raised position for the allotted time, which is usually 2-3 seconds at first.
- Back to the beginning position, gently lower the leg.
- Follow your physical therapist's advice and carry out the exercise for the prescribed number of repetitions, such as 10-15.
- The exercise should be done again on the other side by switching legs.

**Blood Flow Restriction Training Protocol:**

Blood flow restriction training protocol consists of isometric contraction of quadriceps which progresses to extension of leg over the bolster and straight leg raise, half squat, resistance to walking with elastic tube given 8 weeks, where treatment started on postoperative week 2 and ends on week 8. 20reps given for 5set with rest period of 3minutes per day, external load was low.

**1. Straight leg raising with blood flow restriction**

The subject is in supine lying position legs laid out comfortably on the floor. Bend the knee of your non-injured leg at a 90-degree angle, planting the foot flat on the floor. Stabilize the muscles on your straight leg by contracting your quadriceps (the group of muscles on the front of your thigh).Inhaling slowly; lift the straight leg six inches off the ground. Hold for three seconds. Exhaling slowly, lower the leg to the floor with control Relax and repeat 10 times.

**2. Knee extension exercise with blood flow restriction**

Subject is sitting on a chair or bench. Lifting one leg up, extending at the knee to the fullest range tolerable hold briefly at the top of the movement, squeezing the

muscles at the front of the thigh before lowering your leg back down for 5-7 seconds. Gently lower the leg by bending the knee to complete a repetition. Ensure the movement is slow and controlled. Ensuring full knee extension (leg completely straight). Repeat for the 10 repetitions.

**3. Half squat with blood flow restriction**

Subject is in standing position place the feet about shoulder-width apart, pointing ahead with a slight angle outward Create an arch in your foot, pressing down with your heel, the base of your first toe, and the base of your 5th toe to create a sort of tripod—this will provide stability and even distribution of your weight. Drive your hips back into a hip hinge, bringing your chest forward, engaging your glutes and hamstrings. Descend to the desired position, either to parallel or just above, keeping balanced with your weight evenly distributed in your feet. For a half squat, your shins should be as vertical as possible. Drive your hips up and back, pulling in your shins to vertical as you return to standing.

**Data Analysis**

Using descriptive and inferential statistics, the acquired data was tabulated and evaluated. The mean and standard deviation (SD) were applied to all parameters. The significant differences between pre-test and post-test measures were analysed using a paired t-test. The significance level of $p < 0.0001$ was judged statistically significant when using the unpaired t-test to examine significant changes between two groups.

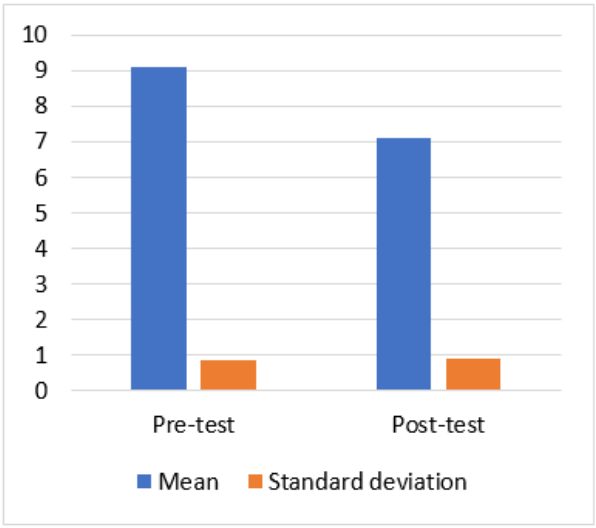



**Fig 1: Pre and Post-test values of NPRS scale in BFR training**

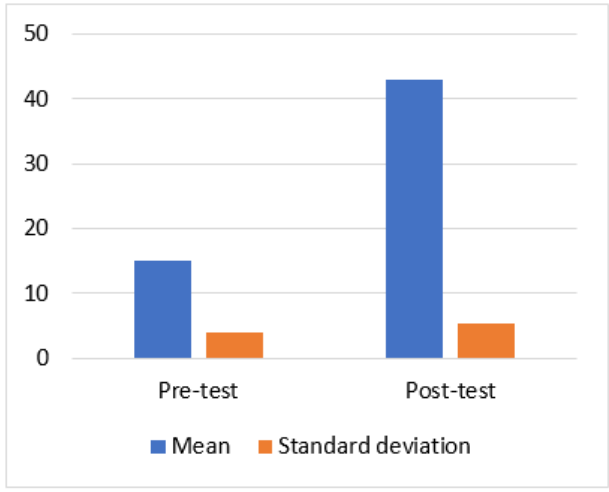



**Fig-2: Pre and Post-test values of NPRS scale in strengthening control**

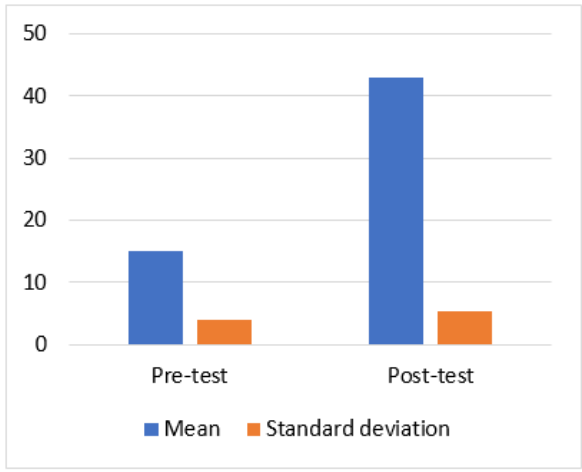



**Fig-3: Pre and Post-test value of goniometer in BFR training (flexion)**

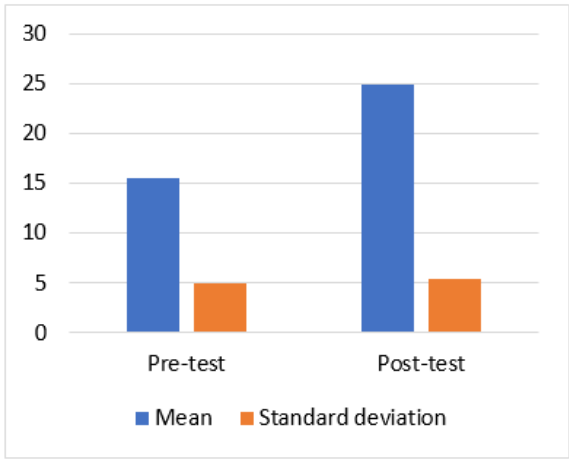



**Fig-4: pre and post-test values of goniometer in Strengthening control (flexion)**

## Result

- The data acquired were statistically significant between pre-test and post-test values of NPRS scale in the blood flow restriction training group, with a mean value of 9.10 in before testing and 4.40 after the test and a standard deviation of 0.88 in before the test and 0.97 in after the test.
- Pre-test and post-test values of NPRS scale in the strengthening group, with a mean value of 9.10 in before testing and 7.1 after the test and a standard deviation of 0.88 in before the test and 0.89 in after the test.
- Pre-test and post-test of goniometric measurements in the blood flow restriction training, with a mean value of 15 in before testing and 43 after the test and a standard deviation of 4.08 in before the test and 5.37 in after the test. Pre-test and post-test of goniometric measurements in the strength training, with a mean value of 15 in before testing and 43 after the test and a standard deviation of 4.08 in before the test and 5.37 in after the test according to the statistical analysis performed on the quantitative data.
- Blood flow restriction training was therefore shown to be helpful in reducing pain and enhancing range of motion in knee joints following ACL surgery.

## Discussion

The current study's objective is to evaluate the effectiveness of the anterior cruciate ligament strengthening exercise and blood flow restriction technique in post-rehabilitation. Additionally, with anterior cruciate ligament surgery, access the pain and work on enhancing the strength and range of motion. Within the span of 5 weeks, the comparison is shown. Before and after the treatment, the NPRS and range of motion were used to measure the outcomes. When the responses from the two groups were compared, the blood flow restriction training group performed much better than the strengthening exercise group.

This study is to find out the effectiveness of blood flow restriction training exercise and conventional exercises for patients with ACL injury. This study has a sufficient level of evidence that highly recommends the blood flow restriction training exercises to the patients with ACL injury. During this experimental study some stretches and strengthening exercises were given to strengthen the muscles around the knee with blood flow restriction. which is effective in pain reduction and increases the range of motion of the knee.

It was preferred that blood flow restriction training According to many writers, including Rosenblatt et al., BFR-RT can dramatically lessen knee joint discomfort and effusion while skeletal muscle strength and hypertrophy are increased to a identical degree as with High load resistance training. positive effects on general physical performance. Thus, during the increasing limb loading phase of recovery following surgery, BFR-RT may be better suitable for the NHS's ACLR patient groups.

BFR-RT can increase skeletal muscle development with a greater deduction in knee joint discomfort and outflow. This results in greater overall gains in physical function was preferred by many authors like Luke Hughes et al.,, The National Health Service may therefore find that BFR-RT is better suitable for early rehabilitation in ACLR patient populations.

In 89% of patients who were checked at least two years after surgery, four-strand hamstring tendon autograft eradicated anterior tibial subluxation. 11% of attempts failed total. At the time of the follow-up, the functional knee scores had greatly increased, but the results did not match those of the knee arthrometric testing.

## Conclusion

According to the study's conclusions, blood flow restriction training was found to be more beneficial than strengthening exercise for the treatment of post-rehabilitation of anterior cruciate ligament.

**Ethical committee:** This research work has been approved by the ISRB committee.11 ISRB number -03/010/2022/ISRB/SR/SCPT.

**Source of Funding**: Self

**Conflict of Interest**: No conflict of interest during this research.

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Original Article

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# Effect of Dry Needling on Patients with Lumbar Radiculopathy in Reducing Pain and Increasing Range of Motion Compared to Interferential Therapy

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**Abstract**

**Background:** The most prevalent disorder affecting the spinal cord is lumbar radiculopathy. The incidence of this condition is estimated between 3% and 5% of the population and it impacts both male and female equally. The goal of this present study is to compare the effectiveness of dry needling to interferential therapy [IFT] in terms of reducing pain and increasing the lumbar range of motion in patients with lumbar radiculopathy.

**Purpose:** To determine the effect of dry needling on patients with lumbar radiculopathy in reducing pain and increasing lumbar ROM compared to interferential therapy.

**Materials and Methods:** 30 subjects participated and pre assessment and post assessment was taken using Numerical Pain Rating Scale [NPRS] and the Modified-Modified Schober Test [MMST]. For both groups, the intervention period lasted for 2 weeks and the entire study procedure was carried out from November 2022 to April 2023.

**Result:** This study showed an extremely satisfied statistical significance difference between post-test values of both groups ($p<0.0001$). However, the experimental group showed substantially greater statistical significance than the control group in terms of the decrease in pain levels and the increase in lumber ROM.

**Conclusion:** The study concluded that intervention provided to the experimental group was more effective than intervention provided to the control group.

**Keywords:** Lumbar radiculopathy, L4-L5 and L5-S1, nerve root compression, radiating pain, dry needling, IFT.

## Introduction

Low back pain that radiates to one or both lower extremities caused by nerve root compression is commonly known as lumbar radiculopathy. In India, lumbar radiculopathy occurs at a rate of 23.9%[1]. Comparatively, only 4 to 6% of the overall population suffers with lumbar radiculopathy. From 6 to 11% of subjects have sciatica symptoms in addition to low back pain. The occurrence of sciatica caused by a disc is 4.4% in the general population.[2]

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The word "lumbar radiculopathy" (LR) refers to a painful condition due to the compression or irritation of the lumbar nerve roots., more especially the L4-L5 and L5-S1 level nerve roots. The pain radiates along the sciatic nerve, which runs from one or both legs down to the low back. Degenerative arthritis, lumbar stenosis, intervertebral disc degeneration or herniation, as well as other ailments such as bone or muscle tumours, infections, or inflammation of the nerve roots, are the main causes of this disease. Signs and symptoms of lumbar radiculopathy depend upon the nerve root affected, most common symptoms such as the low back ache, sharp radiating pain, alterations in the deep tendon reflex, weakness in the muscles, foot numbness, hypersensitivity, tingling and burning sensation in the affected area [3].

The terms radiculopathy and radicular pain are not the same. Only radiating pain is observed in radicular pain, whereas sensory and/or motor loss can be reliably seen in radiculopathy. Radiculopathy could represent a spectrum of radicular pain, and both conditions frequently coexist together [4]. Conventional treatments for lumbar radiating pain include spinal manipulation, physical therapy, myofascial release, exercise as acceptable. Pain relief options include acetaminophen, nonsteroidal anti-inflammatory drugs, muscle relaxants, anti-epileptic drugs (Gabapentin and Pregabalin), membrane stabilizing agents, and narcotics[5]. The use of McKenzie exercises has been proven to produce some immediate clinical improvement in individuals receiving conservative treatment for lumbar radiculopathy[6.] According to some reports, spinal manipulation can improve lumbar radiculopathy patients' pain levels, straight leg raise test results, range of motion, amount of disc herniation, and neurological symptoms [7].

The use of a tiny monofilament needle in acupuncture without the application of an injection is known as "dry needling. Numerous neuromusculoskeletal pain disorders can be treated with dry needling, which is frequently utilized to treat tissues such ligaments, tendons, superficial fascia, tissue with scarring, peripheral nervous system nerves, and nerve bundles. A number of State Boards of Physical Therapy and the National Physical Therapy Association recently narrowed the scope of dry needling to include only "intramuscular" procedures, which involve inserting needles into nodules within taut bands of muscle, also known as "trigger points" (TrPs) or "myofascial trigger points" (MTrPs)[8]. A twitch reaction happens when the muscle being pricked contracts quickly and uncontrollably. The twitch reaction is believed to be the result of a reflex in the spine that follows the mechanical contact the needle provides. The flicker reaction is widely used to determine whether trigger points are present, which often impacts either the patient selection process or the procedure's factors. Studies have indicated that treating trigger points initially can considerably increase the recovery of patients with chronic lumbosacral radiculopathy, and that merely conservative therapy may not be sufficient [9]. Non-functional electrical stimulation (ES) like IFT is a therapeutic approach in which surface electrodes are used to deliver electrical current to neurons in order to promote muscle activity[10]. Individuals with persisting low back aches for a long time may experience a reduction in discomfort, better range of motion, and an improvement in postural stability with an exercise programmed that emphasizes trunk strength, trunk stability, and postural stability[11].

## Aim

The aim of this study is to compare the effectiveness of dry needling to interferential therapy in terms of reducing pain and increasing lumbar ROM in patients with lumbar radiculopathy.

## Materials and Methods

It was an experimental study conducted on 30 subjects with lumbar radiculopathy, age between 30-50 years was taken and convenient sampling techniques with computer generated random methods were used in the study to allocate the subjects into two groups. The entire study procedure was carried out from November 2022 to April 2023.

**Inclusion Criteria**

- Age – 30 to 50 years.
- Male and Female patients with lumbar radiculopathy.
- Intervertebral disc herniation.
- Low back ache with radiating pain on leg.
- Positive SLR.
- Positive slump test

**Exclusion Criteria**

- History of spinal surgery.
- Cancer.
- Fracture in the spine or pelvis.
- Refusal to undergo needle therapy.
- Existence of any red flags for the lumbar spine such as cauda equina.
- History of spinal canal stenosis.
- Pain that scored higher than 8 on the NPRS scale.
- Open wounds, skin diseases and hypersensitivity to metals.

**Outcome Measure**

Assessment was performed before starting treatment and after weeks of study.

- Numerical Pain Rating Scale [NPRS].
- Modified-Modified Schober Test [MMST].

**Procedure**

A total of 30 subjects were chosen based on inclusion and exclusion criteria. Informed consent was obtained from the subjects after thorough explanation of the study procedure. The subjects were randomly divided into two groups: experimental group and control group. Experimental group subjects (n=15) received dry needling, interferential therapy and low back exercises and control group subjects (n=15) received interferential therapy and low back exercises. Experimental group subjects received treatment for 2 sessions in a week [2 weeks] and Control group subjects received treatment for 3 sessions in a week [2 weeks].

**Intervention Protocols for Experimental Group**

The subjects were instructed to lie down in a prone lying position on the examination table and palpated the lower back and pelvic region to identify the most painful trigger points that can be treated with dry needling. The lumbar paraspinal muscles and gluteus medius muscles are the targeted trigger points for dry needling on patients with lumbar radiculopathy**.** A cotton swab dipped in isopropyl solution was used to clean the trigger point area. The procedure was informed to the subjects, and suitable thin, solid filament dry needles with 0.30x60mm were chosen. The needle was carefully inserted into lumbar paraspinal muscles and gluteus medius muscle trigger points or tight bands of muscle known as myofascial trigger points. The surrounding neurovascular structures were protected from harm. Once the needle is inserted, techniques such as gentle movements or fanning method was performed to elicit a localized twitch muscle response. The needle was inserted in the targeted trigger points for 2 minutes. During dry needling, the twitch response was produced in the muscle. Once the desired duration had passed, the needles were removed gently from the subjects. To reduce post-needling pain, subjects were instructed to apply a cold pack for ten minutes twice daily after their treatments. After this procedure, IFT was given to the subjects. The subjects were in prone lying and four electrodes were placed on the painful area of the lumbar region with equidistance that is away from the most painful area. IFT was given to the subjects with the frequency – 100Hz, duration- 15 minutes, Intensity- as per patient tolerance. Dry needling and IFT was given to the subjects for 2 sessions in a week for 2 weeks. After finishing IFT, low back exercises were given to the subjects to strengthen and to increase the lumbar range of motion. Before starting low back exercises, the subjects were provided with an explanation of the purpose and a detailed instruction about low back exercises. Exercises were given to the subjects for 2 days in a week for 2 weeks.

**Low Back Exercises**

**Pelvic Bridge:**

The subjects were in supine lying, and hands flat on the floor with the palms facing down. Their feet were flat on the ground, hip-width apart, and their hips and knees were flex to an angle of 90°. Then the subjects were instructed to contract their abdominal muscles and slightly compress their buttocks. Subjects were then told to elevate their pelvis off the ground and tilt it into a "neutral" position without holding their breath.

**Protocols:**

- Hold for 15 to 20 seconds
- Repeat this exercise for 10 x 3 sets per day.

**Back Extension:**

The subjects were prone lying, with their hands beneath their shoulders. Inhale and softly squeeze your palms together as you exhale. The subjects were advised to straighten their arms, lift their chest off the ground, maintain their hips firmly planted, and uncurl their buttocks.

**Protocols:**

- Hold for 15 to 20 seconds at the top
- Back to the starting position by lowering the chest.
- Repeat this exercise for 10 x 3 sets per day.

**Cat And Camel:**

The subjects were in quadruped position (start on hands and knees). The subjects were instructed to take breath in, then arch their back up to the ceiling as high as comfortable and hold this for a few seconds. Then subjects are asked to breath out and arch their back the opposite direction as low as comfortable.

**Protocols:**

- Hold for 15 to 20 seconds.
- Repeat this exercise for 10 x 3 sets per day.

**Bird – Dog:**

The subjects were in a push-up position with their knees on the ground and placed their hands shoulder-width apart with their palms touching the ground. Then they are instructed to extend their right leg backwards with their toes pointed and stretch their left arm forward to keep their hips balanced.

**Protocols:**

- Hold for 15 to 20 seconds
- Repeat this on the opposite side.
- Repeat this exercise for 10 x 3 sets per day.

**Partial Curl – Up:**

The subjects were in supine lying with hip and knees flexed and their feet flat on the floor. The participants were asked to cross their arms lightly, tighten their stomach, and rise halfway up while maintaining a shoulder-to-head alignment.

**Protocols:**

- For 15 -20 seconds, hold this position and uncurl to lie down.
- Repeat this exercise for 10 x 3 sets per day.

**Intervention Protocols for Control Group**

For the control group, interferential therapy and low back exercises were given to the subjects. Same experimental group, IFT and Low back exercises procedure was followed and was given to control group subjects. IFT and low back exercises were given to the subjects for 3 sessions in a week [2 weeks].

**Data Analysis**

Pre-test and post-test values of NPRS and MMST are analysed using the paired and unpaired t-test. Paired 't test' were used for analysing the pre and post-test values of individual groups. Whereas, Unpaired 't test' were used to analysis the post-test values of both the groups.

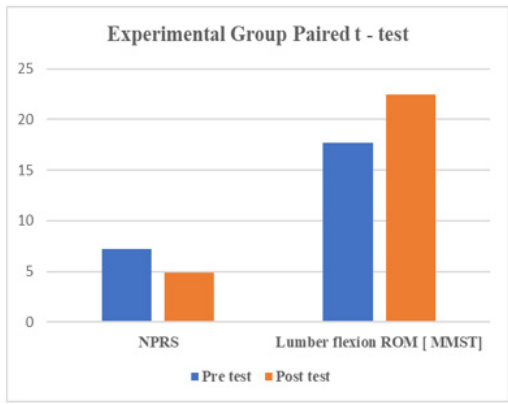



**Fig- 1: Comparison between pre and post values of NPRS and MMST in experimental group.**

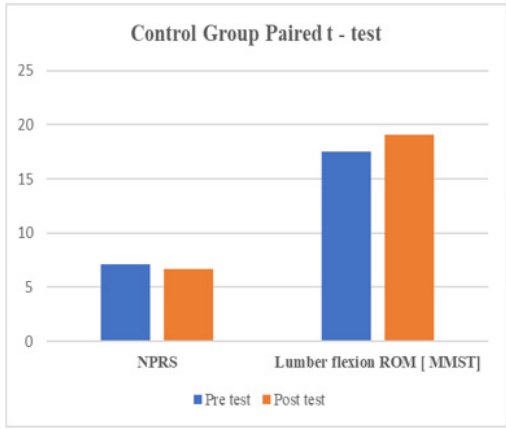



**Fig - 2: Comparison between pre and post values of NPRS and MMST in control group.**

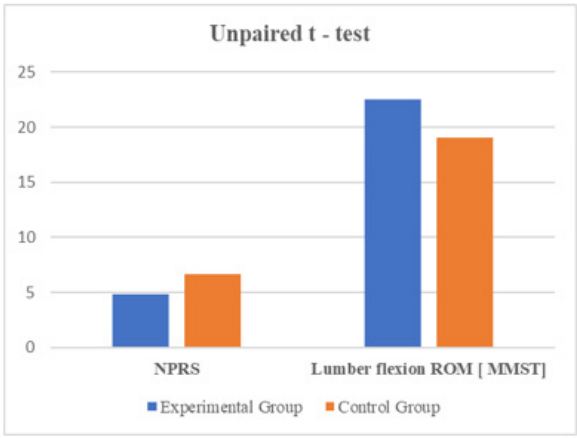



**Fig - 3: Comparison between post values of NPRS and MMST in experimental group and control group.**

## Result

The statistical analysis of pain in experimental group by using NPRS, pre- and post-test values of mean 7.20 ± 4.87and P <0.0001, whereas lumbar flexion ROM in experimental group by using Modified-Modified Schober Test, pre- and post-test values of mean 17.67 ± 22.47 and P<0.0001**[Fig-1]** were statistically significant.

The statistical analysis of pain in control group by using NPRS, pre- and post-test values of mean 7.07 ± 6.67and P<0.0001, whereas lumbar flexion ROM in control group by using Modified-Modified Schober Test, pre- and post-test values of mean 17.47 ± 19.07 and P<0.0001**[Fig-2]** were statistically significant.

The statistical difference between the two groups subjects was evaluated by post values of NPRS and Modified-Modified Schober Test of mean 4.87± 6.67 and 22.47± 19.07; and P value is <0.0001**[Fig-3]** were considered to be extremely statistically significant.

These differences indicated that the subjects receiving dry needling, IFT and low back exercises in the experimental group were highly effective in reducing and increasing ROM compared to the subjects receiving IFT and low back exercises in the control group.

## Discussion

This study indicates that there was a significant difference between in reducing pain and increasing lumbar flexion ROM on subjects treated with dry needling, IFT and low back exercises compared to subjects treated with interferential therapy and low back exercises by using Numerical Pain Rating Scale and the Modified-Modified Schober Test. In this study, dry needling technique was effective due to the use of dry needles which releases the trigger points on the muscle so that it helps to reduce pain and improve the functional activity whereas interferential therapy reduce pain but not release the trigger points but it is effective to treat along with dry needling and low back exercises. Low back exercises also play a major role to strengthen back and core muscles. Hence, this study confirms that dry needling, IFT and low back exercises is more effective compared to interferential therapy and low back exercises on patients with lumbar radiculopathy in reducing pain and increasing lumbar flexion ROM.

CE Rainey, et al., stated that dry needling is an invasive technique that activates MTrPs using a monofilament needle. Utilizing trigger point dry needling (TrPDN) with IES intervention to treat lumbar and/or hip stability issues has a significant impact on pain reduction[12].

Gohil, et al., (2021) according to the study's findings, patients with lumbar radiculopathy, which is linked to myofascial trigger points, can get pain relief from the trigger point dry needling approach. Raja MPT, et al., concluded that Visual Analogue Scale (VAS), Modified - modified Schober Test, and Disability scores in the study suggest that back exercise with interferential therapy participants experience much less pain than abdominal strengthening exercise with interferential therapy subjects [9].

## Conclusion

The study concluded that intervention provided to the experimental group was more effective in decreasing pain and increasing lumbar flexion ROM than intervention provided to the control group by using NPRS and MMST.

**Ethical clearance:** This research work has been approved by the ISRB committee. ISRB number - 03/011/2022/ISRB/SR/SCPT.

**Funding:** Self

**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# Effectiveness of Dry Needling on Upper Trapezitis Patient Compared to Ultrasound Therapy

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**Abstract**

**Background:** This study was designed to inspect the effectiveness of Dry Needling on Upper Trapezitis patient compared to Ultrasound Therapy

**Purpose:** To compare the effectiveness of dry needling on upper trapezitis patients compared to ultrasound therapy.

**Materials and Methods:** Fifty participants were divided into a couple of categories: Group A received dry needling twice a week, while Group B received ultrasound therapy four times a week for two weeks. Stretching and strengthening exercises were given to all groups. Participants were evaluated using the Pain Rating Scale (NPRS), cervical lateral flexion range of motion, and cervical rotation range of motion at two intervals (before and after treatment). Study period: November 2022 to April 2023

**Result:** According to the statistical evaluation, there was a significant within-group improvement for NPRS and CROM (Lateral Flexion and Cervical Rotation) before and after therapy for both Groups A and B, with a p value of 0.0001. With a higher effectiveness for DRY NEEDLING in lowering discomfort and enhancing ROM, the between-group evaluation is statistically significant with $p<0.0001$ for NPRS and $p<0.0001$ for CROM (lateral flexion and cervical rotation).

**Conclusion:** Dry needling is more effective than ultrasound therapy in upper trapezitis.

**Keywords:** Upper trapezitis, Dry Needling, Ultrasound therapy, NPRS, CROM (Lateral flexion and rotation).

## Introduction

The trapezius is one of the two main underlying muscle groups, expanding laterally to the scapular spine and longitudinally through the occipital bone into the lower thoracic vertebrae. The muscle that attaches to the C7–T12 vertebral spinous processes, the external occipital protuberance, the nuchal ligament, and the medial portion of the superior nuchal line is its origin. The muscle is attached to the acromion, the scapular spine, and the lateral portion of the clavicle[1].

Trapezitis, an inflammation of the trapezius muscle, includes myofascial pain syndrome. Muscle spasm occurs shortly after inflammation.

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It occasionally hurts and feels like your muscles are tense. In the event that the underlying injury is left untreated, spasm results in the development of trigger points, which are muscle knots[2].

In addition to underlying disorders, there are other reasons for neck pain. Enduring constant tension, worry, sleeping incorrectly, or donning heavy jewellery[3]. Trapezius pain is extremely common due to excessive use[4].

An invasive other option for reducing pain and trigger points in tense muscles is dry needling. When the trigger point is inserted using a plastic guide and a sterilised needle at various angles, such as 30 degrees and 45 degrees. The use of dry needles increases range of motion and lessens pain[5].

When it affects the epidermis, fascia, and tendon, an inward insertion of the needle provides a more potent analgesic effect than one that only penetrates the skin and superficial muscles[6].

MTP inhibition, therapeutic stimulation of MTPs improvement, muscle distribution reduction, removal of the source of muscle discomfort, return to usual peripheral nerve stimulation, promotion of self-treatment of damaged tissues, and reduction of automatic movement of muscles are some of the objectives of DN[7].

Ultrasound treatment (US) is a pain-relieving non-invasive method. It provides strength to the tissues via mechanical vibrations, which are higher frequency sound waves. US is a well-known safe, non-invasive, and cost-effective treatment. The physiological impacts of the US depend on its frequency and severity. When intensity is between 0.5 and 0.7 W/cm2, it has been shown to promote soft tissue flexibility and reduce discomfort. How much US is absorbed in tissues depends on the applied US frequency, which can increase cell temperature from 34.3°C to 37.3°C when utilised in Continuous mode at 3MHz[8].

Although the relaxing impacts of ultrasound on brain regions are thermal effects increase tissue flexibility, lessen pain, accelerate metabolism, and enhance blood flow depth[9].

Piezoelectric crystals, which are used to make ultrasound probes, use high-frequency, alternating voltages to transform electrical impulses into mechanical vibration motion. A detector or applicator in close proximity to the patient's skin produces this kind of motion[10, 11, 12].

Trouble sleeping, paraesthesia, tiredness in the upper extremities, restricted range of motion, and paraesthesia are just a few of the signs and symptoms of neck discomfort. The upper trapezius, which is most frequently shortened, is distinguished by a decrease in the range of motion (ROM) for lateral flexion with rotation. With therapy US on the UT, muscle rigidity was reduced and the active movement was increased[13].

## Aim

To compare the effectiveness of dry needling and ultrasound therapy on upper trapezitis patient

## Materials and Methods

50 patients with upper trapezitis, ranging in age from 25 to 45, were the subjects of an experimental study conducted by Dr. Milton Physiocare.The study's sampling strategy was accessible. Study period: November 2022 to April 2023.

**Inclusion criteria:**

- Subjects must be around the ages of 25 and 45 and have cervical and upper trapezius ache.
- Subjects willing to participate in the study.
- cervical range of motion is restricted

**Exclusion criteria:**

- The individual's cervical surgical experience.
- Spinal pathology is eliminated if the NPRS scale is greater than 8.
- A previous cervical fracture.

**Outcome measures**

Assessments were done at the beginning (before the start of intervention) and two weeks later.

- Numeric Pain Rating Scale (NPRS)
- Cervical Range of Motion (lateral flexion and rotation)

**Procedure**

Individuals were chosen based on inclusion and exclusion criteria. The method was described

to the individuals, and they were then requested to sign the permission document. Each participant was evaluated using the evaluation form. Individuals were randomly assigned into a pair of groups, A and B.The evaluation was done at the start of the trial and again after two weeks.

**Group A: Dry Needling**

Patient positioned in chair, hands on table, head leaning on hands

Therapist approaching the individual's affected side from back.

Technique: A 0.30mm diameter and 50mm length acupuncture sterilised needle is utilised to adequately expose the treatment area. Dry needling involves cleansing the region being treated with spirit, palpating any nodules, then positioning a fine needle and plastic guide tube over a myofascial trigger point and tapping to cause a twitch response. When a needle was placed into a trigger point penetrated at a 30 degree angle, the fanning technique was used, and the needle was held for a few seconds before being effectively taken out. Use a Cold pack for 10 minutes twice daily after the procedure to decrease post-needling discomfort.

**Group B: Ultrasound Therapy**

The patient was instructed to properly bend forward while seated in a chair with support as well. His head and arms were supported by a pillow. The trapezial trigger sites get ultrasound treatment four times per week for the following two weeks.

Protocol for Treatment: The final test will be given two weeks following the intervention at a frequency of 3 MHZ with an intensity of 1.0 W cm2 for an overall of 10 minutes.

**Exercise Program:**

(10 Repetition, 3 Sets, 10 sec hold)

- Upper trapezius stretch
- Shoulder shrugs
- Shoulder blade squeeze

**Isometric Exercise:**

- Neck flexion
- Neck extension
- Neck side bending
- Neck rotation

**Data analysis**

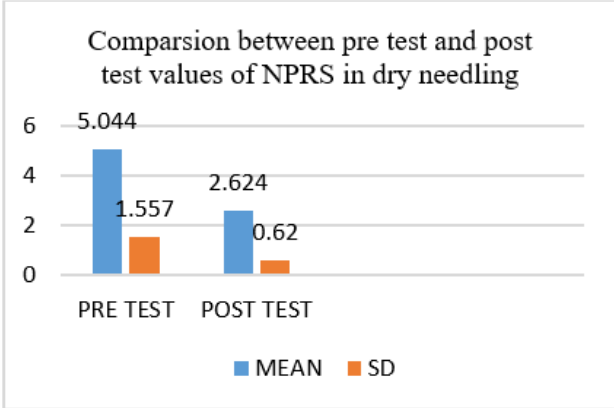



**Fig - 1: Group A Paired T –Test By Using Nprs (Dry Needling)**

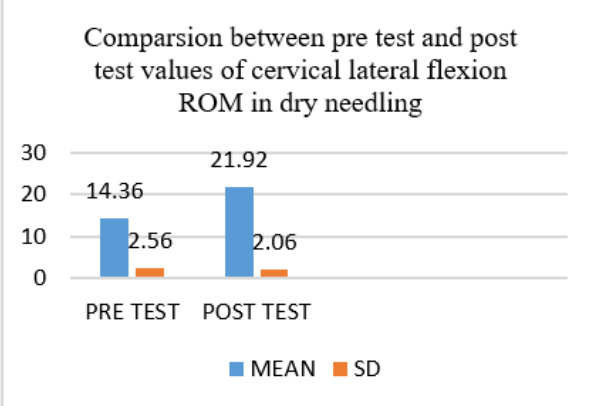



**Fig - 2: Group A Paired T-Test By Using Cervical Lateral Flexion Rom (Dry Needling)**

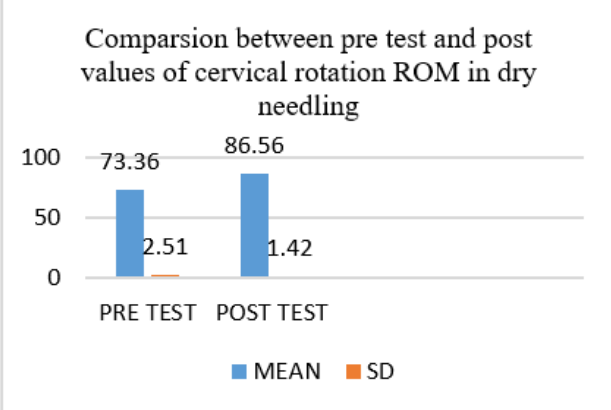



**Fig - 3: Group A Paired T-Test By Using Cervical Rotation Rom (Dry Needling)**

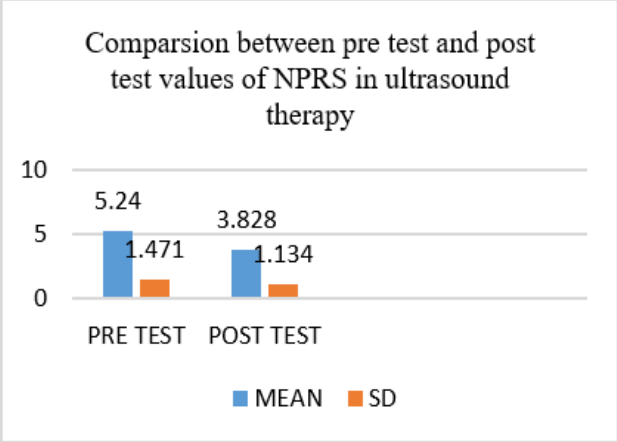



**Fig - 4: Group B Paired T-Test By Using Nprs (Ultrasound Therapy)**

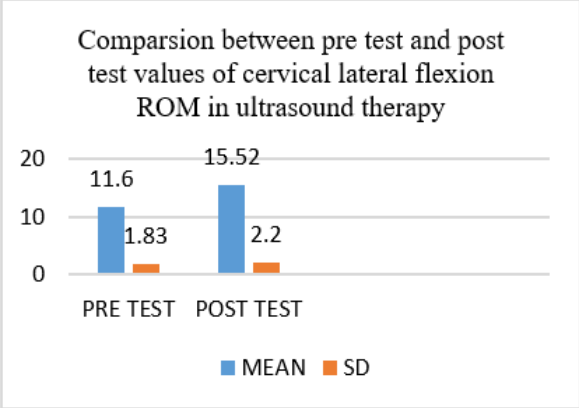



**Fig - 5: Group B Paired T-Test By Using Cervical Lateral Flexion Rom (Ultrasound Therapy)**

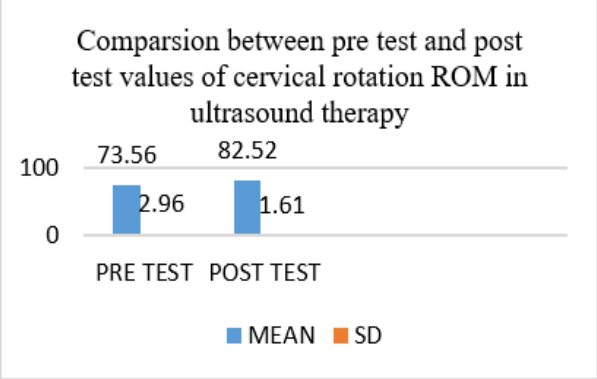



**Fig - 6: Group B Paired T-Test By Using Cervical Rotation Rom (Ultrasound Therapy)**

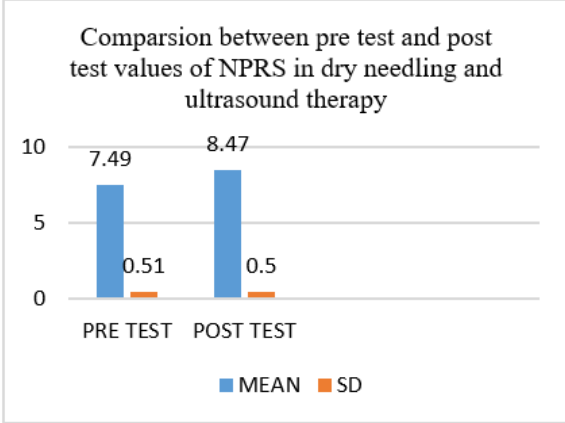



**Fig- 7: Both Group Unpaired T-Test By Using Nprs**

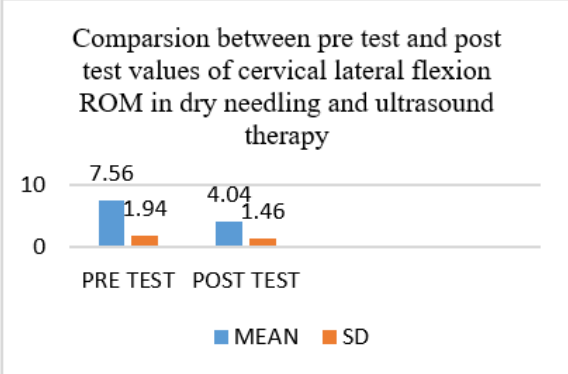



**Fig - 8: Both Group Unpaired T-Test By Using Cervical Lateral Flexion Rom**

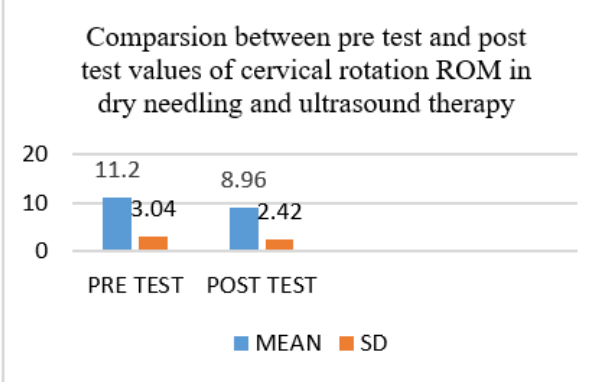



**Fig - 9: Both Group Unpaired T-Test By Using Cervical Rotation Rom**

## Result

50 individuals participated in the study. There were 25 participants total in each group.

For NPRS, the mean was 7.49 for Group A (Dry Needling) and 8.47for Group B (Ultrasound), p value was <0.0001 and t value was =8.9641 demonstrating that the outcome was statistically significant.

For CERVICAL LATERAL FLEXION ROM, the mean was 7.56 for Group A (Dry Needling) and 4.04 for Group B (Ultrasound), p value was <0.0001 and t value was =17.5125demonstrating the result was statistically significant.

For CERVICAL ROTATION ROM, the mean was 13.20 for Group A (Dry Needling) and 8.96 for Group B (Ultrasound), p value was <0.0001 and t value was =5.4515 demonstrating that the result was statistically significant.

## Discussion

This study compares the effectiveness of ultrasonic therapy with dry needling for treating upper trapezitis in patients. Additionally, the impact on pain management and neck range of motion will be assessed. Over the course of two weeks, this contrast is displayed.

In the present study, 50 participants were divided into a pair of 25 each: group A underwent dry needling twice per week, and group B received ultrasound four times per week for two weeks.

The same workout programme was given to each of these groups. Prior to and after therapy, results were evaluated using the NPRS scale, cervical lateral flexion range of motion, and cervical rotation range of motion. The significant benefits of dry needling are higher than those of ultrasound therapy by a significant amount. dry needling group were superior to the ultrasound group when results were compared between each of the two groups.

The data analysis shows that both groups had greater NPRS, Cervical Lateral Flexion ROM, and Cervical Rotation ROM levels. In contrast, with regard to of NPRS, Cervical lateral flexion ROM, and Cervical rotation ROM, individuals in the dry needling groups outperformed those in the ultrasound group .An early study by Maithili Deshpande, et al., (2023) Conclusion: Depending on data, each dry needling and percussor are successful at decreasing discomfort; meanwhile, in a medical condition, precursor acts superior with the goal of minimising discomfort while improving individuality[14].

An early study by Chien-Tsung et al., (2010) stated that the study's findings supported the efficacy of dry needling when used remotely. Dry needling a faraway myofascial trigger point may lessen the irritability of a proximal myofascial trigger point[15]. An early study by Jay Shah et al., (2015) determined that dry needling changes the MTrP state and reduces discomfort. When trigger point status improves, there is a statistically significant and clinically major decrease in discomfort[16].

An early study by Asefeh Sedighi, et al., (2017) determined that patients with cervicogenic headache significantly improve the trigger point sensation, rom after receiving dry needling into the sub occipital and upper trapezius muscles[17].

An early study by. Mayur A Ajmera, et al., (2018) determined that individual with trapezitis, dry needling, and equipment supported soft tissue mobilization are higher in decreasing discomfort, effective rom, raising decrease disability, findings of the study goes with results of M Priyanka, TG Tilak Francis et al., (2017) determined that dry needling therapy is more superior than cryotherapy for relieving pain in the upper trapezius muscle because it results in a minimize in range of pain and an greater in rom[18].

## Conclusion

Finding of this study concludes that through Upper trapezitis pain decreases by both dry needling and ultrasound therapy, In patients with upper trapezitis, dry needling therapy looks to be more successful than ultrasound therapy in relieving discomfort and enhancing cervical range of motion.

**Ethical Clearance:** Taken from institutional ethical committee. ISRB number -03/ 012/ 2022/ ISRB/ SR / SCPT

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Effect of Dry Needling in Patients with Plantar Fasciitis in Reducing Pain Compared to Ultrasound Therapy

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**Abstract**

**Background:** Pain and discomfort below the medial calcaneal tubercle especially in the weight-bearing areas are the hallmarks of plantar fasciitis heel pain. It affects about 10% of people in the general population and affects about 83% of active working individuals between the ages of 25 and 65.

**Purpose:** To determine the effect of dry needling therapy on subjects with Plantar fasciitis in reducing pain and increasing Ankle Range Of Motion (ROM) when compared to Ultrasound therapy with ankle exercises.

**Materials and Methods:** The subjects were selected according to selection criteria. All the subjects were assessed using Numeric Pain Rating Scale (NPRS) and Ankle ROM. A sample of 50 (45 females and 5 males) was taken for the study which was further divided into two groups where the experimental group received Dry needling therapy with ankle exercises (n=25) and the control group received Ultrasound therapy with ankle exercises (n=25). The intervention was given for two weeks. The entire process was performed from November 2022 to April 2023.

**Result:** Statistical analysis showed that there was a significant difference obtained within the groups of pre and post-test for NPRS and ROM ($p<0.0001$). A significant difference was obtained between the experimental and control groups for NPRS and ROM ($p<0.0001$).

**Conclusion:** Dry needling therapy with ankle exercises was more beneficial in reducing pain than ultrasound therapy with ankle exercises in Plantar fasciitis subjects.

**Keywords:** Plantar fasciitis, Dry needling, Ultrasound therapy, ankle exercises, Dorsiflexion, Plantar flexion.

## Introduction

Pain and discomfort below the medial calcaneal tubercle especially in a weight-bearing area are the hallmarks of plantar fasciitis heel pain, especially right after relaxation, such as keeping the first step on the floor in the morning.[1] Lower extremity tendinopathy have a prevalence between 20% and 40% and are caused by plantar heel discomfort or plantar fasciitis, which can afflict both athletes and non-athletes.[2-4] The most frequent aberrant site in people with plantar fasciitis is thought to be the central band which is the origin of plantar aponeurosis. It is unclear how exactly plantar heel discomfort develops. According to earlier research, plantar fasciitis can be caused by trauma, inflammation, metabolic, degenerative, or nutritional issues.[5,6]

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Stretching of calf muscles, taping of the foot, manual therapy techniques such as joint mobilization and manipulation, soft tissue mobilization near the sites of nerve entrapment, and neural mobilization techniques which are done passively, orthoses, anti-inflammatory drugs either taken orally or as an injection and night splints are just a few of the conventional treatments currently being used to treat plantar fasciitis.[7,8]

Surgery is typically only considered as a last resort if conservative treatment for at least 6 months has failed.[9] Pain on the heel and many other pain disorders of the musculoskeletal system is increasingly being treated with acupuncture and dry needling.[10]

To treat musculoskeletal pain issues, dry needling therapy is described as a "professional treatment employing a filiform thin needle which is passed into the skin and stimulates the trigger points, connective tissues, and muscles".[11]

Decreased dorsiflexion of the ankle, increased body mass index (BMI) and weight-bearing due to employment have all been identified as major risk factors.[12] Following the failure of conventional treatment, the effectiveness of dry needling therapy was evaluated on a male subject, who experienced quick pain alleviation over 2 weeks at the age of 53.[13] Based on the evidence that is currently available, they found low evidence that dry needling therapy has a good effect on short-term pain intensity reduction and moderate evidence that it has a positive long-term impact on pain and pain-associated disability in patients with Plantar fasciitis when compared to other interventions.14 For the treatment of pain caused by MTrPs, the deep method of dry needling has been demonstrated to be more successful than the superficial method.[15]

In the treatment of plantar fasciitis, it was discovered that ultrasound therapy was superior to radial extracorporeal shock wave therapy.[16] Even though it modestly affects the ankle joint range of motion, the study found that dry needling therapy on the trigger points can be utilized as a useful other option before advancing to more invasive therapies for plantar fasciitis.[17] Chronic plantar heel discomfort is linked to obesity and pronated feet, which may also be risk factors for the syndrome.[18]

Plain radiography, bone scans, magnetic resonance imaging (MRI), and ultrasound are imaging methods that can be used for this. With MRI and ultrasound, the Plantar fascia can be directly imaged.These techniques have shown that people with plantar fasciitis have thicker plantar fascia than those without plantar fasciitis.[19]

## Aim

To determine the effect of Dry needling therapy on subjects with Plantar fasciitis in reducing pain and increasing Ankle ROM when compared to Ultrasound therapy with ankle exercises.

## Materials and Methods

It was an experimental study design with a convenient sampling technique. The 50 subjects were allocated randomly into two groups where the experimental group received Dry needling with ankle exercises and the control group received Ultrasound therapy with ankle exercises based on inclusion and exclusion criteria. The entire process was performed from November 2022 to April 2023.

**Inclusion criteria:**

- Age between 25 and 65 years.
- Females > Males.
- Windlass test positive.
- Known Plantar fasciitis cases.
- Clinical symptoms such as morning first-step pain.
- Pain more than 3 but not less than 8 in NPRS.

**Exclusion criteria:**

- Any ankle surgeries.
- Pain more than 8 in NPRS.
- Dermatological diseases in the area of dry needling.
- Known peripheral vascular diseases.

**Outcome measure:**

Pre-assessment was taken two weeks before intervention and Post assessment was taken two weeks after intervention.

- Numeric Pain Rating Scale (NPRS)
- Ankle Range Of Motion (ROM)

**Procedure**

The 50 subjects were allocated randomly by using a randomization method (computer-generated random numbers). All the subjects were described relating to the study. The consent form was signed by the patient before the treatment.

**Experimental Group (n=25): Dry needling therapy with ankle exercises.**

In this procedure, 25 subjects received Dry needling therapy with ankle exercises. Myofascial trigger points were activated by dry needling. The subjects were comfortably lying in a prone position during the procedure. After inserting the needle, it was partially pulled back and then pushed forward repeatedly to elicit the desired reaction. This method is known as the Fanning method. The needle was left in the muscle for as long as necessary to produce the desired reaction for a few seconds and as long as the participant could tolerate it. The desired reaction was determined by observing muscle twitching, and the movements of the needle were repeated until the twitching stopped. Once the twitching ceased, the needle was left in place for five minutes. *Needle length*: 30 mm to 50 mm.[17] *Needle diameter*: 0.6 mm.[17] *Targeted muscle*: Gastrocnemius and Achilles tendon. *Duration*: 2 sessions per week for two weeks.[13]

**Control group (n=25): Ultrasound therapy with ankle exercises.**

In this procedure, 25 Subjects received Ultrasound therapy with ankle exercises. The subjects were instructed to lie in a prone position on the couch or table. The treatment was provided in longitudinal strokes using a direct contact method throughout the plantar fascia. During the application, a gel was used for the transmission of ultrasonic waves between the transducer and the subject's skin. The treatment was given for 8 minutes.[16] *Frequency*: 3 MHz.16 *Duration*: 5 sessions per week for two weeks. *Mode:* Pulsed mode.[16]

**Ankle Exercise Program:**

This program was prescribed for all the subjects. They were prescribed to do the exercises for 2 weeks 20 times per day in the morning sessions and evening sessions each by counting up to 30.

**1. Standing calf stretch exercise:**

The subjects were made to Stand by holding onto a wall with their arms placed in an extension position and their toes facing forward. The subjects were asked to extend their right leg backward and to keep their right foot flat on the floor. Then the subjects were asked to tilt forward and slowly bend their left knee until they felt the stretch in the right calf muscle. The subjects were asked to hold the stretch. This procedure was repeated on the left leg.

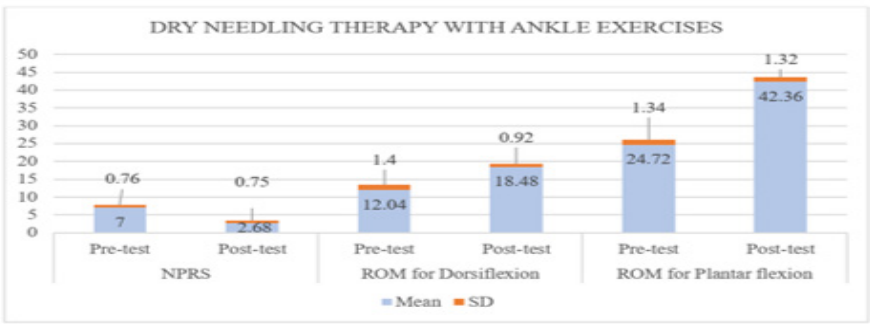
**2. Towel stretch exercise:**

The subjects were asked to Sit on the floor with their legs out in front of them. They were instructed to wrap the towel around the ball of their foot just below their toes. They were asked to Gently pull on the towel, allowing their feet to slowly bend up toward their knee while keeping their knee straight. The subjects felt the stretch behind their heel or their knee. They were instructed to Hold the stretched position and were repeated on the other leg.

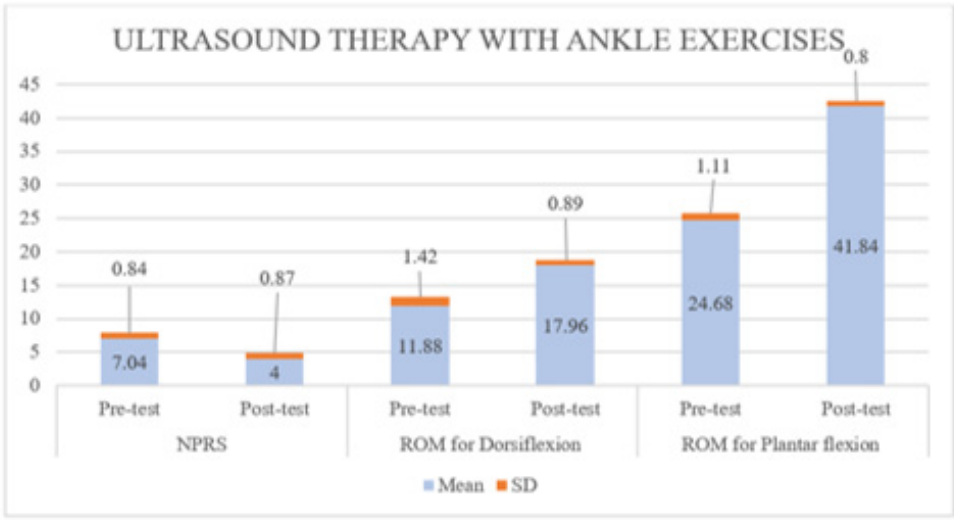
**3. Plantar fascia stretch exercise:**

The subjects were made to sit on a chair or table as per their comfort and asked to place their painful foot on the thigh of their other leg. Subject's one hand supported the heel and the other was placed on the toes. They were asked to pull the toes of the painful foot toward their shin bone with their hand until they felt a stretch. They were instructed to Hold the stretched position and were repeated on the other leg.

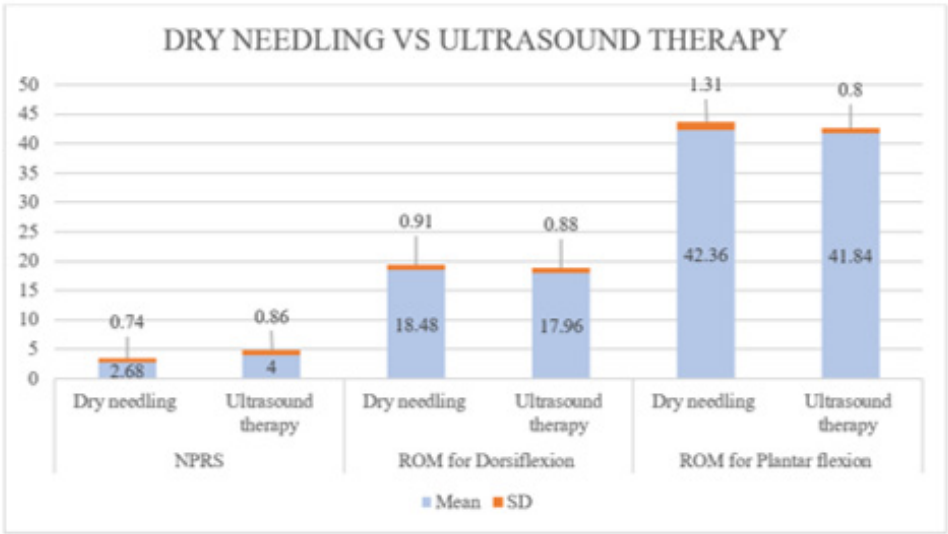
**Data Analysis**




**Graph-1: Comparison of pre and post-test values for Dry needling therapy with ankle exercises.**




**Graph-2: Comparison of pre and post-test values for Ultrasound therapy with ankle exercises.**




**Graph-3: Comparison of post-test values for Dry needling therapy and Ultrasound therapy with ankle exercises.**

## Result

The paired t-test was used for Dry needling therapy with ankle exercises. The mean value of the pre-test was 7 and the post-test was 2.68 using NPRS. Meanwhile, Dorsiflexion's pre-test and post-test mean values were 12.04 and 18.48 respectively. Also, the mean value of the pre-test was 24.72 and the post-test was 42.36 for plantar flexion. As a result, the findings were statistically significant with a p-value <0.0001 (graph 1).

The paired t-test was used to test within the group of Ultrasound therapy with ankle exercises. The mean value of the pre-test was 7.04 and the post-test was 4 using NPRS. Meanwhile, Dorsiflexion's pre-test and post-test mean values were 11.88 and 17.96 respectively. Also, the mean value of the pre-test was 24.68 and the post-test was 41.84 for plantar flexion. As a result, the findings were statistically significant with p-value <0.0001 (graph 2).

The Unpaired t-test was used to test post-test values of Dry needling therapy with ankle exercises and Ultrasound therapy with ankle exercises which revealed that the mean value was 2.68 using NPRS,18.48 for Dorsiflexion and 42.36 for plantar

flexion in Dry needling therapy group whereas the mean value was 4 using NPRS, 17.96 for Dorsiflexion and 41.84 for plantar flexion in Ultrasound therapy group. As a result, the findings were statistically significant with the p-value less than <0.0001 (graph 3).

The statistical analysis revealed a statistically significant difference in values between Dry needling therapy and Ultrasound therapy with ankle exercises.

This revealed that Dry needling therapy with ankle exercises produced better functional results in reducing pain when compared to Ultrasound therapy with ankle exercises.

## Discussion

Luis Llurda-Almuzara, et.al, suggested that in comparison to other interventions, this systematic review and meta-analysis discovered weak evidence that dry needling improves long-term pain and pain-related disability, but substantial evidence that it improves short-term pain intensity.[14] In a 2010 study, they found that for the treatment of pain related to the Myofascial trigger point, the deep form of dry needling is more successful than the superficial one.[15] According to Bihter Akinoglu, et.al, the sense of ankle proprioception in subjects with Plantar fasciitis can only be improved with a combination of radial extracorporeal shock wave therapy and exercise therapy; ultrasound therapy alone and exercise therapy alone were both ineffective in this regard.[16]

The study which was conducted in 2016, concluded that despite having no impact on the range of motion of the ankle joint, trigger point dry needling can be an effective alternative treatment for plantar fasciitis since it reduces the degree of heel discomfort.[17] According to Elizabeth A. Tough, et.al, there is insufficient evidence that, when compared to normal therapy, dry needling directly into myofascial trigger points has a general therapeutic impact.[20]

One of the studies demonstrated that a home-based stretching exercise program was successful for patients with plantar fasciitis in terms of lowering discomfort, improving function, and increasing the strength of both extrinsic and intrinsic foot muscles.[21] According to Renata Graciele Zanon, et.al, exercises that stretch the fascia and posterior musculature of the leg are effective for easing plantar pain and restoring function in those with persistent plantar fasciitis.[22]

## Conclusion

In conclusion, the study revealed that both Dry needling therapy and Ultrasound therapy affects reducing pain for Plantar fasciitis. Dry needling therapy appears to be more beneficial than Ultrasound therapy in reducing pain and increasing the range of motion at the ankle joint in subjects with Plantar Fasciitis.

**Ethical clearance:** Taken from the institutional ethical committee. ISRB number-03/ 013/ 2022/ ISRB/ SR/ SCPT.

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**Conflict of interest:** Nil.

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Original Article

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# Efficacy of Low Blood Flow Restricted Exercise on Increasing Muscle Strength in Patients with Knee Osteoarthritis Comparing with Conventional Strength Training

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**Abstract**

**Background:** The prevalence of OA knee is diagnosed with radiographic features 15% of patients were symptomatic in one study. OA affects nearly 6% of adults. Female sex is more common. 13% of females and 10% of male in 60 years are affected with OA and in 70 years of population rises to 40%.

**Purpose:** To find the efficacy of low blood flow restricted resistance exercise on increasing muscle strength in patients with knee OA compared with conventional strength training using NPRS for pain and knee ROM.

**Materials and Methods:** A total of 60 subjects were assigned in this study. The NPRS and knee ROM were used to calculate pre-and post-test results. Each session included three sets of five repetitions with a ten-second hold in between. The tables were tabulated and statistically evaluated.The entire process was conducted from November 2022 to April 2023.

**Result:** According to the statistical analysis, both groups had a statistically significant improvement between their pre and post-exercise values ($p<0.0001$). There is also a significant variation in post-exercise results between the two groups ($p<0.0001$), indicating that blood flow restriction with exercises is more effective than conventional strength training with exercises**.**

**Conclusion:** Blood flow restriction has been shown to be more effective than conventional strength training at relieving pain and increasing knee ROM.

**Keywords:** Arthritis, Osteoarthritis, Blood flow restriction, Resistance

## Introduction

In the anatomical view of OA as a full knee joint of knee. The knee is a wide joint of the human body. It is a synovial joint which contains tibiofemoral and patellofemoral joints . The knee joint performs flexion and extension and some other movements. The anatomical structure and function are depending on muscles, bones, ligaments, cartilage, synovial fluid and tissue. The four ligaments of the knee joint are ACL, PCL, MCL and LCL. The knee had multiple bursae to prevent. The two menisci will separate the fibrocartilage structures attached with tibia and femur. The bursae will prevent the friction between

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the joint surfaces.[1,2] This joint is a common form for arthritis and it is degenerative and characterised by ongoing worsening of cartilage, ligament and joint cavity and the consequences in pain and disability. The OA will affect the biomechanics of the joint.[3] The knee is one of the prominent joints. Osteoarthritis is a degenerative joint disease. It commonly affects the elderly. The OA patients may experience pain, tenderness, stiffness, decreased ROM, downturn of ADL activity.[4] The two aspects of the OA knee are primary. Due to degeneration friction of the joint may increase. The therapy of knee OA disease consists of two essential components: diagnostic and treatment.[5]

The muscles, tendons, and connective tissue around the knee can be strengthened with the aid of resistance bands.[6] Knee band exercises help increase knee mobility and stability while also lowering discomfort and swelling.[7]

Exercise therapy gives pain alleviation that is at least as effective as pharmacological pain drugs while avoiding adverse reactions. In case of mild to moderate OA knee conservative management can be given. Muscle weakness is linked to pain and physical impairment in people with OA of the knee, and it promotes disease progression.[8]

Straight leg raising (SLR) exercises: patient lay in a supine position. A small pillow was put between the knees. They maintain adduction with contraction for seconds.[9] BFR exercise results in enhanced fatigue resistance & improved oxygen consumption when combined with very rigorous training. Blood flow resistance has been performed in samples in low intensity (eg: 25,35%) of1 repetition. Short rest intervals between (eg: 25 seconds). The BFR program will help to restorative the muscle and bone alteration. This study will help us to compare the effectiveness of BFR and conventional strength training in OA knee patients.[10]

## Aim

To study the efficacy of low blood flow restricted resistance exercise on increasing muscle strength in patients with knee OA compared with conventional strength training.

## Materials and Methods

The Study was conducted on 60 subjects with knee osteoarthritis for ages between 40 and 60 years for 8 weeks from a private physiotherapy clinic. Convenient sampling was used in this study. The entire process was performed from November 2022 to April 2023.

**Inclusion criteria:**

- Subject of the age group of 40 to 60 years.
- Subjects were selected in both genders.
- Subject with clinically diagnosed osteoarthritis of knee joint.
- Subjects with score below 8 on VAS Scale.
- Subject with stage 2 mild OA knee (knee joints will reveal greater bone spur growth)

**Exclusion criteria:**

- knee surgeries
- pain more than 10 NPRS scale
- Open wound around knee

**Outcome Measure:**

Assessment was done before and after the end of 8 weeks of study.

- Numeric pain rating scale (NPRS)
- Range of Motion.

**Procedure**

Sixty subjects diagnosed with osteoarthritis were screened for inclusion and exclusion criteria. All participants were asked to sign their consent form. The participants were clearly explained about the study. The patients were divided into two groups (Group A-30, Group B-30). The pre and post-test values were measured by visual analog scale, knee range of motion.The entire process was conducted from November 2022 to March 2023.

Group A received blood flow restriction with exercise.

Group B received conventional strength training.

**Group A: Blood Flow Restriction:**

- Blood flow restriction (BFR) is a technique that involves the application of a specialized

tourniquet or cuff to partially restrict blood flow to a specific area of the body, such as the knee, during exercise or rehabilitation.

- Application of the cuff: A cuff, typically made of an inflatable material, is placed around the upper thigh, proximal to the knee joint. The cuff is then inflated to a specific pressure, which is determined by the healthcare professional based on individual factors such as limb size and tolerance.
- Blood flow restriction: The inflated cuff partially restricts arterial blood flow to the muscles below the cuff, while still allowing venous blood flow to return from the muscles. This restriction creates a temporary ischemic (low-oxygen) environment in the working muscles.
- Exercise or rehabilitation: With the cuff in place, the individual performs exercises specific to their knee rehabilitation program. These exercises typically involve low-intensity resistance training or gentle movements to avoid excessive strain on the knee joint.
- Training parameters: During BFR training, the intensity of exercise is typically lower than traditional training methods, with lighter weights or resistance. This is due to the enhanced muscle response and fatigue that occurs with the restricted blood flow.

Duration and frequency: BFR training sessions are typically shorter in duration compared to regular training sessions, usually lasting around 10-15 minutes.

Safety considerations: BFR should be performed under the supervision of a qualified healthcare professional who is experienced in this technique.

Potential benefits of BFR for knee rehabilitation may include improved muscle strength and size, enhanced recovery, reduced joint stress, and improved functional outcomes.

Duration: BFR training sessions typically last 10-15 minutes.

Intensity: BFR training involves using lower-intensity resistance or performing exercises at around 20-40% of your one-repetition maximum (1RM).

Repetitions and sets: Perform three to four sets of 15-30 repetitions for each exercise.

Rest intervals: Keep rest intervals short, typically ranging from 30 seconds to one min.

**Group B: Conventional Strength Training:**

**Straight leg raises:**

Extend one leg straight out in front of you while bending the opposite knee, ensuring the foot stays flat on the ground. Engage the quadriceps muscle in the extended leg by tightening it. Maintain this raised position for a set duration.

Lie on a mat or other solid surface on your back amount of time, usually 2-3 seconds to begin.

Remain in the raised position for the allotted time. Follow your physical therapist's advice and carry out the exercise for the prescribed number of repetitions, such as 10-15. The exercise should be done again on the other side by switching legs.

**Calf Raise:**

Standing near a wall or other sturdy surface, your feet should be shoulder-width apart for stability. Toes pointed forward, keep your feet parallel to one another. Lift your heels as high off the floor as you can while slowly rising up onto your toes. While maintaining your upright posture, concentrate on tightening your calf muscles. The desired number of times should be done with the movement. It is advised to begin with two to three sets of 10 to 15 repetitions each. As your strength and endurance improves, gradually increase the number of sets and repetitions. Between sets, take a short break of 30 to 60 seconds to allow for recovery.

**Quadriceps Isometrics:**

Patients were instructed to lie on supine. Underneath the affected knee, A small rolled towel was placed. Ask the patient to push the back of the knee into the rolled towel and encourage them to tense the quadriceps muscle on top of the leg. The patients were told to contract for five seconds, then relax gradually.

**Data Analysis**

The obtained data was gathered and scrutinized. The mean and standard deviation (SD) were utilized for all parameters. A paired t test was conducted to ascertain whether there were any significant

differences between pre and post-test measurements, and an unpaired t test was conducted to determine between the two groups. A P-value of 0.0001 was utilized as the statistically significant cut off.

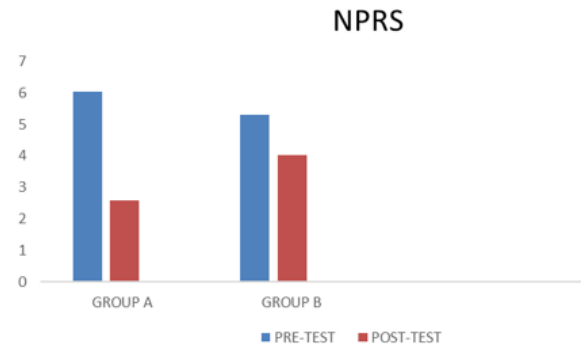



**Fig: 1 Comparison of pre and post-test values of NPRS in blood flow restriction and conventional strength training.**

**Graph No.1:**

**Graph-1**: Comparison of post-test values of NPRS in Blood flow restriction and conventional strength training

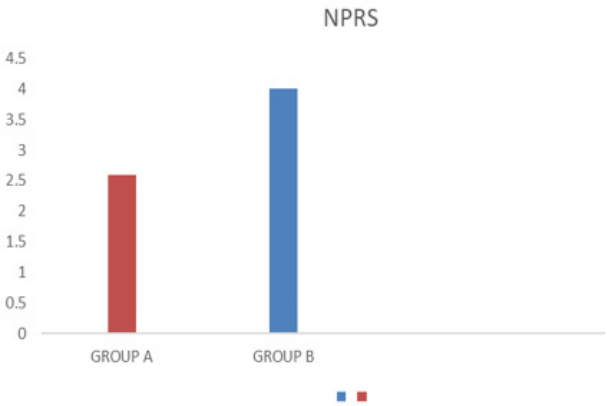



**Fig-2: Comparison pre and post-test values of ROM in blood flow restriction and conventional strength training**

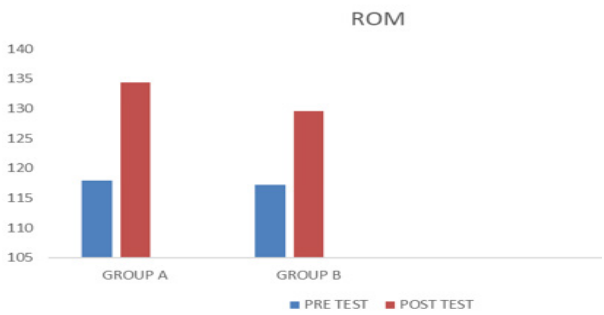



**Fig-3: Comparison post-test values of ROM in blood flow restriction and conventional strength training**

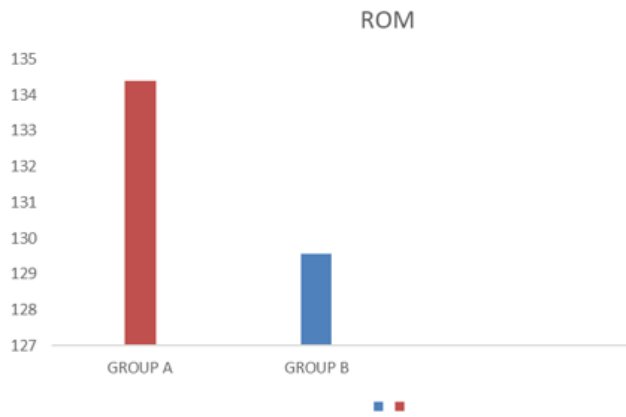



**Fig-4: Comparison post test values of ROM in blood flow restriction and conventional strength training**

## Result

After statistical analysis of data, it was found that there were statistically significant disparities between the values of two groups. Graph 1 contrasts the pre and post test of NPRS and ROM of blood flow restriction with exercise. The pre test mean and SD values of NPRS is 6.04 and 1.55 and post test mean and SD values of NPRS is 2.59 and 0.55. The pre test value of knee flexion was mean and SD 117.97 & 2.71. Whereas the post test value of knee flexion was mean and SD 134.4 and 2.46 with P value <0.0001.

Fig 2 contrasts the pre and post-test of conventional strength training with subjects. The mean and SD value of NPRS is 5.31 and 1.51. Whereas the post test is 4.01 & 1.51 with P value of <0.0006. The pre test value of knee flexion was mean and SD 117.97 & 134.4. Whereas the post test value of knee flexion was mean and SD are 129.57 & 3.00 with P value of < 0.0001.

Fig 3 contrasts of comparison between the blood flow restriction and conventional strength training with exercise. The mean and SD value of blood flow restriction and conventional strength training in NPRS is 2.59 & 0.55 and 4.01 & 1.51. Whereas the mean and SD of shoulder flexion was mean and SD are 134.4 & 129.57 and 2.46 & 3.00.

Fig 4 consist of ROM in blood flow restriction and conventional strength training

As a result, Blood flow restriction with exercise is more significant than conventional strength training

with exercise in patients with osteoarthritis of the knee, which increases the strengthening of the muscle and increases range of motion.

## Discussion

The most common type of arthritis in the knee is osteoarthritis. It is a degenerative, "wear and tear" type of arthritis that primarily affects people over the age of 50, though it can affect younger people as well. The cartilage in the knee joint gradually wears away in osteoarthritis.[11,12] The cartilage becomes frayed and rough as it wears away, and the protective space between the bones shrinks. This can cause bone to rub against bone thus resulting in painful bone spurs. Osteoarthritis typically develops gradually, and the pain it causes worsens over time. Walking, aquatic exercise, water jogging, yoga, and Tai Chi have all been found to be effective in OA knee patients to improve their functional status, gait, pain, and aerobic capacity.[13-15]

The purpose of the study is to find the effects of blood flow restriction and resistance training using among OA Knee patients. Research studies also stated that blood flow restriction have shown more effective in OA Knee.[16]

According to the study of Robert W Spitz, et.al (2022) stated that pneumatic cuff or elastic band is used in blood flow restriction exercise to limit arterial inflow into the muscle and block venous return out of the muscle during the exercise bout. It has been demonstrated that the resulting ischemia, when combined with low-load exercise, helps to increase muscle size and strength. The accompanying discomfort from this kind of activity poses a hindrance to using blood flow restriction (BFR).[17-20]

As a result, Blood flow restriction with exercise has been found to be more significant than conventional strength training in osteoarthritis of the knee to reduce pain and to increase range of motion.

## Conclusion

This finding led me to the conclusion that blood flow restriction with exercise training was found to be more successful than conventional strength training in reducing pain, increasing muscle strength and restoring function and quality of life in patients with osteoarthritis of the knee. Further research and long term follow up studies are necessary to validate these results and assess the long-lasting effects of blood restriction with exercise in the management of osteoarthritis of the knee.

**Ethical Clearance:** Taken from Institutional ethical committee. ISRB number: 03/014/ 2022/ ISRB/ SR / SCPT

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Effect of Dry Needling in Patient with Cervical Radiculopathy in Reducing Pain and Increasing Rom Compared to Interferential Therapy

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**Abstract**

**Background:** This study was designed to inspect the effectiveness of Dry needling and interferential therapy on cervical radiculopathy patients.

**Purpose**: To compare the effectiveness of dry needling and interferential therapy in patients with cervical radiculopathy.

**Materials and methods**: It is an experimental study from November 2022 to April 2023. In this study, 30 subjects were allocated randomly using a randomization method (computer-generated random numbers) according to inclusion and exclusion criteria. Group A was allocated for interferential therapy with neck exercise (n=15) and Group B was allocated for dry needling with neck exercise (n =15). Outcome measures are NPRS (Numerical pain rating scale), Goniometer. Informed consent was obtained from the patient.

**Result:** From the statistical analysis, both groups showed extremely satisfied statistical significance between their pre- and post-test values ($p<0.0001$) Also, there is a significant difference in the post-test values of both groups ($p<0.0001$) which denotes that dry needling therapy with neck exercises values are higher than the IFT with neck exercises values for reducing pain and increasing ROM of cervical joint for cervical radiculopathy.

**Conclusion**: In this study, Dry needling with Neck exercise activities was found to be more beneficial than IFT with neck exercise in reducing cervical pain and increasing ROM.

**Keywords**: Cervical radiculopathy, Dry needling, Interferential therapy, Neck exercise, NPRS, Goniometer

## Introduction

Pain that originates in the neck and travels to the area where the damaged root is distributed is the classic sign of cervical radiculopathy. There is no dermatomal distribution of pain, and the precise location and pattern of pain might vary greatly. Due to compression of the nerve, this type of condition occurs[1].

The nerve root is most susceptible to compression in the starting side of the intervertebral foramen because the entry of the root is conical, these originate in the dural sac which is at the central and this is the biggest component.[2,3]"Dry needling" entails driving a needle directly through the skin and into the muscle. Despite the use of an acupuncture needle, the therapy is grounded in conventional Western medical theory.

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Any basic anatomy education will teach you where the needle insertion sites are in the skeletal muscles. It refers to the insertion of medication[4,5].

Interferential therapy (IFT) is a frequent electrotherapeutic procedure used to relieve pain.[6,7]. To create a new current at the frequency of medium, two currents at medium frequency must interfere with one another.[8] The descending pain suppression system (DPSS), physiological block of nerve conduction, enhanced circulation, and placebo mechanism make up the other potential mechanism[9,10]. Interferential therapy are used to reduce pain by the mechanism of pain gate theory.

## Aim

To compare the effectiveness of dry needling and interferential therapy in patients with cervical radiculopathy in reducing pain and increasing ROM.

## Materials and Methods

It is an experimental study. In this study, 30 subjects were allocated randomly using a randomization method (computer-generated random numbers) according to inclusion and exclusion criteria. Group A was allocated for interferential therapy with neck exercise (n=15) and Group B was allocated for dry needling with neck exercise (n =15). Outcome measures are NPRS (Numerical pain rating scale), Goniometer. Informed consent was obtained from the patient.

Study period: November 2022 to April2023

**Inclusion criteria:**

- Both male and female
- between the age group 30 to 50 years
- Symptoms positive for cervical radiculopathy
- Positive for Spurling's test
- Subjects with pain 8 or less than 8 in NPRS

**Exclusion criteria:**

- Any neck surgeries
- Pain more than 8 in NPRS
- Severe osteoporosis
- Neck instability

**Outcome measure:**

- Goniometer.
- Numerical pain rating scale [NPRS].

**Spurling test:**

Spurling test are used to assess the presence of cervical radiculopathy,usually it aggravates the pain. The patient is usually seated or standing upright during the test.The physiotherapist explains the procedure to the patient, including its purpose and what sensations or symptoms the patient may experience during the test.

Test Execution: The physiotherapist performs the Spurling's test by gently tilting the patient's head to one side (typically towards the affected side) and then applying a downward pressure or axial load on the patient's head.

Observation of Symptoms: The physiotherapist closely observes the patient's response during each step of the test. The patient is asked to report any sensations or symptoms, such as pain, tingling, or numbness, that they experience during the test

**Procedure**

In this study, 30 subjects were allocated randomly to either Group A or Group B using a randomization method (computer-generated random numbers) according to inclusion and exclusion criteria. This study is a Single-blind study design where the subjects were unaware of which group they are assigned to and blinding of the therapist performing the interventions may not be possible due to the nature of the intervention. Group A was allocated for interferential therapy with neck exercise (n=15) and Group B was allocated for dry needling with neck exercise (n =15).

**Group A: Interferential therapy with neck exercise.**

**Interferential therapy:**

The purpose and procedure of interferential therapy were explained to the subject and informed consent was obtained from the patient. The subject was made to sit comfortably and four carbon electrodes

with conductive gel were placed in the neck region[11], The parameters of Interferential therapy:

- Frequency: 80 to 120 Hz
- Intensity: as per the subject tolerance
- Duration: 20 minutes, 5 times/ week

**Group B: Dry needling with neck exercise.**

**Dry needling:**

The subject was placed prone. To lower the resident microflora of the skin by 80–91% before inserting the needle(s), 70% isopropyl alcohol[11] was applied to the regions and allowed to dry for at least ten seconds. Needles were discarded after one-time use because re-applying the same needle in different areas will harm the subject by causing adverse effects like an infection. The dominant hand of the therapist is used to hold the needle. The needle was placed 5 to 10 mm deep and held there for 30 seconds.

Muscles involved:

- Upper trapezius [12,13]
- Deltoid

**Home exercise program:**

The subject was made to sit comfortably and neck isometric exercises were given actively by placing the subject hand on the forehead and asking them to give resistance for cervical flexion. cervical extension, lateral flexion isometrics also given). Duration: 5 to 10-second hold, 5 reps on a daily basis.

**Data Analysis**

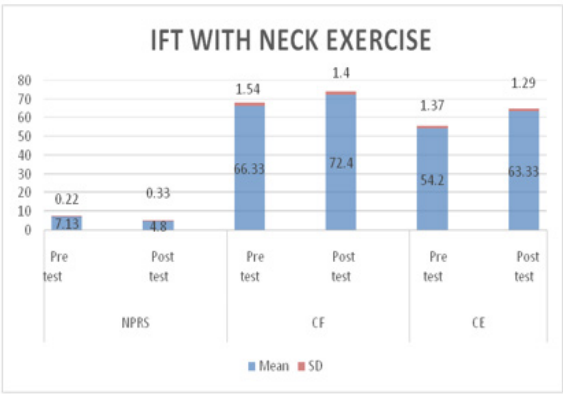



**Fig - 1: Comparison of pre and post-test values of IFT with neck exercise**

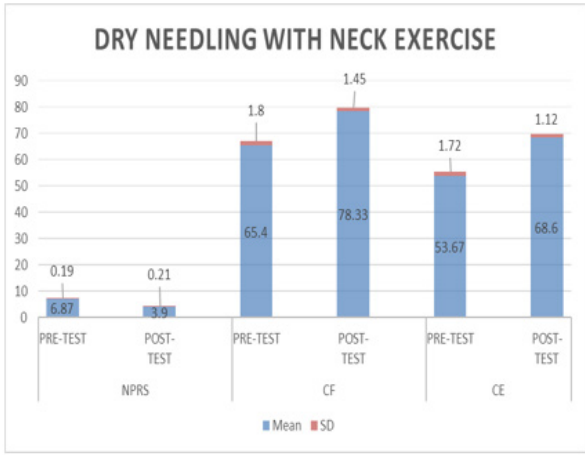



**Fig - 2: Comparison of pre and post test values of Dry needling with neck exercise**

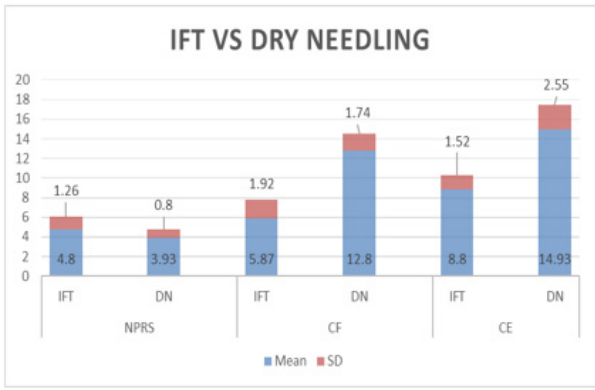



**Fig - 3: Comparison of Post-test values of IFT and Dry needling with neck exercise.**

## Result

After statistical analysis of data, it was found that there were statistically significant disparities between the values of the two groups. Fig 1 contrasts the pre and post-test of IFT with neck exercise subjects. The Mean and SD value of NPRS in the pretest is 7.13 & 0.22 and the post-test value of mean and SD is 4.80 and 0.33. with p-value<0.0001. The pre-test value of cervical flexion was mean 66.33 and SD 1.54, whereas the post-test value was mean 72.40 and SD 1.40 with p-value<0.0001. The pre-test value of cervical extension was mean 54.20 and SD 1.37 whereas the post-test value is mean 63.33 and SD 1.29 with p-value<0.0001.

Fig 2 contrasts the pre and post-test of dry needling with neck exercise subjects. The Mean and SD value of NPRS in the pre-test is 6.87 & 0.19 and

the post-test value of mean and SD is 3.9 and 0.21. with p-value<0.0001. The pre-test value of cervical flexion was mean 65.40 and SD 1.80, whereas the post-test value was mean 78.33 and SD 1.45 with p-value<0.0001. The pre-test value of cervical extension was mean 53.67 and SD 1.72 whereas the post-test value is mean 68.60 and SD 1.12 with p-value<0.0001.

Fig 3 contrasts the Comparison between IFT with neck exercise and dry needling with neck exercise. The mean and SD value of IFT and dry needling in NPRS was (2.87 and 0.74) and (3.87 and 0.83). In cervical flexion the mean and SD values of IFT and dry needling were (5.87 and 1.92) and ( 12.80 and 1.74). In cervical extension the mean and SD values of IFT and dry needling were 98.80 and 1.52) and (14.93 and 2.55).

As a result, Dry needling with neck exercise has been found more significant than IFT with neck exercise in cervical radiculopathy to reduce pain and increase range of motion.

## Discussion

The goal is to determine the efficacy of dry needling with neck exercise in cervical radiculopathy compared to interferential therapy with neck exercise to increase ROM and reduce pain. It is unattainable to anticipate at the outset of symptoms in which a certain participant would not respond to the Treatment. According to Rhee JM, Yoon T, Riew KD et. al (2007) study, "Cervical Radiculopathy." Therefore, for the majority of individuals with cervical radiculopathy, nonsurgical therapy should be tried until there is a severe or worsening neurologic deficit. Despite the fact that numerous nonsurgical management techniques are thought to provide at least some short-term pain relief, none of the commonly used nonsurgical therapies have been proved to affect the natural history of the condition in a controlled, prospective manner.

According to the study by Kietrys DM, (2013) they advise dry needling, as opposed based on the best currently available evidence (grade A), for reducing pain immediately following treatment and at 4 weeks in patients with upper-quartile MPS[15]. A single TrPDN therapy session for individuals with acute mechanical neck pain decreases the discomforts and scattered pain[16] and increases cervical range of motion., according to a study by Mejuto-Vazquez MJ et al (2004). Johnson MI et al. (2006) came to the conclusion that there were similarities in the IFT parameters and pain-relief regimes utilized by respondents, according to Tabasam G. The majority of responders established IFT parameters through a process of trial and error based on patient[17] feedback regarding IFT comfort. Additionally, IFT equipment is large, expensive, and typically used in physiotherapy clinics, which could be why respondents typically deliver IFT for fewer than 30 minutes when the patient is present.

Interferential current(IFC) flowed through the tissues of our body in the largest amount of voltage reported in superficial tissue and in muscular structures there was reduced voltage recorded, according to Beatti A., et. al (2011) analysis. In 'real' IFC, larger voltages are passed outside of the electrodes then the junction of the electrodes is placed over the skin[18]. In line with one circuit, the modulated IFC had the maximum voltage. When aiming at deeper tissues, 'genuine' IFCs outperformed the premodulated IFC in terms of higher observed voltages. However, additional research with larger samples is necessary to verify the findings of this study. Proponents of dry needling believe that it can help alleviate the symptoms of cervical radiculopathy by releasing muscular tension, reducing inflammation, and improving blood flow to the affected area. The precise mechanism of action is not yet fully understood, but it is thought to involve local biochemical and neurological effects Critics of dry needling argue that the evidence supporting its effectiveness for cervical radiculopathy is limited and mixed. While some studies have shown positive outcomes in terms of pain reduction and functional improvement, others have reported no significant differences compared to sham or placebo treatments. Additionally, the lack of standardized protocols and variations in needling techniques make it challenging to draw definitive conclusions.

The study "Cervical radiculopathy" by Rhee JM, et al. (2007) found that it is impossible to know at the time of the onset of symptoms whether a particular patient will not react well to nonsurgical treatment or whether the patient has a poor natural history. Therefore, for the majority of individuals with cervical radiculopathy, nonsurgical therapy should be tried until there is a severe or worsening neurologic deficit.[19] None of the frequently used nonsurgical therapies has been demonstrated to change the natural history of the condition in a controlled, prospective fashion,

despite the fact that many nonsurgical management methods are assumed to give at least some short-term pain reduction.

## Conclusion

As a result of the findings, it has been proven that Dry needling with neck isometric exercise is more effective than IFT with neck isometrics exercise. That is, in cervical radiculopathy, though the IFT with neck exercises had a good outcome in reducing pain and disability, Dry needling plays a significant role in preventing and relieving pain and disability, and neck exercise also aids in pain relief.

**Ethical Clearance:** Taken from the institutional committee.

ISRB number-03/015/2022/ISRB/SR/SCPT

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Comparison of Physiological Profiles among Collegiate Volleyball Players- With and Without Musculoskeletal Pain: A Case Controlled Study

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**Abstract**

**Background:** The success of athletes is greatly influenced by their morphological and anthropometric traits. Numerous studies have examined how often volleyball players experience musculoskeletal pain, which is typically located in the upper and lower back. The present study was to compare the physiological profiles with or without musculoskeletal pain in volleyball players.

**Purpose:** To compare the difference in the physiological profiles of volleyball players with or without musculoskeletal pain.

**Materials and methods:** The subjects were collegiate volleyball players selected based on inclusion criteria. They explained about the study. Volleyball players were allocated into two groups of total 83 containing group A (n=23) with musculoskeletal pain and group B without musculoskeletal pain. The pro agility shuttle, vertical jump, standing broad jump, 40-yard test, three cone drill were assessed and the body composition was assessed using skinfold caliper. The entire process was performed from February 2023 to June 2023.

**Result:** From the statistical analysis made with quantitative data revealed no statistical difference between group A and group B

**Conclusion:** The present study shows there was no significant difference in the physiological profiles of volleyball players with or without musculoskeletal pain.

**Key words:** volleyball players, physiological profiles, anthropometric measurement.

## Introduction

Athletes' success is influenced by their physical traits. In volleyball, height matters for better ball handling, but taller players may struggle to jump due to higher body weight. Skinfold thickness helps assess body composition and dietary condition brought on by exercise.1 High-impact sports like volleyball, basketball, and football increase the risk of musculoskeletal issues due to agility, repetitive training, and aggressive play. Athletes' body posture is a focal point of research as exercise can impact spine curvature.[2] Volleyball players commonly experience upper and lower back pain. Higher thoracic

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kyphosis and lumbar lordosis angles correlate with increased lower back pain frequency, while a deeper angle of thoracic kyphosis is associated with more frequent neck pain.[3] Volleyball is a popular sport played by 200 million people worldwide. However, it comes with a risk of common injuries such as ankle, knee, and shoulder injuries. Volleyball's dynamic tasks (jumping, blocking, smashing) strain the musculoskeletal system, leading to ankle, knee, and shoulder injuries. Ankle injuries are typically acute, while knee and shoulder injuries can be acute or overuse related.[4] Italian senior volleyball players: centers are more ectomorph, less endomorph; setters are opposite. Hitters/opposites lie between setters and centers.[5] Tall stature's usefulness is well agreed to. Volleyball players have "kinanthropometric" profiles, involving jumping skills, height, body composition, velocity, and coordination, vital for technical prowess, strength, and coordination in the sport.[13] Volleyball players had lower body fat percentages and higher lean body mass and water percentages compared to controls, likely due to consistent physical activity and training.[6,1] Except for low values (often 5 mm or fewer), skinfold thickness was estimated to be the nearest 0.5 mm. These measurements were taken at the arms, triceps, subscapular, and supra-iliac regions of all participants.[10]

## Aim

The aim is to study the comparison of physiological profiles between with and without musculoskeletal pain among collegiate volleyball players.

## Material and Methods

**Subjects:** Recruited from Saveetha college physical education

**Sampling technique:** Convenient sampling.

**Sample size:**83 samples.

**Study period:** February 2023 to June 2023

**Inclusion criteria:**

- Collegiate volleyball players
- Age level (18-24)
- With and without musculoskeletal pain

**Exclusion criteria:**

- Players with recent surgery.
- Players with fractures.

**Procedure**

This was a case-controlled study. A total of (N=83) Subjects were assessed based on the inclusion and exclusion criteria. Collegiate Volleyball players, Age Level (18-24), With and without Musculoskeletal pain, Male players were included. Players who recently underwent surgery or had fractures were excluded from the study. Participants provided written authorization after being informed about the study's details. The participants were divided into two groups: Group A (N=23) and Group B (N=60). The following outcome measurements were assessed: height, body weight, skinfold caliper measurements, 40-yard sprint, vertical jump, standing broad jump, pro-agility shuttle, and three cone drill, all conducted on the ground. The vertical jump was measured in centimeters, the 40-yard test required measuring tape and cone markers, and the pro-agility test needed a stopwatch and six cones.

Subjects wore trousers for the ground-based tests. Before data collection, their age, height, and mass were recorded. Height was measured barefoot using a stadiometer, and body mass was measured with a weighing machine to calculate BMI. The next step was a structured warm-up consisting of ten minutes of running and flexible mobilization for the lower body. This was followed by linear and lateral runs over 20-40 yards, progressively increasing in difficulty. The tests were then conducted in the specified order.

**Outcome measures:**

**Skinfold caliper:** Skinfold caliper was used to check the body composition of an individual at the sites of Triceps, chest, subscapular, midaxillary, abdominal, iliac crest, thigh, calf.

**40-yard sprint:** A timing light system recorded sprint episodes at 10 yards, 20 yards, and 40 yards,

using gates at specific intervals. Subjects started the sprint 30 cm behind the starting line from a three-point stance, and the best trial of two attempts was rated based on timing accuracy down to 0.001 second.

**Vertical jump:** To maximize vane movement, the individual stood face-on to the Vertec on their dominant side with feet on the ground, using the last vane movement as the zero reference. The height was measured from the highest vane moved during the jump without moving forward. Knee angle during the jump wasn't restricted. Vertical jump height was calculated by subtracting reach height from leap height. Each subject had three trials, with the best one analyzed.

**The pro-agility shuttle:** Subjects practiced for the test in advance, starting with a three-point stance between timing gates, crossing the centerline. The test involved a hand tap on the line, followed by a 5-yard (4.57m) sprint to one side. They touched marked lines at both ends of the shuttle for turning. After a 10-yard (9.14 m) run to the opposite side, timing ended upon entering the gate. Three trials were conducted for left and right movements.

**Standing broad jump:** For the standing wide jump, the athlete placed both toes on the back of the starting line and leaped forward while swinging their arms and crouching, aiming for a two-footed landing. To be valid, the landing had to be stable ("stick" the landing). If not, the trial was redone. Body angles during the jump's warm-up stage were not restricted. The length was measured from the line of sight to the back of the heel at the landing using a tape measure. Each subject performed three tests, and the best trial was analyzed.

**Three cone drill:** Subjects practiced before the test, starting in a three-point position at Marker 1, 30 cm from the starting line. At the start, they sprinted to Marker 2, touched the floor with their right hand, and returned to Marker 1, repeating the action. Next, they circled Marker 2, ran through Marker 3, around Marker 2, and finished at Marker 1. A subject guided them to ensure correct completion. Timing started when the participant opened the entryway and ended when they closed it after the test. Two trials were completed, with right turns between Markers 2 and 3 in the first trial and left turns in the second. The study used the shortest duration between the three trials for the pro-agility shuttle.

**Data Analysis:**

Statistical analysis was done to evaluate the physiological profiles with and without musculoskeletal pain among collegiate volleyball players. The selected variables were assessed using Mann-Whitney U test. Mean and standard deviations were calculated and the comparison of the data to normative values.

**Table 1: BMI characteristics**

| BMI (N) | Mean | SD |
|---|---|---|
| 83 | 22.85 | 4.03 |

## Table 2: Agility test

| With musculoskeletal pain (n=23) | Without musculoskeletal pain (n=60) | | | Mann Whitney U test | | |
|---|---|---|---|---|---|---|
| Variables | Mean | SD | Mean | SD | Z value | P value |
| 40 yards | 5.86 | 0.37 | 5.77 | 0.42 | -0.973 | 0.331 |
| Vertical | 2.46 | 0.18 | 2.65 | 1.005 | -1.208 | 0.227 |
| Pro agility | 4.37 | 0.23 | 4.24 | 0.26 | -1.986 | 0.047 |
| Standing | 2.46 | 0.12 | 2.50 | 0.21 | -0.316 | 0.752 |
| Three cones | 10.27 | 5.66 | 8.74 | 0.40 | -3.359 | 0.001 |

**Table - 3: Body Composition**

| Without musculoskeletal pain (n=23) | | | With musculoskeletal pain (n=60) | | Mann Whitney U test | |
|---|---|---|---|---|---|---|
| **Variables** | **Mean** | **SD** | **Mean** | **SD** | **Z value** | **P value** |
| Triceps | 9.73 | 2.299 | 9.30 | 1.579 | -0.489 | 0.625 |
| Midaxillary | 8.8833 | 1.58480 | 9.0435 | 0.92826 | -1.084 | 0.279 |
| Chest | 8.9167 | 1.66001 | 8.6522 | 1.66812 | -0.510 | 0.610 |
| Subscapular | 9.9667 | 2.25469 | 9.7391 | 2.00493 | -0.382 | 0.703 |
| Abdomen | 11.6000 | 2.63741 | 11.2174 | 2.64500 | -0.628 | 0.530 |
| Iliac crest | 10.2167 | 2.02603 | 10.2174 | 2.13108 | -0.067 | 0.947 |
| Thigh | 10.1000 | 2.23758 | 9.5652 | 1.61881 | -0.851 | 0.395 |
| Calf | 8.7500 | 1.49150 | 8.7826 | 1.12640 | -1.347 | 0.728 |

## Results

The participants were selected based on the specific age group (18-24) of collegiate volleyball players. Body mass index was assessed before the trails. A total of 83 participants were included in the study, selected according to specification for inclusion and exclusion criteria. Among the participants, 23 individuals experienced musculoskeletal pain, including pain in the shoulder, wrist, knee, and ankle, while the remaining 60 participants were without musculoskeletal pain. The BMI of both group A with and group B without musculoskeletal pain participants of 83 collegiate volleyball players with mean of 22.85 ± SD of 4.03. The between the group results using Mann Whitney U test, the variables of group A with and group B without musculoskeletal pain were not significant ($p>0.05$). The participants' 40 yards sprint measurements were recorded with mean score of 5.86 ± SD of 0.37 (A), 5.77 ± 0.42 (B) and P value is 0. 331.Vertical jump test with mean of 2.46 ± SD of 0.18(A), 2.65 ± 1.00 (B) and P value is 0.227. Pro agility test with mean of 4.37 ± SD of 0.23 (A), 4.24 ± 0.26 (B) and P value is **0.047**. Standing broad jump with mean of 2.46 ± SD of 0.12 (A), 2.50 ± 0.21(B) and P value is 0.752.Three cone drill with mean of 10.27 ± SD of 5.66 (A), 8.74 ± 0.40 (B) and P value is **0.001**. Therefore, three cone drill and pro agility shuttle values are significant. The Normal significant value is less than 0.05. The variables of group A with and group B without musculoskeletal pain were not significant ($p>0.05$) for skin fold calliper variables at eight sites. The participants triceps with mean of 9.73 ± SD of 2.29 (A), 9.30 ± 1.57 (B) and P value 0.625. Midaxillary with mean of 8.88 ± SD of 1.58 (A), 9.04 ± 0.92 and P value is 0.279. Chest with mean of 8.91 ± SD of 1.66 (A), 8.65 ±1.66 (B) and P value is 0.610. Subscapular with mean of 9.96 ± SD of 2.25 (A). 9.73 ± 2.00 (B) and P value is 0.703. Abdomen with mean of 11.60 ± SD of 2.63 (A), 11.21 ± 2.64 (B) and P value is 0.530. Iliac crest with mean of 10.21 ± SD of 2.02 (A), 10.21 ± 2.13 (B) and P value is 0.947. Thigh with mean of 10.10 ± SD of 2.33 (A), 9.56 ± 1.61 (B) and P value is 0.395 and Calf with mean of 8.75 ± SD of 1.49 (A), 8.78 ± 1.12 and P value is 0.728. The present study found no significant difference in physiological profiles between collegiate volleyball players with and without musculoskeletal pain. However, the three-cone drill and pro agility shuttle tests showed a significant difference in performance outcomes between the two groups. The analysis demonstrated that the three-cone drill exhibited a higher level of variability compared to the pro agility shuttle. This suggests that musculoskeletal pain has an impact on the performance of both the three-cone drill and pro agility shuttle test. This pie chart demonstrates how players with musculoskeletal pain have significant psychological perseverance and were unaffected by their performance level. The three-cone drill and pro agility tests, which evaluate a player's ability to change direction while accelerating, had an impact on the performance of two players.

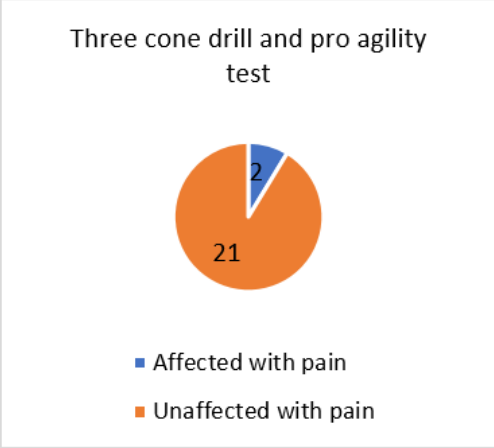



**Fig. 1 Participants Involved in Pro Agility**

Therefore, performance requires a higher pain tolerance.

## Discussion

This study compared physiological profiles of collegiate volleyball players with and without musculoskeletal pain. In order to help those participating in both the immediate and future planning stages of yearly conditioning programs, an effort was made to incorporate information on the physical characteristics (skinfold caliper for measuring the body composition) and physiological characteristics which includes various variables like 40-yard sprint, vertical jump test, pro agility test, standing broad jump and three cone drill. The study finding showed musculoskeletal pain has no effect on participants body composition using skinfold caliper. Despite the fact that the pro agility shuttle 5-10-5 and three cone drills were affected in participants with pain when compared with no pain participants. The three-cone drill demonstrated a considerably greater impact compared to the pro agility shuttle. However, 40-yard sprint, vertical jump test and standing broad jump were not affected in participants with pain. The pro agility test and three cone drill assess how quickly a player can change direction while accelerating, requiring a higher pain tolerance for performance. As a result, players suffering from musculoskeletal pain did not have the same level of tolerance to perform. The study which was done by Julia S Malmborg in 2018 concluded that participants with persistent pain had poor medical conditions but performed at the same level as those with infrequent pain. This is compatible with the current study findings that players' performances were unaffected by musculoskeletal pain as they had high psychological perseverance.[18]

The study conducted by MJ Duncan in 2006, which examined the anthropometric and biological characteristics of elite volleyball players, highlights the value of analyzing physiological profiles for informing position-specific training plans and addressing potential weaknesses in the sport. These findings align with my study, where the identification of weaknesses in players was based on anthropometric and physiological profiling. By incorporating these findings into training programs, athletes can target and improve their specific weaknesses, thereby optimizing their performance and skill development in their respective sport.[13]

The findings from Koley et al.'s 2010 study on Indian inter-university volleyball players, which demonstrated superior hand grasping power compared to controls and indicated mechanical stability benefits in the sport, are consistent with recent research showing that volleyball training significantly improves skill levels without notable changes in skinfold thickness or Vo2max, suggesting that agility performance in volleyball may be influenced more by skill execution and other factors rather than alterations in skinfold thickness.[14]

Kirsch's 2019 analysis links GIRD to shoulder pain in tossing athletes.[17] To minimize musculoskeletal pain and enhance performance during tossing, adopt these strategies: 1) Implement reactive adjustments for increased arm external rotation, and 2) Follow H. Hebestreit's 2008 recommendations to describe, identify risk factors, and implement safeguards against sports injuries.[15]

## Conclusion

The findings of the present study indicate that there were no notable differences in the physiological profiles of volleyball players with and without musculoskeletal pain. It was observed that common physical attributes such as the 40-yard sprint, vertical jump, and standing broad jump were not significantly affected by musculoskeletal pain. However, the three-cone drill, which demands a high pain tolerance,

displayed a significant impact compared to the pro agility shuttle. These insights shed light on the specific areas of performance that may be influenced by musculoskeletal pain in volleyball players, emphasizing the importance of pain management strategies and targeted interventions to optimize overall performance.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws and institutional regulations. (Application Number 03/016/2022/ISRB/SR/SCPT).

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**Conflict of interest:** The authors state that there is no conflict of interest.

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Original Article

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# Effect of Spencer Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation in Adhesive Capsulitis

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**Abstract**

**Background:** Adhesive Capsulitis in the shoulder characterized as a self-limiting situation that lasts only while it has also been described as a 24 week long-term impairment caused by a chronic condition. SMET is a widely used method to restore normal ROM and reduce pain. PNF aims to improve joint synchronization, movement control, and mobility.

**Purpose:** This study focuses on the effect of Spencer Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation for reducing pain and disability in Adhesive Capsulitis.

**Materials and Methods:** A total of 40 participants were selected based on inclusion and exclusion criteria from Eyan Healthcare Foundation during the period of November 2022 to July 2023. They were split into two groups, with 20 Participants receiving Spencer Muscle Energy Technique and 20 Participants receiving Proprioceptive Neuromuscular Facilitation. Subjects with age of 40-70 years, with or without diabetes and pain or stiffness on shoulder were included and Subjects with recent trauma, injury around the shoulder were excluded in the study. All the subjects underwent pre-test measurement with Shoulder Pain and Disability Index (SPADI) and the same repeated for post-test measurement at the end of 4 weeks.

**Results:** By statistical analysis there is a significant difference between the two groups. The Spencer group displays a greater difference than the PNF group when comparing mean differences of the two groups using SPADI.

**Conclusion:** The study concluded that subjects who underwent Spencer Muscle Energy Technique are found to be more effective in reducing pain and disability than Proprioceptive Neuromuscular Facilitation in Adhesive Capsulitis.

**Key Words:** OMT, SPADI, SMET, PNF, Adhesive Capsulitis.

## Introduction

A clinical condition known as Adhesive Capsulitis of the shoulder is characterized by a progressive decrease in both active and passive shoulder mobility leading to discomfort and restricted movement along with weakened muscles[1]. The rate of prevalence has been reported to be 2–5% for people in the age group 40 to 65 years old. However, it is reported to be more common in women and affects 10-20% of those with

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diabetes mellitus and could either be related to an operation, an idiopathic cause (primary), or known root (secondary)[2].

The Spencer technique, commonly referred to as the Spencer's seven steps, is an Osteopathic Manipulative Therapy (OMT) that was created in 1915. It combines Spencer's slowness, slow-motion, and local expansion of the shoulder joint complex performed by a physiotherapist within a comfortable range, followed by isometric contraction of energy producing muscles followed by contraction and relaxation[3].

The PNF therapy method was developed by Kabat and Knott in the early 1950s. PNF aims to enhance joint synchronization, movement control, and mobility. This may be done by rotating diagonal patterns due to various boosts and observing advisor's recommendations[4].

PNF strategies have been shown to be the most effective for significantly improving ROM in the few research that have been done. SMET primarily targets soft tissues, but it also significantly aids in joint mobilization. Through a mechanism known as "Enhanced Tolerance to Stretch" SMET not only improves muscle extensibility but also increases the range of motion (ROM) of joints. In an effort to determine which of these techniques offers significant advantages in our clinical setting[5].

## Aim

The aim is to compare the effect of Spencer Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation for reducing pain and disability in adhesive capsulitis.

## Materials and Methods

An experimental study was carried out at the Eyan Healthcare Foundation Kumaran Nagar, Tiruvallur, Tamil Nadu, India from November 2022 to July 2023. A total of 40 participants were selected based on inclusion and exclusion criteria. The safety of the treatment and the simplicity of the procedure was explained to the participants, and written informed consent was obtained. They were split into two groups, with 20 Participants receiving Spencer Muscle Energy Technique and 20 participants receiving Proprioceptive Neuromuscular Facilitation.

**Inclusion criteria**

- Subjects with age of 40-70 years.
- Both males and females are included.
- Subjects with or without diabetes mellitus.
- Pain or stiffness over the shoulder region.

**Exclusion criteria**

- Subjects who are not interested in this study.
- Subjects with a recent history of trauma.
- Subjects with rotator cuff lesion and tendon calcification.
- Rheumatoid Arthritis.
- Osteoporosis and Malignancies in the shoulder.
- Neurological deficits affecting the shoulder.
- Pain or disorders of cervical spine, elbow, wrist or hand on affected side.

**Outcome Measure**

- Shoulder Pain and Disability Index(SPADI).

**Procedure**

Participants willing to participate were divided into two groups: Spencer Muscle Energy Technique group and Proprioceptive Neuromuscular Facilitation group. Participants underwent Shoulder Pain and Disability Index (SPADI) measurements prior to testing and were repeated for post-test measurements.

The Treatment includes:

- **Modality:** Interferential Therapy for both the groups.

  Participants positioned in sitting with undressed shoulder region, physiotherapist places the electrodes of 2 channels crossover around the affected shoulder, Frequency of 80 – 100 Hz, Duration of 10 minutes and Intensity depends on subject comfortable tolerance level.

- **Exercise:** Spencer Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation.

**Spencer Muscle Energy Technique Group**
Participants treated with Spencer Muscle Energy

Technique, the following movement patterns were performed, and the treatment duration was 30 minutes[6].

**Spencer Techniques**

**Shoulder Extension**

Participants positioned in side lying with affected shoulder uppermost and physiotherapist stand in front of participant with one hand stabilize the acromioclavicular joint and other hand extend the participant shoulder in horizontal plane with elbow flexed position until end range barrier was felt. Resistance was provided on the elbow joint and participants were instructed to push at a resistance barrier against resistance and maintained in contraction for 8-10 sec. The same procedure is repeated on the new restricted barrier position.

**Shoulder Flexion**

Participants positioned in side lying with affected shoulder uppermost and physiotherapist standing in front of participant with one hand stabilizing the acromioclavicular joint and other hand flexing the participant shoulder in horizontal plane with elbow extended position until end range barrier was felt. Resistance was provided on the elbow joint and participants were instructed to push at a resistance barrier against resistance and maintained in contraction for 8-10 sec. The same procedure is repeated on the new restricted barrier position.

**Shoulder Circumduction**

Participants positioned in side lying with affected shoulder uppermost and physiotherapist standing in front of participant with one hand stabilizing the acromioclavicular joint and other hand abducted the participant shoulder in horizontal plane with elbow in flexed position. Participant elbow joint was used to rotate the humerus clockwise and anticlockwise direction with slight compression on shoulder joint for 15 times each.

**Shoulder Circumduction with Traction**

Participants positioned in side lying with the affected shoulder uppermost and physiotherapist standing in front of participant with one hand stabilizing the acromioclavicular joint and other hand abducted the participant shoulder in horizontal plane with elbow on extended position. Participant distal forearm was used as pivot to rotate the humerus clockwise and anticlockwise direction with slight compression on shoulder joint for 15 times each.

**Shoulder Abduction and Shoulder Abduction with External Rotation**

Participants positioned in side lying with affected shoulder uppermost and physiotherapist standing in front of participant with one hand stabilizing the acromioclavicular joint while participant grabbed on physiotherapist same forearm and other hand provided resistance on elbow joint for abduction force. Participant has to extend upward pressure on the elbow to increase abduction till end range was felt. Participants were instructed to push at a resistance barrier against resistance and maintained in contraction for 8-10 sec. The same procedure is repeated on the new restricted barrier position.

**Shoulder Internal Rotation**

Participant positioned in side lying with affected shoulder uppermost with elbow flexed and hand positioned on the back within the available range and physiotherapist standing in front of participant with one hand stabilize the acromioclavicular joint while the other hand applied resistance on elbow joint where the arm was internally rotated position. Participant has to exert forward pressure to the elbow to internally rotate until the end range is felt. Participants were instructed to push at a resistance barrier against resistance and maintained in contraction for 8-10 sec. The same procedure is repeated on the new restricted barrier position.

**Shoulder Adduction with Distraction**

Participant positioned in side lying with affected shoulder uppermost with shoulder and elbow extended and rested on therapist shoulder and physiotherapist standing in front of participant with clasped his hand around participant shoulder and provide downward and upward motion on the deltoid muscle to increase soft tissue motion of deltoid as well as ligament on shoulder joints. It was continued for 30 sec and repeated.

**Proprioceptive Neuromuscular Facilitation group**

Participants treated with Proprioceptive Neuromuscular Facilitation, the following movement patterns were performed and the treatment duration was 20 minutes[7].

**PNF Techniques**

**Diagonal 1(D1) Flexion Pattern of Proprioceptive Neuromuscular Facilitation**

Shoulder Flexion, Adduction and External Rotation, Elbow Flexed, Forearm Supinated, Wrist Flexed and Radial Deviated with Fingers Flexed. Participants positioned in supine lying and Physiotherapist in Walk stand on the affected shoulder and place one hand over the arm and other over the hand. As the participant starts moving the extremity, the physiotherapist applies resistance.

**Diagonal 1(D1) Extension Pattern of Proprioceptive Neuromuscular Facilitation**

**S**houlder Extension, Abduction and Internal Rotation, Elbow Extended, Forearm Pronated, Wrist Extended and Ulnar Deviated with Fingers Extended and Abducted. Participant positioned in supine lying and Physiotherapist in walk stand position on the affected shoulder and places both the hands at the agonist muscles at the elbow and dorsal aspect of wrist. Participant is instructed to move the limb to the opposite hip joint diagonally. The resistance is applied by the physiotherapist.

**Diagonal 2(D2) Flexion Pattern of Proprioceptive Neuromuscular Facilitation**

Shoulder Flexion, Abduction and External Rotation, Elbow Extended, Forearm Supinated Wrist Flexed and Ulnar Deviated with Fingers in Extended and Abducted. Participant positioned in supine lying and Physiotherapist in walk stand position on the affected shoulder and places one hand over the dorsum of wrist and finger and other hand over the elbow joint. The resistance is applied by the physiotherapist.

**Diagonal 2(D2) Extension Pattern of Proprioceptive Neuromuscular Facilitation:**

Shoulder Extension, Adduction and Internal Rotation, Elbow Flexed, Forearm Pronated, Wrist Flexed and Ulnar Deviated, Fingers Flexed and Adducted. Participants positioned in supine lying and Physiotherapist in walk stand on the affected shoulder and place one hand over the elbow joint and other over the palmar surface of the hand. The resistance is applied by the physiotherapist.

**Data Analysis**

For this study, 40 participants with adhesive capsulitis of male 18 and female 22 between the ages of 40 to 70 years were selected. The participants with pain and disability measured by SPADI before and after the treatment to provide pre-test and post-test values respectively.

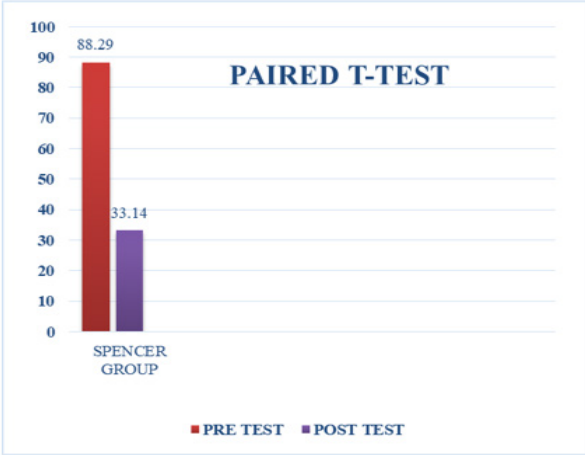



**Fig - 1: Analysis of pre-test and post-test values of SMET group.**

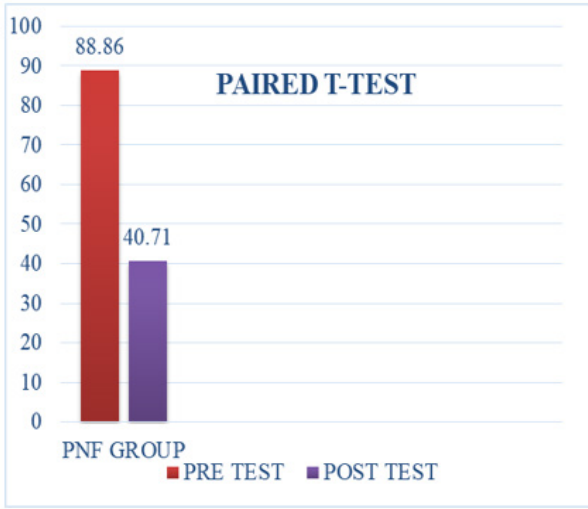



**Fig - 2: Analysis of pre-test and post-test values of PNF group.**

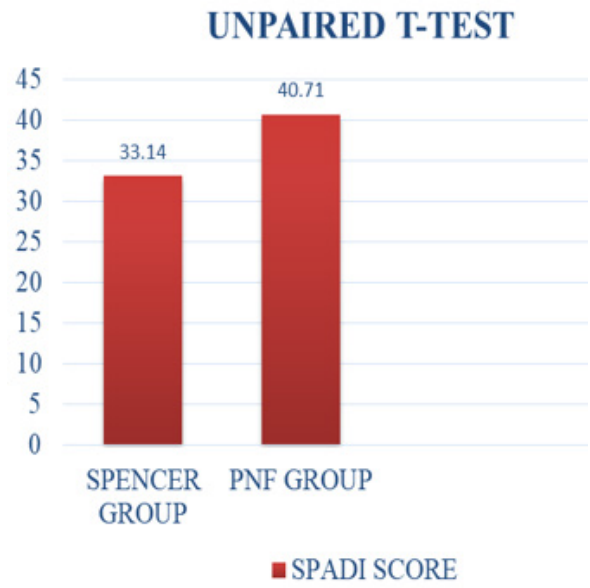



**Fig - 3: Comparison of post-test values of SMET and PNF groups.**

## Result

In this present study the pre-test and post-test values of SPADI score analyzed between the both groups using a t-test in which Spencer group pre-intervention was 88.29(±8.08) and post-intervention was decreased to 33.14(±6.99) whereas in PNF group the pre-intervention was 88.86(±7.60) and post-intervention was decreased to 40.71(±4.15).

According to the statistical analysis, the outcome of the current study demonstrates that both the groups significantly improved as a result of treatment. The Spencer group displays a greater difference than the PNF group when comparing the mean differences of the two groups. Therefore, it can be said that Spencer Muscle Energy Technique reduces pain and disability in Adhesive Capsulitis more effectively than Proprioceptive Neuromuscular Facilitation.

## Discussion

The purpose of the current study is to compare the efficacy of Spencer Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation in Adhesive Capsulitis. Paired and Unpaired t-tests with a baseline of significance of 0.05 were used to statistically evaluate pre-test and post-test data of parameter SPADI. Both Spencer group and PNF group individuals got treatment for a total of 4 weeks. The SPADI pre-test is measured prior to therapy and post-test is measured after 4 weeks. Both the groups received Interferential Therapy before the treatment and Spencer group received treatment for 30 min and PNF group received treatment for 20 min. Based on statistical analysis, the findings of the current study indicate that there is a significant improvement in both Spencer group and PNF group after the effect of treatment.

An articulatory approach with seven distinct steps is the Spencer Muscle Energy Technique which is used to relieve shoulder pain brought by adhesion of the capsule. By using this method passive movement by regular, smooth motion is intended to stretch muscle, ligament and capsule contractions. Contractor ES et al., concluded that Spencer Muscle Energy Technique is more efficient in lowering functional disability[8]. Chavan SE et al., concluded that combining the Spencer Muscle Energy Technique with traditional treatment improved shoulder range of motion[9]. Mushyyaida Iqbal et al., concluded that for reducing pain and enhancing joint ROM and function in Adhesive Capsulitis where the Spencer's joint mobility and Muscle Energy approach was proven to be more effective[3].

The PNF is the best stretching approach where the goal is to enhance ROM, particularly in short-term alterations. It is used to develop muscle strength and endurance, facilitate stability and mobility, and restoration of movement. Lin P et al., concluded that the PNF approach was more effective than conventional manual therapy at restoring the joint structure[10]. Kalyani Malpani et al., concluded that for subjects with adhesive capsulitis the Proprioceptive Neuromuscular Facilitation found to be effective[11]. Mubarka Saeed et al., concluded that Proprioceptive Neuromuscular Facilitation technique shows more significance in improving pain in Adhesive Capsulitis[7].

Based on the statistical analysis, both groups showed improvement in SPADI score. However, Participants in the Spencer Muscle Energy Technique group improved better on SPADI score than Participants in the Proprioceptive Neuromuscular Facilitation group. The limitation of this study is participant's daily activities are not observed, which could have influenced the research and during

treatment some participant's active participation at the initial stage has been challenging. Further study on PNF needed to investigate long term effects and to improve the quality of research, randomized and standardized blinding approaches are recommended.

## Conclusion

This study found that both the strategies utilized in the current Spencer Muscle Energy Technique and Proprioceptive Neuromuscular Facilitation are helpful in lowering pain and disability in adhesive capsulitis. However, Spencer Muscle Energy Technique is more effective than Proprioceptive Neuromuscular Facilitation.

**Ethical clearance:** Taken from the institutional ethical committee. ISRB number - 03 /017/ 2022/ ISRB/ SR/ SCPT

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**Conflict of Interest:** Nil.

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Original Article

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# The Role of Specific Eye Care Exercise Combined with 0-20-20 Vision Rule in Managing Computer Vision Syndrome among Computer Users

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**Abstract**

**Background:** Digital Eye Strain (DES) has enhanced one of the crucial well-being matters with the expanded utilization of digitalized gadgets with optical revealing. Common digital eye strain manifestations include eye strain, headaches, blurred vision, and neck or shoulder pain, which typically get worse the more video display terminals (VDT)users use them. Very little investigation has been done to show how digital use affects Indian users' physical health, particularly among college undergraduate.

**Purpose:** To find the effect of specific eye care exercise combined with 20-20-20 vision rule in managing computer vision syndrome among computer users.

**Methods:** Seventy-four participants were selected for inclusion and exclusion criteria. They were divided into two groups: 20-20-20 Vision Rule Group (37) and conventional group (37). The pre and post-test values will be measured by computer vision syndrome - questionnaire. Group-A received 20-20-20-vision rule along with eye exercise and group-B received specific eye exercise. Both programs were given for 2 weeks, weekly 6 days.

**Results:** Using Computer vision syndrome-questionnaire, 20-20-20 vision rule group's post-test mean was 25.51 and whereas conventional group's was 29.35. This demonstrates that the conventional group received a higher score of digital eye strain symptom positive than the 20-20-20 vision rule group.

**Conclusion:** Specific eye care exercise combined with 20-20-20 vision rule in managing Digital Eye Strain among digital users was found to be more successful than specific eye exercise in reducing manifestation of Digital Eye Strain.

**Keywords:** Digital Eye Strain, computer vision syndrome, 20-20-20- Vision rule

## Introduction

Digital Eye Strain (DES) has enhanced one of the crucial well being matters with expanded utilization of digitalized gadgets with optical revealing. The subjective asthenopic manifestation experienced by video display terminals (VDT) users have been identified, acknowledged, and validated by numerous investigations. When compared to non-users, VDT

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users report it 1.4–1.5 times more frequently than they do. In his research, Red and green lights are reported to cause more visual tiredness than white and blue lights, according to research on the color of ambient light.[1] More than 60 million folks were evaluated to be identified with Digital eye strain.[2] It is also mentions as Visual Fatigue (VF) and Digital Eye Strain(DES).[3] Hazards are male gender, adult age more than 40 years ,person who uses power glasses, failure of execute offer genomic habit.[4] The load of digital eye strains elevated in developing countries due to work task, poor knowledge of ergonomics during digital operating, blockade and utilization of private protecting equipment.[5,6,7] Digital eye strain was characterised as the concomitant eye and vision issues brought on by digital use.8 Common digital eye strain manifestation include eye strain, headaches, blurred vision, and neck or shoulder pain,which typically get worse the more video display terminals (VDT) users use them.[9] The prevalence of digital eye strain among digital users ranges from 64% to 90%. Numerous studies have linked extended digital use, awkward workstation postures, and a variety of musculoskeletal pains, but the majority of them were concentrated on western adult patients.[10,11] Compared to men, women had much increased chance of having headaches as well as neck and shoulder pain.Interstudy, Toamaet al. found that there were more girls than males who had digital eye strain.[12] Other investigators reported obtaining similar result Digital eye strain is the reason for poor production in work related task. It includes manifestations such as headache, dry eyes, eye redness, cervical and shoulder pain. Digital Eye Strain is due to laptops, cellular phones, e-readers and people who even watch for more than 3 hours. Other causes are screen illumination, less distance from the screen. Digitals can increase their rate and precision on many work processes, which improves overall worker organization. Documents can be written and edited much more rapidly with the aid of a word clarifying plan of action and course of action such as invoice and accounting, can also occur more rapidly and with fewer errors. Digital Eye Strain decreases the speed and productivity of the process The various manifestation groups are the focus of treatment for digital eye strain, and it is advised to administer a single therapy for all manifestation tic groups. The main tendency of vision is through replacement, accommodation difficulties, base-in urban-up prisms, and residual astigmatism. Treatment options for dry eye manifestation include changing the lighting, positioning the screen correctly, adjusting the angle of gaze in regard to manifestations related to artificial tears and screens, increasing wink rates,and moistening the air in the space. It is advised to reduce blue light as much ''as'' as a precaution, it is advised to minimise the amount of blue light exposure that accesses the eye or is released from a computer monitor. Blue light has some impact on digital eye strain as well.[14] In fact, the typing speed of digital workers at baseline, when they were permitted three 30 second pause plus a three minute pause every hour, and a rest interval plus interruption. where during the interval, stretching movement were taught. For the circumstances with interval and movement, productivity increased by 5% and 15%, respectively. Common digital eye strain manifestation include eye strain, headaches, blurred vision, and neck or shoulder pain, which typically get worse the more video display terminals (VDT) users. The prevalence of digital eye strain among digital users ranges from 64% to 90%. Numerous studies have linked extended digital use, awkward workstation postures, and a variety of musculoskeletal pains. So, the research was to find the effectiveness of the 20-20-20 vision role in managing computer vision syndrome along with specific eye exercise.

## Aim

To find ''the effect of specific eye care exercise combined with 20-20-20 vision rule in managing Digital Eye Strain among digital users''.

## Methods

This was an experimental study done with 74 subjects with computer vision syndrome aged between 25-50 years of both genders from a private company from Chennai. Samples were conveniently selected and allocated into two groups.

**Study period:** December 2022 to june 2023

**Inclusion Criteria:**

- Age:25-50 years
- Both gender

- Using Digital or Laptop More Than 4 Hours\ day
- Presence of eye strain by using computer or laptop
- >6 score in computer vision syndrome-questionnaire
- History Of Using Glasses and contact lens

**Exclusion criteria:**

- History Of Eye disease
- Blind person
- Recent Eye Related Surgery
- Using Digital or Laptop lessthan1 hour\day

**Outcome Measure**

Asment was done at initial and at the end of the study using Computer vision syndrome-questionnaire:The quantity of manifestations was assessed using the 16 questionnaire items as follows: never, meaning there was no manifestation at all, go through an evaluation of ;some times meaning only occasion in all seven-day period, go through a sum total of 1; and frequently, meaning at least twice a seven-day period, received a score of 2. Two categories of intensity were used to evaluate it: moderate received a score of 1, and strong received a score of 2. The frequency score and intensity score were then multiplied for each manifestation,and the result was recorded in the following order:0= 0;1 or 2 =1;4 =2. A total was calculated by adding the recorded results for every of the 16 manifestations. A computer-positive expression has been defined as having a total score of less than 6.

**Procedure**

74 participants were selected from MC engineers company according to inclusion, exclusion criteria incidence rate of the condition Informed consent was obtained from each participant. Participants were explained regarding the wellbeing and simplicity of the procedure, all the participants were to be chosen according to convenient sampling technique. Pre assessment was taken using computer vision syndrome-questionnaire and data was recorded. Intervention groups were given specific eye exercises combined with the 20-20-20 vision rule. Conventional groups were given routine specific eye exercises as an intervention. Post assessment was taken using the same scale and data was recorded.

**20-20-20 Vision Rule Group**: 37 participant were selected according to selection principles,the participants were asked to see 20 feet far away for 20 seconds from their digital display every 20 minutes of their working time and asked to perform eye movement such as see medially, laterally, upward and downward direction every two hours of their working time for two weeks and every 20 minutes of work,exercises performed.It was practiced 6 days a week for two weeks.

**Conventional group:** 37 participants were selected according to selection principles, participants were asked to perform eye movements such as see ‘‘medially, laterally,upward and downward direction every two hours of their working time for 6 days for two weeks.”

**Data Analysis**

Statistical analysis was done to evaluate the effects of specific eye care exercise combined with the 20-20-20 vision rule in managing Digital Eye Strain. Among digital users. Pre and post result values for Computer vision syndrome-questionnaire were not paired, unpaired t test was conducted.

The pre-test mean value of Computer vision syndrome-questionnaire in 20-20-20 Vision Rule Group and conventional group 29.97 and 30.43 and with two-tailed p value of <0.0001.

The post -test mean value of Computer vision syndrome-questionnaire in 20-20-20 Vision Rule Group and conventional are 25.51and 29.35 and with two-tailed p value of<0.0001 Pre-test and post-test values of

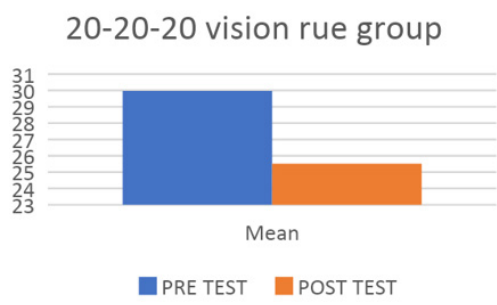



**Fig-1: Pre and post- test analysis of 20-20-20 vision rule group**

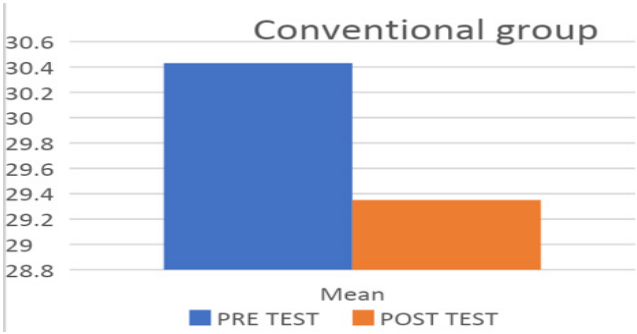



**Fig-2: Pre and post test analysis of conventional groups.**

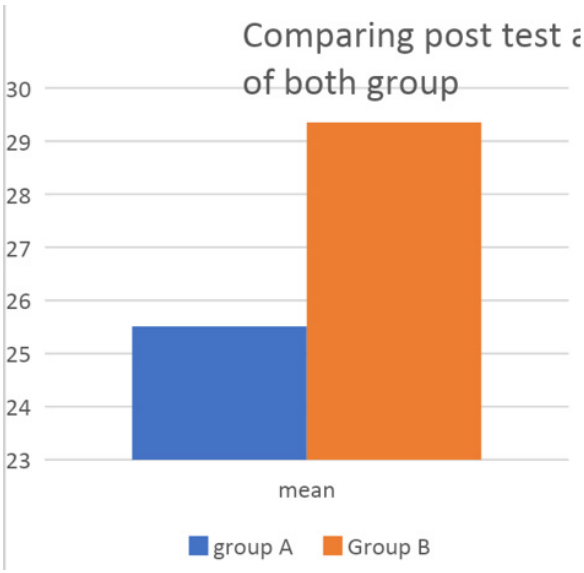



**Fig-3: Comparison of post-test analysis of both group**

## Result

The statistical analysis of quantitative data between the experimental and control groups, as well as within the groups, statistically significant variation. The statistical analysis of computer vision syndrome in the 20-20-20 vision rule group by using computer vision syndrome-questionnaire, pre-and post-test values of mean 29.97 and 25.51, SD value of 4.68 and 4.17 and P<0.0001 were statistically significant.

The statistical difference between the two groups' subjects was evaluated by post values of 20-20-20 vision rule and conventional group test of mean 25.51 and 29.35 and SD value of 4.17 and 3.90 and P value is <0.0001. These values were considered to be extremely statistically significant. These differences indicated that the subjects receiving 20-20-20 vision rule combined with specific eye exercise, was highly effective in reducing computer vision syndrome than the conventional group.

## Discussion

Corneal irritation (dry pupils, itchy eyes, and red eyes) is one of the eye issues brought on by prolonged digital use, and is known as Digital eye strain. vision that is hazy, headaches, backaches.The pain and soreness brought on by Digital Eye Strain Can affect daily living or performance at work,even though eye professionals have not yet connected it to any ongoing eye damage. However, by taking a few preventative measures, the symptoms and indicators of eye strain caused by digital devices can be swiftly eradicated.

Digital Eye Strain causes an inappropriate atmosphere and poor eyeglass or contact lens wear are two of the primary causes of digital eye strain. Changes must be done to enhance these circumstances in order to prevent digital eye strain.

The term "Digital eye strain" refers to eye issues brought on by extended digital use, such as: Red, itchy, and dry eyes are manifestations of ocular irritation, distorted vision, headaches, low back pain, neck pains ,muscle tiredness.

In my research,the role of specific eye care exercise combined with the 20-20-20 rule has an effect on managing computer vision syndrome among computer users. I concluded that those who received 20-20-20 vision rule combined with specific eye exercise, were more effective in reducing computer vision syndrome than conventional groups.

A statistically significant difference between groups-A and B as well as within each group was found by statistical analysis of quantitative data. Using computer vision syndrome -questionnaire, 20-20-20 Vision Rule Group post-test mean was 25.51 and whereas conventional group was 29. 35. This demonstrates that conventional groups received a higher score of manifestation positive than 20-20-20 Vision Rule Group and this suggests that 20-20-20 Vision Rule Group performed considerably better than Conventional Group. This strongly suggests that specific eye care exercise combined with 20-20-20 vision rule in managing Digital Eye Strain among digital user's effective than specific eye exercise.

The effects of regular exercise on visual physiology and illness discussed. Dynamic exercise temporarily lowers intraocular pressure. Exercise is good for the eyes for the vast majority of people because it lowers the risk of central veins in a blockage neovascular macular degeneration due to age and improves control of peripheral hypertension and diabetes. Ophthalmologists ought to promote regular physical activity while using the proper eye protection.

Digital Eye Strain diagnosis Penn suggests the following suggestions possible remedies for vision problems. The environmental causes for Digital vision Strain are easily reversible with a few straightforward modifications. Following Are Some Remedies for these environmental issues:

Lowering glare and harsh reflections on the digital screen by altering the lighting in the space, drawing the shades, adjusting the screen contrast brightness, or mounting a filter or monitor hood.Not Only would this improve eye concentration, but it might also make it unnecessary to squint while seeing the screen. If the room's present lighting is an issue, the visor test can assist identify it. When doing the test, participants cup their hands over their eyes to obscure the lights while seeing the monitor. Lighting should be used if instant benefit is perceived.

Parihar JK, et al., (2016) in his study concluded that the asthenopic component may be reduced with the use of suitable refractive aids, LED displays with a greater refresh rate and resolution,screen filters, improved ambient illumination,and altered ergonomic monitor placement. Modifications to digital peripherals, such as a low keyboard with forearm support and vertical mouse design, may also aid with repetitive musculoskeletal ailments.It is advantageous to utilise lubricating eye drops.

Polyunsaturated Supplements, steer clear CLs,and treatment prior ocular surface diseases in order to preserve an optimal ocular surface and prevent related manifestation. Periodic work breaks from prolonged VDT exposure are necessary to prevent cumulative labor-induced fatigue vision,corneal damage, and musculoskeletal injury/strain. It requires a complex, critical analysis because it is the outcome of several, overlapping, concurrent causes.[1]

Ranasinghe, et al,(2016) concluded that Digital Eye Strain was among digital workers in Sri Lanka. Female gender, longer employment history, greater daily digital use, previous eye disease, non-application a DD_filter, contact lens house,and greater understanding of ergonomics procedure were substantially linked with the frequency of eye problems. The length of employment including the presence of a pre-existing ocular condition were factors that were related to the severity of eye problem.[2]

## Conclusion

This finding led to the conclusion that specific eye care exercises combined with 20-20-20 vision rule in managing Digital Eye Strain among digital users was found to be more successful than specific eye exercise in reducing manifestation of Digital Eye Strain and therefore reducing sickness absenteeism and improving quality of life in participants.

**Ethical clearance**:Taken from institutional ethical committee.ISRB number 03/006/2022/ISRB/SR/SCPT

**Funding**:Self

**Conflict of interest**: No conflict of interest during this research.

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Original Article

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# Efficacy of Spinal Extension Exercise and Ergonomic Advice for Non-specific Low Back Pain Among University Population

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**Abstract**

**Background:** College students are required to sit for long periods of time in their classrooms. Prolonged sitting is defined as sitting for more than 2 hours continuously, students usually sit in classrooms on an average of 6 to 8 hours per day. Prolonged sitting has become a major risk factor causing low back pain especially among university students. The recurrence of LBP at old age also increases if the person is found to have LBP at an early stage.

**Purpose:** The objective of this research is to establish the gradual development from functional limitations in non-specific low back pain (NSLBP) among college students after spinal extension exercise and ergonomic advice.

**Materials and Methods:** Based on inclusion and exclusion criteria, the subjects were identified. They were provided with an explanation of the study. A group of 60 subjects were recruited for this research and divided into 3 groups, in which the first group was given spinal extension exercise (n=20), the second group (n=20) was given ergonomic advice and the third group (n=20) was given combination of both the interventions. The Roland-Morris Disability Questionnaire is a 24-item self-report tool for assessing function. The entire process was performed from November 2022 to April 2023.

**Result:** From statistical analysis, the group that received spinal extension exercise combined with ergonomic advice has better outcomes. (p=0.001)

**Conclusion:** The spinal extension exercise given along with ergonomic advice is effective in the treatment of NSLBP for university students.

**Keywords:** Non-specific low back pain, spinal extension exercise, ergonomic advice, university population, Roland-Morris Disability Questionnaire.

## Introduction

Most people deal with low back pain at a certain point in their lives, which is a very common problem. In many parts of the world, low back is a very common cause for activity resistance. When the patho- anatomical etiology of the pain cannot be

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identified, the phrase "non-specific low back pain" is used.[2] However, NSLBP is not adequately localized and is produced by soft tissue. Additionally, Non-specific low back pain refers to pain that is unrelated to neurological conditions or degenerative diseases.[2,3] From various studies we can see that approximately 60% and 80% of people have back discomfort. Only 5% among them may be identified as having nerve root pain; the remaining 80% have non-specific low-back pain.[4]

The college students attend lectures and spend time in front of computers to look up resources. A student spends an average of 6-8 hours of their day by sitting in class. Long periods of sitting are one of the causes contributing to musculoskeletal discomfort particularly in university students who experience low back pain. The most often affected anatomical sites for people who sit for longer duration are the shoulders and lower back region among the other musculoskeletal disorders. Because of poor posture and movement, these areas were strongly correlated with personal factors and work ergonomics.[5] Nonspecific low back pain leads to functional disability if not treated for a period of time. It is on the rise in the university population. The incidence of low back pain may be influenced by a few anatomical variables. Awkward posture for longer duration can decrease the strength of Paraspinal muscles.[6,7] According to a thorough literature review; poor dynamic trunk extension ability is connected to persistent back-related occupational impairment and recurrent low back discomfort.[8]

Physiotherapeutic interventions play a major role in managing and in prevention of low back pain.The main aim in the course of treatment of non-specific low back pain includes pain relief, increase in function, patient education, increase in range of movement, and prevention of further episodes. LBP is generally treated with application of modalities. A great number of therapists agreed that physical activity and back education programs are effective.[9] In workplaces, when considerable forward reaching is required, workers with low back pain find it difficult to bend forward and handle goods. If heavy bending and reaching in the front are avoided, handling objects can frequently be done with minimum stress.[10] By providing a proper fit between the workers and their occupations, ergonomics attempts to improve individual comfort, health and safety, productivity, and efficiency.[11] The McKenzie Method is used to treat patients with low back pain. You can take effective steps to lessen your back pain, such as back exercises and stretching for lower back pain. A thorough literature evaluation revealed a connection between poor dynamic trunk extension ability and low back-related persistent occupational incapacity and recurrence of low back pain.[12] However, there is little proof to back up the effect of workouts specifically designed for extensions on non-specific low back discomfort in university students.

## Aim

To determine whether spinal extension exercise and ergonomic advice is effective for reducing disability and improving function in subjects with Non-specific low back pain in the University population.

## Materials and Methods

It was an experimental study conducted on 60 subjects with Non-specific low back pain taken from a university. Convenient sampling with a random allocation method was used in the study. The entire process was performed from November 2022 to April 2023.

**Inclusion criteria:**

- Age: 18 – 25
- Male and female subjects.
- Prolonged sitting (>3 hours)
- Suffering from Non-specific low back pain.[13]

**Exclusion criteria:**

- Pregnant women.
- Patients with referred pain to lower limbs.
- Patients with known pathology (osteoporosis, disk herniation, spinal stenosis, etc.)
- Medical Illness (kidney disease, tumor)
- Patients with chronic disease affecting the musculoskeletal system.
- Patients with fractures in the spine and pelvis.[2]

**Outcome Measure:**

The Roland-Morris Disability Questionnaire (RMDQ), a 24-item self-report survey, is used to measure how well people with non-specific low back pain can function. The scores vary between 0 (no impairment) to 24 (severe impairment), with each question contributing one point. Both the pre- and post-test results were gathered.

**Procedure**

The present study invited the students of a university with Non-specific low back pain. A Google link was circulated to 320 students through Whatsapp from which 267 students gave permission for them to take part in the study. Only 63 participants met the inclusion criteria. SLR test was performed for both the lower limbs to rule out any nerve related pathologies from which 3 were excluded. Informed consent was obtained from all the participants before assessment and interventions. The included participants were randomly allocated to 3 groups; Group A (n=20) received spinal extension exercise, the subjects in Group B (n=20) received only ergonomic advice while the subjects in Group C (n=20) received spinal extension exercise and ergonomic advice. Roland-Morris Disability Questionnaire (RMDQ) was used to assess the disability of participants in the study. The pre-assessment was conducted before starting the interventions. The post assessment was conducted following two weeks of interventions for all the three groups.

**Spinal extension exercise:**

The participants were instructed to perform spinal extension exercises 3-4 times a week for two consecutive weeks. They were instructed to take a prone lying position initially, followed by prone on elbows, then prone press-ups and standing extension exercise. All the extension exercises were repeated for 10 repetitions in two sets.

- **Prone lying:** the subjects laid their face down for one to two minutes.
- **Prone lying on elbows:** subjects laid their face down with extension of trunk on elbow and held for 5 seconds.
- **Prone press-ups:** subjects laid their face down and extension of the trunk by elbow to extension of trunk with the hand (push up position)
- **Standing extension exercise:** The subjects come to standing position, they were instructed to extend their trunks and hold the position for five seconds with their hands behind their backs.

**Ergonomic advice:**

The participants were instructed to follow the below advice:

**While sitting in class:**

- Correct seat height adjustments that allow the thighs parallel to the floor.
- Avoid stooping while you sit.
- Positioning the monitor/book directly in front of the person.

**While driving/traveling:**

- Prevent increased curvature of the back.
- Place the pillow behind the back.
- Use the mirrors to avoid frequent turning.
- Take necessary breaks during a long drive.

**While lifting heavy objects:**

- Heavy objects must be carried in a squat position by bending the knees and not by stooping.
- If the object is big, call another person for help.

## Data Analysis

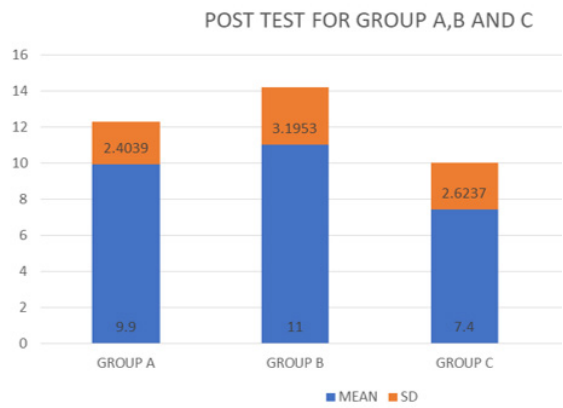



**Fig-1: All groups Mean and SD**

**Table-1: Result reports the One-way ANOVA between groups.**

| | | Pre test | | Post test | | | |
|---|---|---|---|---|---|---|---|
| Groups | Non-specific LBP | Mean | Std. Deviation | Mean | Std. Deviation | F | *p*-value |
| Group A | 20 | 13.5500 | 2.35025 | 9.9000 | 2.40394 | 8.927 | 0.001 |
| Group B | 20 | 12.7000 | 3.04527 | 11.0000 | 3.19539 | | |
| Group C | 20 | 12.9500 | 3.01706 | 7.4000 | 2.62378 | | |
| Total | 60 | 13.0667 | 2.79750 | 9.4333 | 3.11022 | | |

## Result

Three treatment groups, each with 20 participants, were formed from the total of 60 subjects. The subjects were between the age group 18-25 years old, out of which (58.3%) male students and (41.7%) female students.

The pre-test results and post-test results were obtained using Roland Morris Disability Questionnaire and checked for significance (Table 1). All the three groups showed positive effects post treatment with reduced mean and standard deviation. All the three groups were compared together using their mean and standard deviation (Fig 1)

A one-way ANOVA report (Table 1) showed statistically significant differences between the groups following the intervention with significance (*p* - value 0.001). The post intervention outcome of Roland-Morris disability questionnaire of all the three groups with their mean and standard deviation are shown in Fig 1. Following significant differences between the groups the post-hoc analysis was performed. The post-hoc value shows that Group C is better with mean difference (2.50) with significance (*p*-value 0.018) when compared with Group A. The post-hoc of Group C is also better with mean difference (3.60) with significance (*p* – value 0.001) when compared with Group B. This result shows that there is more improvement in the participants in Group C post intervention compared to Group A and Group B, henceforth depicting that spinal extension exercise combined with ergonomic advice is much more effective than the exercises given alone.

## Discussion

The main aim of this study is to find the efficacy of spinal extension exercise and ergonomic advice in treating non-specific low back pain for the students of university population. The results of this study show that the functional impairment measured by the RMDQ has significantly reduced. A group that received spinal extension exercise combined with ergonomic advice demonstrated improved effectiveness in treating NSLBP in college students when comparing students that received spinal extension exercise only in one group and ergonomic advice in another group.

Kanchan Kumar Starker, et.al, (2019) performed a study in which he treated NSLBP patients. In that study three groups were taken in which each group received different interventions along with ergonomic advice. That study concluded that the second group in which the subjects underwent spinal manipulation exercise and ergonomic advice gave better outcomes compared to the other two groups.[14] This can be due to the effectiveness of spinal manipulation exercise. Hence, ergonomic advice given along with other forms of exercise can be fruitful in treating patients with non-specific LBP. A research that was conducted by Shinde SB in the year 2022 invited IT professionals with LBP. The study included participants who sit for work duration of more than 5 hours. It can be seen from that study that people who sit for prolonged time in awkward posture are drastically affected in the low back region.[12]

In a similar study conducted in Saudi Arabia, students who spend more than three hours a day sitting have a 61.5% prevalence of low back pain, compared to 38.5% for students who spend less time sitting.[15] The common risk factor associated with our study has been found to be prolonged sitting for longer hours. This increase in prevalence of low back pain with respect to sitting for longer duration can be due to the stress and tension that falls on back muscles as the muscles in the back are responsible in keeping the body erect. Given that most academic activities are done while seated, sitting time is another crucial consideration. This aggravates pain around low back.[16]

The current study doesn't categorize the students based on their department that the individual is studying. FerruhTaspinar, et.al, performed a study in which university students from different departments were investigated for low back pain. The prevalence of low back pain was slightly higher in sports students than in medical students.[17,18] This can be due to different activities that the students are required to perform during their course.

From the current study spinal extension exercise given to Group A was more effective than ergonomic advice given to Group B. A study conducted by Bajaj M N, et.al, in 2022 compared spinal extension exercise and conventional physiotherapy management in treating mechanical LBP, the result showed that the RMDQ scores were better in the group that received spinal extension exercise. This was due to the increase in strength of the back extensor. Prolonged sitting can decrease core stability and decrease the integrity of back extensors. By this we can come into an understanding that increasing the strength of back extensors can improve the functional involvement in participants with NSLBP.[12]

We have used the McKenzie extension type of exercise alone in managing the Non-specific low back pain. A similar study compared extension type of exercises and flexion type for low back pain in which extension exercises showed better improvement in decreasing pain and improving functional status of the participants.[19]

## Conclusion

Findings of this study conclude that Spinal extension exercise and ergonomic advice given to each group has a positive effect on participants with Non-specific low back pain among the population. However, spinal extension exercise combined with ergonomic advice appears to be more beneficial than both the exercises given separately.

**Ethical clearance:** Taken from institutional ethical committee. ISRB number-03/ 009/ 2022/ ISRB/ SR/SCPT.

**Funding:** Self

**Conflict of interest:** Nil

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Original Article

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# Effectiveness of Constraint Induced Movement Therapy and Proprioceptive Neuromuscular Facilitation on Upper Extremity Functions in Stroke

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**Abstract**

**Background:** Stroke is the quickly developing clinical indication of a focal disruption of brain function that lasts more than 24 hours or results in death, with no discernible cause other than vascular origin. Despite the fact that the majority of patients are able to walk again, 30% to 60% of survivors are no longer able to use the arm that was injured. CIMT aims at improves both the motor and functional capacities of a paretic arm. PNF exercises alter the order in which muscles are stimulated, increases the efficiency of joint movement.

**Purpose:** To compare the effectiveness of Constraint Induced Movement Therapy and Proprioceptive Neuromuscular Facilitation for treating upper extremity functions in stroke.

**Materials and Methods:** A total of 30 participants were selected from Sree Annai Physiotherapy Clinic Chennai. According to the inclusion and exclusion criteria. Subjects willing to participate were allocated into two groups Constraint Induced Movement Therapy group and Proprioceptive Neuromuscular Facilitation group. The participants underwent Pre-test measurement with Fugl-Meyer Assessment Upper Extremity FMA-UE and were repeated for Post-test measurement. Study period : November 2022 to April 2023.

**Results:** When comparing the mean differences of the two groups, Constraint Induced Movement Therapy group displays a greater difference than Proprioceptive Neuromuscular Facilitation group. Therefore, it can be said that Constraint Induced Movement Therapy is more advantageous for the upper extremity functions than Proprioceptive Neuromuscular Facilitation.

**Conclusion:** The study concluded that Constraint Induced Movement Therapy is found to be more effective than Proprioceptive neuromuscular facilitation technique for upper extremity function recovery.

**Key Word:** Stroke, Proprioceptive Neuromuscular Facilitation, Constraint Induced Movement Therapy.

## Introduction

Stroke is defined as the rapidly evolving clinical symptoms of a focused (or global) interruption of brain function that lasts for more than 24 hours or results in death and has no other apparent cause than vascular origin.[1] Stroke, a leading cause of disability and death worldwide, conventionally defined as a neurological deficit results from an acute, focused injury to the central nervous system brought on by a vascular cause. Despite its widespread effects, there is no agreed upon definition of "stroke" in clinical

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practice, clinical research, or public health evaluations. Understanding of CNS ischemia, infarction, and bleeding has been increased by developments in basic research, neuropathology and neuroimaging.[2] In India, stroke is the main factor contributing to mortality and disability. The equivalent to 80% of patients with stroke survive the acute stage. Although most patients are able to walk once more, 30% to 60% of survivors are no longer able to utilize the arm that was hurt. Upper extremity function recovery is typically more difficult than lower extremity function recovery. The "learned nonuse" concept postulates that failing to successfully use the wounded arm frequently during the acute and subacute phases can have a negative reinforcement on that arm's utilize. The degree to which motor, sensory, and cognitive functions were initially impaired determines how quickly a stroke victim recovers. Consequently, stroke recovery is essential for developing functions and activities carried out by the survivors. It is concentrated on exploiting the idea of neuroplasticity and motor learning.[3]

Constraint Induced Movement Therapy asserts in improving both the motor and functional capacities of a paretic arm by restricting the side that is unaffected. Use of the afflicted side is mandated by CIMT. Constraint Induced Movement Therapy, or CI Therapy, is a behavioral strategy for neurorehabilitation that is based on the principles of basic neuroscience.[4] Numerous neuroimaging and TMS demonstrated the application of CI therapy results in large configuration that expands the area of the brain engaged in the innervation of movement of the more severely damaged upper extremity.[5]

Proprioceptive Neuromuscular Facilitation (PNF) is widely utilized as a treatment for physical dysfunction brought on by injury or illness. Studies on stroke survivors have revealed that PNF works by reducing deficits and enhances trunk and limb functions.[6] Proprioceptive Neurophysiology serves as the foundation for neuromuscular facilitation. Through the application of neurophysiological techniques, it improves the appropriate neuromuscular stimulation and controls the activation of sensory-motor conductions and proprioceptive stimuli. Exercise and therapy are crucial to stroke recovery. Although there are several exercises for managing stroke, PNF is also one of the widely utilized methods.[7]

## Aim

The aim of the study is to compare the effectiveness of Constraint induced movement therapy and Proprioceptive neuromuscular facilitation on upper extremity functions in stroke.

## Material and Method

A total of 30 participants, aged between 50-70 years were selected according to the inclusion and exclusion criteria and the informed consent form was collected from them before starting the study. All the participants were informed about the purpose and procedure of the study. Subjects willing to participate were allocated into two groups Constraint Induced Movement Therapy group (n=15) and Proprioceptive Neuromuscular Facilitation group (n=15). The participants underwent Pre-test measurement with Fugl-Meyer Assessment Upper Extremity FMA-UE and were repeated for Post-test measurement. The therapy was administered for a period of six weeks.

### Inclusion criteria

- Subjects with age of 50-70 years
- Both males and females are included
- Chronic stroke subjects with mild Spasticity (score of 2 or less on Modified Ashworth Scale)
- No cognitive impairment (score of 20 or more in Mini-Mental State Examination)
- Adequate balance
- Available ROM of about 20 degree or more of fingers and wrist extension.

### Exclusion criteria

- Subjects with recent occurrence of stroke
- Cognitive impairment
- Visual impairment
- Subjects with cardiac anomalies.

### Outcome measure

- Fugl-Meyer Assessment Upper Extremity (FMA-UE).

## Procedure

A total of 30 participants were selected according to the inclusion and exclusion criteria and the informed consent form was collected from them before starting the study. All the participants were informed about the purpose and procedure of the study, as well as the right to refuse to take part or quit from the study at any moment. Subjects willing to participate were allocated into two groups Constraint Induced Movement Therapy group and Proprioceptive Neuromuscular Facilitation group. The participants underwent Pre-test measurement with Fugl-Meyer Assessment Upper Extremity FMA-UE and were repeated for Post-test measurement.

**Constraint Induced Movement Therapy Group:**

The therapy was administered to the subjects while restricting the unaffected upper limb with a mitt. Two times per week for a period of six weeks, the intervention was conducted. Constraint-induced movement treatment was applied while the subject was seated, with one hand on the table doing specified activities. The therapy involved repeatedly teaching the subject with different objects such spoons, papers, balls, and straws. The activities were divided into smaller parts, beginning with grabbing the object and moving forward until the task was finished. The exercises were carried out seated at home, just as they had been in the past in the hospital.

**Proprioceptive Neuromuscular Facilitation Group:**

The exercises were administered to the subjects using a Proprioceptive neuromuscular facilitation technique. It was given to the upper limb twice daily, five days a week for a period of six weeks, for 30 minutes, starting at the proximal joints and working out to the distal. The following movement pattern were performed:

**D1 Flexion Pattern of Proprioceptive Neuromuscular Facilitation**

Shoulder flexion, Adduction and external rotation, Elbow flexed, Forearm supinated, Wrist flexed and radial deviated with fingers flexed. Participant positioned in supine lying and physiotherapist in walk stand position on the affected side and places one hand over the arm and the other over the hand. As the participant starts moving the extremity, the physiotherapist applies resistance.

**D1 Extension Pattern of Proprioceptive Neuromuscular Facilitation**

Shoulder extension, Abduction and internal rotation, Elbow extended forearm pronated, Wrist extended and ulnar deviated with fingers extension and abduction. Participant positioned in supine lying and physiotherapist in walk stand position on the affected side and places both the hands at the agonist muscles at the elbow and dorsal aspect of wrist. Participant was instructed to move the limb to the opposite hip joint diagonally. The resistance was applied by the physiotherapist.

**D2 Flexion Pattern of Proprioceptive Neuromuscular Facilitation**

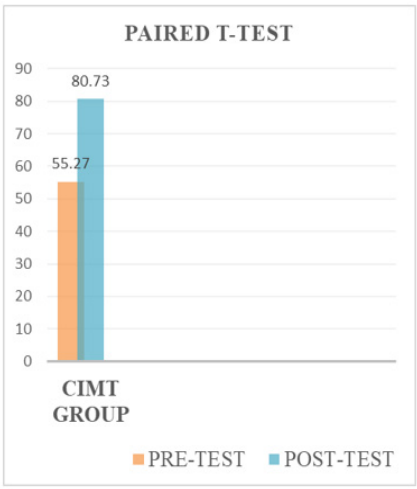
Shoulder flexion, Abduction and external rotation, Elbow extended, Forearm supinated wrist flexed and ulnar deviated with fingers in extended and abducted. Participant positioned in supine lying and physiotherapist in walk stand position on the affected side and places one hand over the dorsum of wrist and finger and other hand over the elbow joint. The resistance was applied by the physiotherapist.

**D2 Extension Pattern of Proprioceptive Neuromuscular Facilitation**

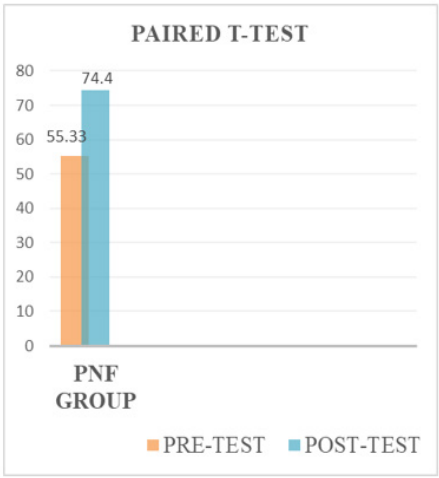
Shoulder extension, adduction and internal rotation, elbow flexed, forearm pronated, wrist flexed and ulnar deviated, fingers flexed and adducted. Participant positioned in supine lying and physiotherapist in walk stand position on the affected side and places one hand over the elbow joint and other over the palmar surface of the hand. The resistance was applied by the physiotherapist.

**Data Analysis**

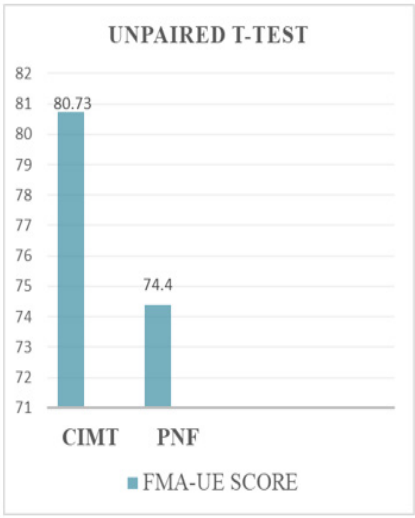
A total of 30 subjects with chronic stroke upper extremity hemiparesis between the age group of 50-70 years were selected for the study. They were split into two groups using a random allocation method: The PNF group and the CIMT group. Evaluation by FMA-UE done in participants before and after therapy to obtain pre-test and post-test values, respectively. For both groups, the pre-test and post-test values of the FMA-UE were compared.




**Graph-1: Analysis of Pre-test and Post-test values of CIMT group.**




**Graph-2: Analysis of Pre-test and Post-test values of PNF group.**




**Graph-3: Comparison of Post-test values of CIMT group and PNF group.**

## Result

The collected data was statistically analyzed using a paired and unpaired t-test, showing significant improvement in both Constraint induced movement group and Proprioceptive neuromuscular facilitation group. While comparing FMA-UE the Post-test mean value in the Constraint induced movement therapy group was 80.73 whereas in the Proprioceptive neuromuscular facilitation group it was 74.40.

When comparing the mean differences of the two groups, Constraint Induced Movement Therapy group displays a greater difference than Proprioceptive Neuromuscular Facilitation group. Therefore, it can be said that Constraint Induced Movement Therapy is more advantageous for the upper extremity functions than Proprioceptive Neuromuscular Facilitation.

## Discussion

The current study compares the effects of proprioceptive neuromuscular facilitation and constraint-induced movement therapy on upper extremity functions in stroke subjects. The outcome results were measured by Fugl-Meyer assessment of upper extremity before and after the treatment. Using paired and unpaired t-tests, the pre-test and post-test data of parameter FMA-UE were statistically evaluated. Beneficial effects were significantly greater in constraint induced movement therapy group. The study found that proprioceptive neuromuscular facilitation approaches and constraint-induced movement therapy were both helpful for treating upper extremity functions in chronic stroke participants. The results imply that combined induced movement treatment is more advantageous for the upper extremity functions than proprioceptive neuromuscular facilitation.

In CIMT group pre-intervention mean of FMA-UE was 55.27(+3.37). After treating the subject with Constraint Induced Movement Therapy the mean value of FMA-UE is increased to 80.73(+4.92), which shows statistically significant difference between the groups.

In PNF group pre-intervention mean of FMA-UE was 55.33(+3.50). After treating the subject with Proprioceptive Neuromuscular Facilitation the mean

value of FMA-UE is increased to 74.40(+3.02), which shows statistically significant difference between the group.

Based on the statistical analysis, both groups showed improvement in FMA-UE. However, subjects in the CIMT group who received Constraint Induced Movement Therapy showed significant improvement in FMA-UE than the subjects in the PNF group who received Proprioceptive Neuromuscular Facilitation.

Muhammad Abba et.al Although CIMT is more advantageous, PNF therapies are also helpful in enhancing upper limb function. For the treatment of persistent upper limb post-stroke deficits, CIMT might be the best option.[3]

Suputtitada A et.al Patients with chronic stroke may benefit from CIMT of intact upper extremities because it may be a successful method for enhancing motor activity and demonstrating learned nonuse.[8]

Corbetta D et.al concluded that CIMT is a multifaceted strategy in which increased activity is combined with restriction of the least affected limb according to the individual's capacity. CIMT might be superior to conventional rehabilitation. There is little available data on CIMT long term consequences. There has to be more research into the connection between participant qualities and better results.[9]

Koyama T et.al stated that a statistical study reveals CI therapy is most effective for treating hand function, pointing to a useful application of this therapy.[10]

Limitation of this study was limited with the specific age group and the study was done with a smaller number of subjects. Further study on CIMT needed to investigate long term effects and longitudinal study are recommended.

**Ethical Clearance:** Taken from the institutional ethical committee. ISRB number - 03/ 018/ 2022/ ISRB/ SR/ SCPT

**Funding:** Self

**Conflict of Interest:** Nil

## Conclusion

This study found that Proprioceptive neuromuscular facilitation approaches and Constraint induced movement therapy were both helpful in treating upper extremity functions in chronic stroke. The results imply that Constraint induced movement treatment is more advantageous for the upper extremity functions than Proprioceptive neuromuscular facilitation.

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Original Article

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# Effectiveness of Active Release Technique and Myofascial Release Technique on Pain and Functional Performance in Lateral Epicondylitis

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**Abstract**

**Background:** Pain with resisted wrist, middle finger, or both dorsiflexion, along with discomfort and tenderness across the lateral epicondyle the humerus, are all symptoms of tennis elbow. It affects 1-3% of adults annually, mainly in the dominant hand.This study was designed to inspect the effectiveness of active release technique and myofascial release technique in lateral epicondylitis.

**Purpose:** To find the effectiveness of active release technique and myofascial release technique in lateral epicondylitis.

**Materials and Methods:** Total of 40 participants were selected from karthik hospital for 4 weeks according to inclusion and exclusion criteria and the participants were explained about treatment safely and about the procedure and written consent was obtained. All the subjects underwent pretest measurement with NPRS and PRTEE at the beginning of treatment

**Results:** Statistical analysis of data showed significant differences not only in myofascial group but also in the active release group. The myofascial release group were significantly higher than the active release group, with a p value of <0.0001

**Conclusion:** Myofascial release Technique is more effective than Active release technique in the lateral epicondylitis

**Key Word:** Tennis elbow, lateral epicondylitis, numerical pain rating scale, patient rated tennis elbow evaluation, myofascial release technique, active release technique, ultrasound therapy

## Introduction

Tennis elbow is described by pain, discomfort and tenderness across the lateral epicondyle of the humerus and by pain with resisted dorsiflexion of wrist, middle finger or both. These are various words that can be used to describe tennis elbow[1]. It affects 1-3% of adults annually, mainly in the dominant hand. It can occur as an acute injury or overuse injury involving repetitive wrist extension against resistance[3]. The extensor carpi radialis brevis, one of the extensor tendons that originate in the lateral epicondyle, has frequently been identified as the essential component in tennis elbow Its unusual anatomy exposes it to shearing force in almost all movements of the arm according to biomechanical research, tennis elbow is essentially a mechanically

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induced condition varied population groups have been shown to have varied incidences of lateral epicondylitis[4].

The etiology of the tennis elbow is multifactorial anatomical reasons like inadequate blood circulation, aging and flexibility issues may contribute to wrist extensor overuse tennis players can profit from additional device personalized to their sport technical mistakes that are considered to be a risk factor for the etiology of tennis elbow include 1. An improper backhand with the elbow leading 2. Too much forearm pronation when performing a forehand topspin 3. Excessive wrist flexion during a service, regardless of the racquet's size, grip, or string tension. The weight is a possible risk factor; these elements influence how the elbow is loaded biomechanically during a tennis overuse, with an emphasis on the elbow, which is the underlying cause of all tendinosis, including that of the patellar and rotator cuff tendons. The following characteristics are most likely to lead to elbow tendon overuse: 1. More than 35 years 2. High degree of activity (in work or sports) 3. Engaging in challenging activities at least three times each week for at least 30 minutes at a time[4]. The list of frequent conditions that might cause elbow pain that may resemble elbow tendinosis is provided below in a succinct manner; it is by no means exhaustive[4]. The differential diagnosis for lateral tennis elbow most frequently stated is posterior interosseous nerve entrapment [example; motor portion of radial nerve in the forearm] clinical symptoms of radial nerve neuropraxia include discomfort during provocative supinator stress tests, as well as widespread pain and tenderness along the radial nerve course in the proximal forearm extensor mass[5].The parasympathetic response of the autonomic nerve system, interpersonal attention, and the Gate Control Theory, and serotonin release are some of the hypotheses mentioned above, and serotonin release are some of the hypotheses mentioned above. According to the Gate Control theory, pain stimuli move via slower nervous system channels than sensory stimuli like pressure. The quicker moving pressure stimuli block the brain's ability to receive painful stimuli, effectively "closing the gate" on the brain's ability to perceive pain. The term "interpersonal attention" describes the hands-on, specialized attention that a massage client receives. This individualized care and human contact frequently have a relaxing impact that lessens the sense of pain[6].

Myofascial release is a commonly used direct manual medicine procedure that manipulates and reduces myofascial limitations associated with a variety of somatic dysfunctions. When combined with other conventional treatments, myofascial release works well to minimize tissue discomfort and provide instant pain relief[9]. Musculoskeletal discomfort can be reduced with the aid of myofascial release treatments. There are explanations for why myofascial release can reduce musculoskeletal discomfort[5].

Active release technique was utilized to treat the muscles that showed scar tissue, including the muscles involved in hand movement[2]. Soft tissue mobilization was used to lengthen the tissue that had been shortened following shortening based on fiber texture in the longitudinal direction. Active release technique is a technique used to treat soft tissues like tendons, nerves, and myofascial. It is used to treat acute injuries, functional fixation damage from prolonged aberrant posture, and repetitive strain injuries[7].

## Aim

The aim of the study is to find the effectiveness of active release technique and myofascial release technique on pain and functional performance in lateral epicondylitis.

## Material and Method

A total of 40 participants were chosen based on inclusion and exclusion criteria. Participants were informed about the treatment's safety and simplicity before providing written consent. Randomly, subjects who agreed to take part were divided into two groups. Myofascial release and the active release technique were used on the ultrasound group. Prior to starting therapy, NPRS and PRTEE pretest measurements were performed on all participants. At the Karthik Hospital, the study technique was conducted. An experimental investigation on tennis elbow included 40 participants in total. Subjects were informed of the purpose of the study and given assurances. The Karthik hospital patients who were referred with lateral elbow Pain were screened.

## Inclusion criteria:

- Both male and females
- Patient who experienced pain while gripping
- Patients who experienced pain with resisted wrist extension
- Patients who experienced tenderness on palpation over the lateral epicondyle of the humerous

**Exclusion criteria:**

They were excluded if any history of trauma, surgery, acute infections, any systemic disorders, cervical spine and upper limb dysfunction, neurological impairments, cardiovascular diseases, osteoporosis, recent steroid infiltration, ossification and calcification of soft tissue, malignancies, recently underwent physiotherapy interventions in least 3 months.

**Outcome measures:**

Assessments were done at the beginning of the trial (at baseline) and two weeks later

- Numeric Pain Rating Scale [NPRS]
- Patient rated tennis elbow evaluation [PRTEE]

**Procedure**

Using inclusion and exclusion criteria, a total of 40 individuals were chosen. After explaining treatment safety and procedure simplicity to the participants, a signed agreement was obtained. Active release with ultrasound and myofascial release with ultrasound were the two groups to which subjects who were willing to participate were randomly assigned. Prior to starting treatment, all individuals had pretest measurement using a patient-rated numerical pain scale and tennis elbow evaluation.

## Group A: Active release technique group:

This Group receives active release techniques. The extensor carpi radialis longus and brevis muscles were worked on by the therapist by applying pressure to the muscles distal to their attachment at the elbow while the patient was seated, elbow flexed and resting on the treatment table, forearm in mid-prone, and wrist in neutral position. The patient began with a bent elbow and a straight wrist. The patient extended the elbow and pronated and flexed the wrist as the therapist held the muscles. The therapist then adjusted the pressure proximally in an effort to loosen adhesions within and between muscle planes. The treatment is carried out 6 times per week for 2 weeks, a total of 15 times for 10 min.

**GROUP B: Myofascial release technique group:**

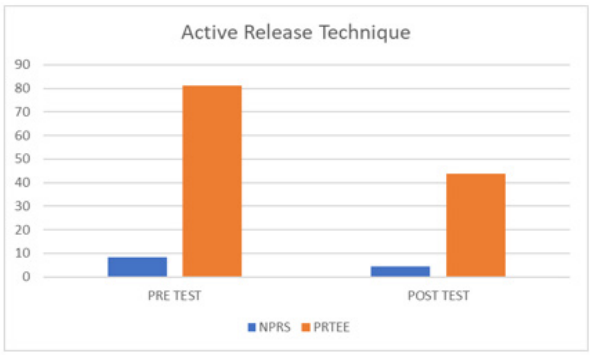
This group receives myofascial release technique. Myofascial release technique was performed with the patient sitting, facing the ipsilateral hand, elbow pronated and flexed to about 15 degrees, and palm flat on the table. The therapist positioned to the side of the table at the level of the patient's shoulder. The therapist started on the humerus immediately proximal to the lateral epicondyle and treated from the common extensor tendon to the extensor retinaculum of the wrist. The therapist applied pressure on the periosteum by using fingertips and carried this contact down to the wrist's extensor retinaculum after passing inferiorly through the common extensor tendon. During this process, patients were instructed to gradually flex and extend their elbows in the easy range of 5° to 10. (2 reps, 5 minutes

**Ultrasound:**

Pulsed ultrasound therapy with a 1:4 pulse ratio of 1MHz at 1.5 W/cm for 5 minutes was used at the ten periosteal junction of the extensor carpi radialis brevis. Using an ultrasound device, in a seated position. Ultrasound gel was used to actively engage the instrument head with the skin. To maximize energy absorption by the tissue, the applicator head was positioned at a right angle to the LE of the humerus. The length of each therapy session was 10 minutes maximum. The patients received no medication during the course of the treatment. Therapeutic ultrasound has no known harmful effects. The therapy will help alleviate body pain in the affected areas. The treatment will assist in reducing body pain in the affected regions. Because ultrasound physical therapy is non-invasive, it is less dangerous than other techniques.

**Data analysis**

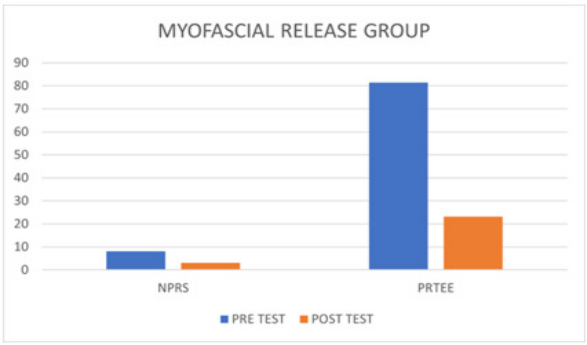
**Active release technique group**




**Graph No: 1**

Interpretation:: Graph no.1 shows that the values are extremely statistically significant.

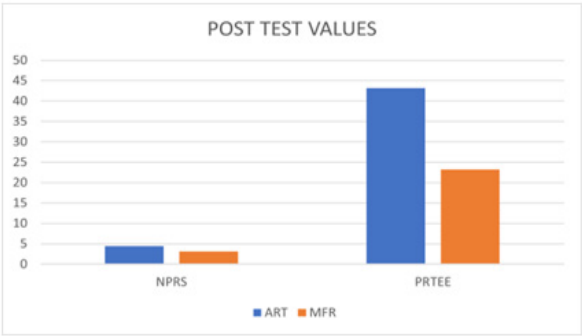
**Myofascial release technique**




**Graph No: 2**

Interpretation: Graph no.2 shows that the values are extremely statistically significant

**Post test values of both group**




**Graph No: 3**

Interpretation: Graph no.3 shows that the values are extremely statistically significant.

## Result

Informed consent was obtained from each participant before the subjects were chosen based on inclusion and exclusion criteria. Two groupings of subjects were created. Twenty subjects received myofascial release with ultrasound in the myofascial release group, while twenty received active release with ultrasound in the active release group.The mean value of the NPRS post test in the myofascial group was 3.15, while it was 4.40, in the active release group. This indicates the myofascial release group were significantly higher than the active release group, with a p value of <0.0001.The myofascial group PRTEE post test mean value was 23.25, whereas the active release group was 43.20. This indicates that the myofascial group PRTEE score were significantly higher than the active release group with a p value of <0.0001.

## Discussion

The goal of this study was to determine the efficacy of Active Release Technique and Myofascial Release Technique in treating lateral epicondylitis.

The myofascial release group consisted of 20 subjects who received myofascial release technique with ultrasound and active release consisted of 20 subjects who received active release technique with ultrasound.

The outcome measures were Numerical pain rating scale and Patient rated tennis elbow evaluation.

Beneficial effects were significantly greater in myofascial release technique than the active release technique. When responses were compared between both groups, the result showed a significant difference in myofascial release technique than the active release technique. statistical analysis of active release technique by using numerical pain rating scale has a p value of 0.0001 were considered statistically significant. The statistical analysis of the myofascial release technique by using the modified numerical pain rating scale the P value of less than 0.0001 was considered statistically significant. the differences between the two techniques by using the numerical pain rating scale the P value is less than 0.0001.

The statistical analysis of the active release technique by using the patient rated tennis elbow evaluation.

Dr shinde et al., 2019 According to the study's findings, myofascial release treatment and mulligan mobilization with movement are both equally efficient at decreasing pain and enhancing grip strength in lateral epicondylitis patients[6].

Dr. Basu et al., 2017 This study came to the conclusion that individuals with lateral elbow discomfort respond well to conservative treatment and active release technique. When used to treat lateral elbow pain, active release technique performed better than the control group[7].

K. Kotteeswaran et al., 2019 Through the course of research, MFR therapy and active stretching were shown to be effective in reducing pain and improving function when compared to active stretching alone. Despite both groups demonstrating similar improvements, the MFR group also demonstrated an added benefit in the treatment of lateral epicondylitis[8].

Ajimsha et al., 2012 Comparing the MFR approach to the control group, it was discovered that there had been a significant improvement in pain (NPRS), functional performance (PRTEE). The greater effect of the MFR group in comparison to the control group is consistent with earlier authors' findings. This may be related to the fact that collagen reorganization causes the fascial tissue to revert to its normal length secondary to the pain alleviation brought on by MFR. The stimulation of afferent pathways and the excitation of afferent A fibers, which can result in segmental pain modulation and modulation through the activation of descending pain inhibiting systems, are also likely to contribute to the analgesics effect of MFR, as is the case with all massage therapy techniques [9].

Nadia Richer et al., 2017 The study showed that a clinical trial examining the effectiveness of combining manual therapy with cryostimulation in individuals with chronic lateral epicondylitis may be successfully completed. According to these preliminary findings, neither the short-term nor the long- term additional benefits of cryostimulation and manual therapy care were realized. Positive results were obtained in the treatment of chronic lateral epicondylitis using manual myofascial point therapy and mobilization approaches. The single therapeutic benefit of cryostimulation in patients with both acute and chronic illnesses should be the focus of future research[10].

Md. Shahadat Hossain et al.,2019 The purpose of the study is to investigate the efficacy of myofascial release in conjunction with traditional physiotherapy in reducing the symptoms of tennis elbow patients. This will aid in their rehabilitation and improve their functional activities[11].

Binder et al., 1985 Tennis elbow has historically been treated with ultrasound therapy. According to research by Binder ultrasound therapy improved recovery in 63% of instances versus 29% of patients who got a placebo[12].

Rashid et al., 2022 For the purpose of reducing pain and increasing range of motion, many exercise forms are addressed. From the most recent studies, the exercises are methodically explained. Mill's Manipulation, a deep transverse friction massage, has finally been discussed in this article[13].

Chait ots m et al., 2003; Hou et al., 2002; Khuman et al., 2013; Kumar & Jetly, 2016; Rodriguez Fuentes et al., 2016; Trivedi et al., 2014 studied MFR combined with another treatment approach in comparison to a different treatment method or methods. All six publications utilizing MFR approaches reported statistically significant improvements in pain, disability, strength, quality of life (QoL), and AROM14.

## Conclusion

According to the study, myofascial release technique with ultrasound and active release technique with ultrasound both reduce pain and increase functional performance. The findings suggest that the myofascial release technique with ultrasound is more beneficial than the active release group with ultrasound in reducing pain and enhancing functional activities in lateral epicondylitis participants.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national

laws, institutional regulations. (Application Number 03/019/2022/ISRB/SR/SCPT)

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Effectiveness of Low-Level Laser Therapy and Pulsed Ultrasound Combined with Exercise for Osteoarthritis of Knee

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**Abstract**

**Background:** A slow loss of cartilage, pain, functional impairment, and a decreased quality of life are all characteristics of the degenerative inflammatory sickness- osteoarthritis of the knee, which affects the whole joint. Pulsed ultrasound primarily has properties to boost tissue metabolism, improve the extensibility of tissues that are fibrous, and raise pain thresholds. Laser beams having a wavelength of between 600 and 800 nanometers are produced by limited laser treatment. It stimulates regeneration and the release of beta-endorphins by increasing protein synthesis in synovial fluid.

**Purpose:** To find the effectiveness of Low Level Laser Therapy and Pulsed Ultrasound combined with exercise for osteoarthritis of knee.

**Materials and Methods:** Total of 60 participants were selected from ACIAN Ortho clinic. According to inclusion and exclusion criteria, the participants were explained about the treatment safety and written consent was obtained. The participating subjects were divided into two groups, Low Level Laser Therapy with exercise group and Pulsed Ultrasound with exercise group. All the subjects underwent pretest measurement with ROM and WOMAC at the beginning of the treatment. Study period : November 2022 to April 2023.

**Results:** Statistical analysis of data showed significant differences not only in the Ultrasound group but also in Low Level Laser Therapy. The Low Level Laser Therapy Group were significantly higher than the Pulsed Ultrasound group, with a p value of <0.0001

**Conclusion:** Low Level Laser Therapy is more effective than Pulsed Ultrasound for osteoarthritis of knee.

**Key Words:** Osteoarthritis of knee, Pulsed Ultrasound, Low Level Laser Therapy, Western Ontario and McMaster Universities Osteoarthritis Index, Range of motion, Isometric exercise.

## Introduction

The degenerative inflammation illness osteoarthritis of the knee, which involves the entire joint, is defined by a gradual deterioration of cartilage along with discomfort, impairment, and a reduced quality of life. The commonest joint ailment is osteoarthritis, which primarily impacts joints that bear weight, like knees[1,2]. Osteoarthritis knee is due to mitochondrial malfunction, a state of oxidative stress, and poor chondrocyte response to

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developing stimuli. The knee's pathogenesis is the imbalance between chondrocytes' proliferation and differentiation[3,4,5].

Laser treatment has a wide range of biological impacts in alleviating pain linked with persistent osteoarthritis[6]. In Laser therapy, individual cartilage is stimulated to repair itself using a monochrome light beam without thermal stress[7]. Limited laser therapy, which generates laser beams with wavelengths between 600 and 800 nanometer, is frequently utilized to treat knee pain. As a result of influencing cutaneous nerve terminals, it mostly has analgesic effects, cellular activation and also causes responsive vasodilation. By stimulating protein synthesis in synovial fluid, it promotes regeneration and releases beta-endorphin, having an analgesic and anti-inflammatory action[8].

Pulsed ultrasound primarily has non-thermal properties to boost tissue metabolism, improve the extensibility of tissues that are fibrous, and raise pain thresholds[9]. A signal of electricity that is then transformed into a mechanical pressure wave by passing via a piezoelectric crystal. The crystal vibrates and emits sound waves, these waves pass through biological material, with some waves being reflected back towards the transducer[10]. Pulsed ultrasonic waves induce cells to vibrate longitudinally and can increase tissue healing by promoting the regulation of cell permeation, production of proteins, and osmotic exchange[11].

## Aim

The aim of the study is to find the effectiveness of Low Level Laser Therapy and Pulsed Ultrasound combined with exercise for osteoarthritis of the knee.

## Materials and Methods

A 60-person experimental investigation was carried out using Osteoarthritis of knee, age between 40-60 years was selected from ACIAN Ortho Clinic. A convenient sampling method was used in the study. Study period : November 2022 to April 2023.

## Inclusion criteria

- Subjects with age of 40 to 60
- Both male and female were included
- Subjects with unilateral osteoarthritis knee
- Pain or stiffness over the knee

**Exclusion criteria**

- Subjects who are not interested in this study
- Subjects with recent history of surgery
- Rheumatoid Arthritis
- Subjects with recent history of trauma
- Neurological deficits
- Subjects who were currently using intra-articular corticosteroids
- Severe obesity (body mass index [BMI] > 40).

**Outcome Measures**

Assessments were done at the beginning ( before the commencement of therapy ) and Two weeks later.

- Range of motion(ROM)
- Western Ontario and McMaster universities Osteoarthritis Index (WOMAC)

**Procedure**

The inclusion and exclusion criteria resulted in the selection of a total of sixty individuals. After explaining the treatment's safety and ease of use to the individuals, a signed agreement was acquired. Participants who agreed to participate were split into two groups. Pulsed ultrasound combined with an exercise group and limited levels laser treatment. All subjects underwent pretest measurement with Range of motion and Western Ontario and McMaster Universities Osteoarthritis Index in the beginning of treatment.

**Low-Level Laser Therapy Group:**

An emission wavelength of 850 nm, power of 100mW was given for a duration of 5 minutes in length. Individuals lie in a supine position with their knees extended. The points that were irradiated were the medial and lateral epicondyle of the tibia and femur. The patient was instructed to perform 5 minutes of treatment in total each day. This was divided into 1 minute each at 5 different spots along the joint line and patellar ligament.

1. Medial anterior joint line
2. Lateral anterior joint line
3. Medial posterior joint line

4. Lateral posterior joint line
5. Proximal attachment of the patellar ligament

**Pulsed Ultrasound Group:**

The identical ultrasound machine was configured with a pulsed mode duty cycle frequency of 1 MHz, and a power of 2 W/cm$^2$. The Individual lie in a supine position and an acoustic gel that contained no pharmaceutically active material, was applied to the affected area. To ensure maximum energy absorption, ultrasound was then applied in circular motion to the medial and lateral aspects of the knee, that probe angled correctly. Pulsed ultrasound given for 5 minutes each session.

**Exercise:**

**1. Quadriceps isometric exercise:**

Individuals are lying supine. Under the knee, a towel was folded up. They were told to tense their quadriceps muscles as hard as they could for five seconds so as to straighten their knees.

**2. Straight leg raising (SLR) exercise:**

Individuals were advised to initiate a maximal isometric quadriceps contraction before the lifting portion of the exercise, elevate the leg up to 10 cm above the plinth, and maintain the contraction throughout the lifting phase for five seconds.

**3. Long-arc quad exercise:**

Individual is said to sit in a chair then straighten the affected leg, without locking your knee. Hold the leg out straight while counting till five.

**4. Sit To Stand:**

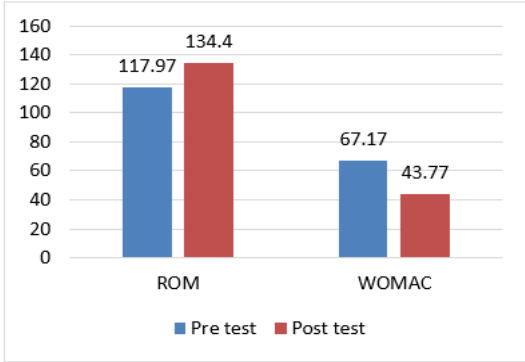
Sit tall in the front of the chair then stand up putting equal weight through the legs. Make sure to fully extend the knee and the hip. Then sit down reaching the chair. It is done in 3 sets of 10 repetitions.

**5. Pillow Squeeze:**

Individuals lie in supine position, both knees bent. Place a pillow between the knees. Squeeze the knees together, by squeezing the pillow between them. Hold for five seconds and relax. Two sets of 10 repetitions.

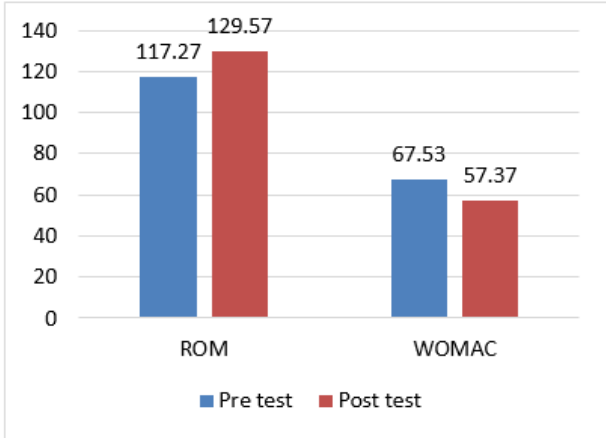
**Data Analysis**

**Low Level Laser Therapy group:**



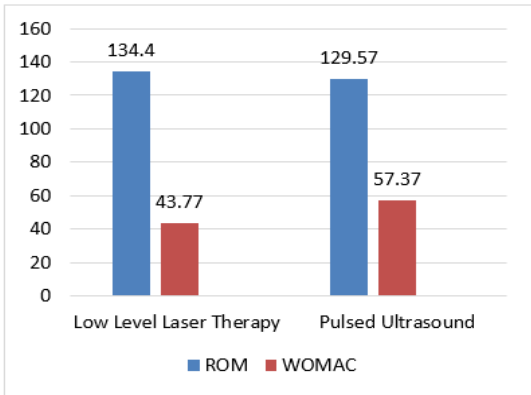

**Graph-1 Shows that the values are extremely statistically significant.**

**Pulsed Ultrasound group:**




**Graph-2 Shows that the values are extremely statistically significant.**

## Post test values of both groups:




**Graph 3: Shows that the values are extremely statistically significant.**

## Result

All of the participants gave their informed permission after being chosen based on inclusion and exclusion criteria. Subjects were divided into two groups. The Low Level Laser Therapy group consists of 30 subjects who received Low Level Laser Therapy with exercise and the Pulsed Ultrasound group consists of 30 subjects who received Pulsed Ultrasound with exercise.

The ROM post-test mean value in the Low Level Laser Therapy group was 134.40, while in the Pulsed Ultrasound group was 129.57. This indicates the Low Level Laser Therapy group was significantly higher than the Pulsed Ultrasound group, with a P value of <0.0001.

The WOMAC post-test mean value in Low Level Laser Therapy was 43.77, while the Pulsed Ultrasound group was 51.37. This indicates that the Low Level Laser Therapy of WOMAC score was significantly higher than the Pulsed Ultrasound group with a P value of <0.0001.

## Discussion

This study's goal was to determine how effective Low Level Laser Therapy and Pulsed Ultrasound combined with exercise for osteoarthritis of knee. The Low Level Laser Therapy group consisted of 30 subjects who received Low level Laser Therapy with exercise and Pulsed Ultrasound consisted of 30 subjects who received Pulsed Ultrasound with exercise. The outcome measures were Range of motion and Western Ontario McMaster Osteoarthritis Index. Beneficial effects were significantly greater in Low Level Laser Therapy than the Pulsed Ultrasound. Statistical analysis of Low Level Laser Therapy with exercise by using Range of motion has a P value less than 0.0001 were considered statistically significant. The statistical analysis of the Pulsed Ultrasound with exercise by using the range of motion has a P value less than 0.0001 was considered statistically significant.

Enas Fawzey Youssef et al., 2016 on the efficacy of the Low Level Laser Therapy on 120 patients aged 40–50 years. The study concluded that the Low Level Laser Therapy treatment is successful in increasing ROM, reducing pain, and increasing knee flexion[12].

Michele Luise De Souza et al., 2018 Combined Ultrasound and Laser Therapy on 70 patients with symptomatic OA Knee concluded that the use of laser therapy was effective in lowering pain and enhancing functionality[13].

Adnan Afzal et al., 2021 low-powered laser treatment in the Treatment of Knee osteoarthritis on 90 patients concluded that different musculoskeletal conditions respond well to LLLT in significant ways[14].

Stausholm MB et al, 2019 concluded that at 4–8 J with 785–860 nm wavelength, low level laser therapy lessens pain and impairment in knee osteoarthritis[15].

## Conclusion

The study concluded that both Pulsed Ultrasound and Low Level Laser Therapy reduced knee pain and increased ROM in osteoarthritis of the knee. But Low Level Laser Therapy was found to be effective in terms of reducing symptoms and improving performing daily tasks.

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**Funding:** Self

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Original Article

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# Effectiveness of Mulligan Mobilization Technique Versus Cyriax Technique for Lateral Epicondylitis: A Pilot Study

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**Abstract**

**Background**: Eccentric loading of extensor carpi radialis brevis tendon near its origin causes tennis elbow, also known as lateral epicondylitis. Tennis elbow is primarily caused by repetitive wrist extension or loaded gripping overuse injuries and when playing tennis, badminton, or any sport are more likely to experience it. The goal of the study was to determine whether tennis elbow pain might be decreased and improve the functional status. Subjects are divided into two groups, Mulligan mobilization technique and Cyriax technique along with ultrasound.

**Purpose**: To find out the effects of Mulligan mobilization technique and Cyriax technique along with ultrasound in the management of lateral epicondylitis.

**Materials and Methods**: Twenty individuals were chosen with tennis elbow (11 males and 9 females) and received treatment for four times/week for two weeks in RENU'S Physiotherapy & Rehabilitation Centre according to the inclusion and exclusion criteria, explained about the procedure and obtained signed informed consent. Subjects were divided into two groups by simple random sampling -Mulligan mobilization technique of Movement with Mobilization(MWM) and Cyriax technique of Deep Tendon Friction(DTF) massage with Mill's manipulation along with ultrasound.

**Result**: Statistical analysis had slight significant difference between Cyriax and Mulligan group for NPRS and PRTEE. Noticeably Cyriax had more improvement in pain reduction than Mulligan group, while Mulligan had improvement in functional impairment than Cyriax, with a p value of <0.0001.

**Conclusion:** Mulligan mobilization and Cyriax method with ultrasound both reduced discomfort and enhanced functional status.

**Keywords**: Tennis elbow, Patient-Rated Tennis Elbow Evaluation (PRTEE), Lateral epicondylitis, Massage,Physiotherapy

## Introduction

Lateral epicondylitis is an inflammatory condition that is better referred to as tendinosis, a painful and frequent musculoskeletal condition of the upper limb's soft tissues of the elbow joint. It is also known by the names tennis elbow and lateral epicondylalgia.[1] Tennis players have a prevalence of LE of 40–50%, and it is a repeated upper extremity

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activity.[2,3] Despite the fact that it only affects 1% to 3% of the population overall and is less widespread, it is nonetheless associated with staggering costs and suffering for people.[4] The main cause of epicondylitis is pain and contractile overload . Pain is characterized by discomfort and soreness in the lateral portion of elbow, with resisted dorsiflexion of the wrist, middle finger, or both. Resistive wrist or third metacarpal extension with the elbow extended make the pain worse.[5]

Additionally, the pain may travel distally down the forearm, which could lead to weak grips .[6,7]

The illness is typically thought to have its roots in repetitive usage leading to micro tearing and advantage degeneration because of an immature reparative response. Although there is no initial inflammatory response or infiltration of inflammatory cells in lateral tendinitis and the sensory fibers of the injured tendons include substance P, a chemical that causes pain, and calcitonin gene-related peptide.[8] It is nonetheless a painful condition. The contractile overload, which repeatedly strains the common extensor tendon and its attachment to extensor muscles of the forearm (extensor carpi radialis brevis, extensor digitorum, extensor digiti minimi, and extensor carpi ulnaris) to the lateral epicondyle of the humerus. The muscle that is most frequently impacted is the extensor carpi radialis brevis (ECRB). Although tennis is frequently linked to lateral epicondylitis, other activities that involve excessive and repetitive use of the forearm extensors include typing and various manual tasks.[9] As a result, according to the statistical evidence, lateral epicondylitis is linked to several missed workdays and persistent impairments brought on by extended limitations in job capacity.[10] One of the most frequently seen lesions causing work-or sports-related pain issues is lateral tendinitis (LT).[11]

Manual therapy methods that involve hands-on soft tissue or joint mobilization lessen pain while also improving the extensibility of contractile tissues and joint mobility. Mulligan Mobilization with Movement (MWM) is an approach to treating musculoskeletal pain that is based on the theory that minor position errors in the articulating surfaces of joints following trauma or strains cause movement restriction and pain that is exacerbated by active muscle contractions within the faulty positions of the joint.[12] Due to MWM's capacity to lessen a bone segment's positional defect, it was able to quickly relieve discomfort and restore. This aids in minimizing discomfort while enhancing grip strength and functional impairment. Deep transverse friction (DTF)massage, commonly referred to as deep friction massage, is a particular form of connective tissue manipulation that is carefully administered to soft tissue structures like tendons. The most popular manipulative method employed by physiotherapists is Mill's manipulation. Cyriax advises performing the operation as soon as possible after the DTF. If the patient can passively extend their elbow all the way, and it entails pushing with a small-amplitude, high-velocity force at the tip of elbow extension while keeping the wrist and palm flexed.

The historical treatment of tennis elbow with ultrasound (US) therapy is common. It's a hand-held device used to create and deliver sound waves by using both heat and non-thermal mechanisms to the interior damaged location in ultrasound therapy, a typical therapeutic approach in physical therapy.[13] It offers the body's soft tissues, such as muscles, tendons, joints, and ligaments, with deep heating and depending on the wave frequency.

## Aim

To find out the effects of Mulligan mobilization technique and Cyriax technique with ultrasound for lateral epicondylitis.

## Material and Method

It was a pilot study conducted on 20 subjects with lateral elbow pain, age between 30-40 years was taken from RENU'S Physiotherapy & Rehabilitation Centre. Simple random sampling was used and samples were gathered in the study period from October 2022 to November 2023.

**Inclusion criteria:**

- Age: 30 – 40 years.
- Pain with gripping.
- Pain with resisted wrist extension analyzed by Cozen's test
- Pain with passive wrist flexion with the elbow extension analyzed by Mill's test

- Tenderness on palpation over the lateral epicondyle of humerus
- Unilateral localization of pain

## Exclusion criteria:

- Cardiovascular disease
- Neuromuscular disease
- Neurological impairment
- Previous trauma
- Surgery
- Peripheral nerve entrapment
- Corticosteroid injection within 6 months
- Inflammatory rheumatic disease

**Outcome measures:**

Assessment was taken as pre-test at initial of the study and post-test after two weeks of study.

- Numeric Pain Rating Scale (NPRS) [14]
- Patient Rated Tennis Elbow Evaluation(PRTEE) [15]

**Procedure**

A total of twenty people were chosen based on the inclusion and exclusion criteria, and their informed consent was obtained and they were informed about the procedure. Their data was gathered. The patients were instructed to choose an envelope from a container that contained an equal amount of chits for Mulligan and Cyriax group. These sheets with labels were folded so that the physiotherapist and participants could not see the label. Patients in the Cyriax group underwent DTF massage and Mill's manipulation, while patients in a different group underwent Mulligan mobilization method using the MMWM approach Both the groups underwent four times per week for two weeks.

**Cyriax Group - Deep Transverse Friction Massage and Mill's Manipulation for Lateral Epicondylitis**

**Deep transverse friction massage:**

Deep tendon friction massage is used to treat tennis elbow at a relaxed position, with the elbow fully supinated and at 90-degree flexion, position the patient. The anterolateral aspect of the lateral epicondyle (the extensor carpi radialis brevis inserts, and the most common source of pain in people with tennis elbow) can be found where the pain is located. Apply DTF by pushing the side of the thumb tip in a posterior direction on the teno-osseous junction. The therapist's fingers should be put on the opposite side of the elbow to create counter pressure while continuing to apply DTF while maintaining this pressure. To get the tendon ready for Mill's manipulation once the numbing effect wears off, DTF is applied for 10 minutes.

**Mill's Manipulation**

The patient is seated on a chair with a back support, sit behind the patient. Support the patient's arm at the elbow's crook while rotating and abducting the shoulder joint to the medial position to 90 degrees. Forearm pronation will occur naturally. Place the thumb on the web space between the patient's thumb and index finger, fully flex the patient's wrist, and pronate the forearm. Place the hand supporting the patient's elbow in the crook of the arm and extend the elbow until all the slack has been picked up in the elbow .[16]

**Mulligan Group – Movement with Mobilization for Lateral Epicondylitis** Instruct the patient to perform a lateral glide with help of Mulligan mobilization belt at the elbow joint first, then make a fist and open it. The elbow was fully extended, and the forearm was pronated. It was confirmed that the individual had a repeating aggravating activity (same indication) prior to giving glide. The patient was subsequently told to glide while holding onto a hand grip strengthener. The gliding hand was positioned just distal to the elbow joint line over the medial surface of the ulnar side, and the stabilizing hand was positioned at the distal end of the arm. As the patient started to compress the grip strengthener, they utilized a laterally directed glide. When the glide was over, the patient had to release the hold. The glide was applied and sustained for approximately 30 seconds while the patient was instructed to repeat the uncomfortable maneuver up to ten times. There was a break of 30 seconds in between each of the three set .[17]

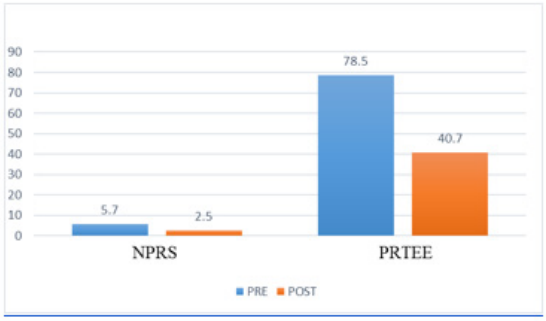
**Ultrasound:**

Patient received US over the affected for ten minutes after the mobilization and, skin and the transducer's surface were both covered with gel.

Circular motion of the US head and transducer rate was 3–4 cm square. The dose of US-1 W/cm$^2$ was chosen for its deeper penetration with the frequency of 1 MHz in continuous mode; this frequency was chosen for the deeper penetration.[18]

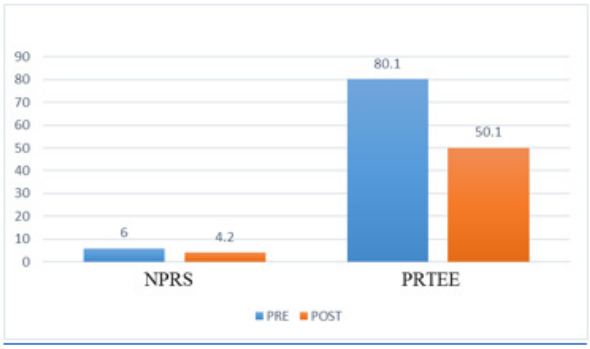
**Data Analysis**

**Cyriax group:**



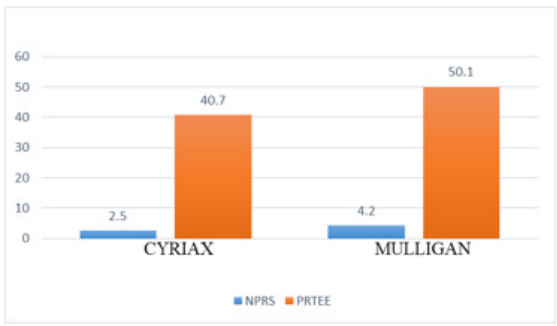

**Graph-1 Comparison of pre and post value of Cyriax group using NPRS and PRTEE scale**

**Mulligan group:**




**Graph-2 Comparison of pre and post value of Mulligan group using NPRS and PRTEE scale**

**Post-test values of both groups:**




**Graph-3 Comparison of post value of Cyriax group and Mulligan group using NPRS and PRTEE scale**

## Results

Total 20 subjects participated and were divided into 10 each of two groups as the Cyriax group and Mulligan group. There is a significant improvement in NPRS and PRTEE among both the groups.

The NPRS post mean value in Cyriax group is 2.50 and in Mulligan group is 4.20 indicates equally significant in both the groups, with p value equal to 0.0013.

The PRTEE post mean value in Cyriax group is 40.07 and Mulligan group is 50.10 with p value <0.0001.

## Discussion

The current investigation finds out the effectiveness of Mulligan mobilization and the Cyriax treatment with ultrasound for lateral epicondylitis is the main objective. Prior to and following therapy, the outcomes were evaluated using the Numerical Pain Rating Scale(NPRS) and the Patient-rated Tennis Elbow Evaluation (PRTEE). The benefits of using the Mulligan mobilization technique with ultrasound and the Cyriax technique with ultrasound to reduce pain and improve functional capacity were both noticeably larger. When the responses from the two groups were compared, the results were statistically equivalent for both groups.

More than 40 different therapeutic modalities have been documented, although none has emerged as being more effective than the others. In order to ascertain the efficacy of two MMWM and CA physiotherapy methods it has been reported that physiotherapy treatment methods are successful in controlling LE patients.

Nagrale AV, et al. 2009 according to the study Cyriax was superior to phonophoresis with exercise and stretching in reducing pain, promoting a pain-free grip, and improving functional status. In the current study, Cyriax and Mulligan mobilization were compared, and the results showed that Cyriax was superior in reducing pain than Mulligan were as well as Mulligan was superior in enhancing functional status .[19]

Anap DB et al. (2012) by separating the subjects into two groups established a treatment protocol

with manual therapy, which includes movement in mobilization along with ultrasound, deep friction massage, stretching, strengthening exercise, and another group of conventional therapy. According to the study's findings, manual therapy was more effective than conventional therapy.[20] The current study's findings therefore showed that MMWM and CA were effective in reducing pain levels and improving functional status in LE patients.

According to Abbas S. et al., 2019, this study compared the effectiveness of Mulligan mobilization with movement and tapping to Cyriax mobilization using deep friction massage with Mill's manipulation. Both techniques were successful in reducing pain and improving functional status.[21] Similar to the Abbas S et al., 2019 study, the current study found that using ultrasound instead of tapping technique had an impact in lowering pain and inflammation caused by tendinitis. Both treatments were successful in reducing pain and improving functional status. Additionally, DTF massage combined with Mill's manipulation is beneficial for treating LE-related discomfort. The goal of MMWM is to mobilize the afflicted joint while it is moving. It differs from other types of mobilization techniques in that MMWM is performed while the joint is in motion as opposed to classic mobilization techniques, such Maitland mobilization, which are applied in a static posture. This aids in adjusting the joint's biomechanics during functional movement. The main finding of the current study was that, whereas CA was superior to MMWM in terms of reducing pain, MMWM was superior to CA in terms of enhancing LE patients' functional status. MMWM is useful in enhancing functional status in LE patients.

## Conclusion

According to the findings, both Mill's manipulation with DTF massage (Cyriax) with ultrasound and Movement with Mobilization (Mulligan) with ultrasound are efficient in reducing pain, enhancing functional ability in lateral epicondylitis. When compared to Mulligan's technique, the Cyriax approach is more effective at reducing pain in lateral epicondylitis. However, Mulligan's method leads to greater improvements in functional ability. By comparing the Cyriax approach, it has an improvement in functional impairment. Both therapies are equally helpful and ultrasound was given.

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Original Article

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# The Effect of High Intensity Interval Training and Resistance Training in Altering Body Composition of Obese Postmenopausal Women

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**Abstract**

**Background:** This study was designed to evaluate the effectiveness of High Intensity Interval Training (HIIT) and Resistance training (RT) on obese postmenopausal women in altering body composition.

**Purpose:** To compare the effectiveness of High Intensity Interval Training and Resistance Training in altering body composition of post-menopausal women

**Materials and Methods:** Twenty obese postmenopausal women randomly selected from Poongothai hospital , karur were divided into two groups using concealed envelope method. Group "A" was given HIIT three times a week and Group "B" was given RT three times a week for four weeks. Body mass index (BMI), Waist Circumference (WC), Waist Hip Ratio (WHR) were used to evaluate body composition at two intervals (pre and post intervention).Study period:October 2022 to June 2023.

**Results:** Statistical analysis show that there is a significant change within the group for BMI, WC, and WHR pre and post intervention with a $p<0.0001$ for both groups A and B. The mean value of HIIT group was 30.2 using BMI, 92.90 using WC, 0.92 using WHR, whereas the mean values of RT was 30.4 using BMI, 93.0 using WC, 0.94 using WHR As a result, the findings are not statistically as the differences were small.

**Conclusion:** According to the findings, obese postmenopausal women who took part in the HIIT Group shows considerable reduction in body composition than RT Group.

**Key Word:** Obesity, Abdominal, Body Mass Index, Waist circumference, Interval Training, High-Intensity.

## Introduction

Menopause, which signifies the end of menstrual periods, is described as happening 12 months following the last menstrual period.[1] According to research by Lovejoy et al., visceral adipose tissue considerably expanded throughout the menopausal transition starting 3–4 years before menopause, and this progression of belly fat corresponded with the gradual decline in serum estrogen over time.[2] Women frequently worry a lot about the menopause. The fear of gaining weight is one of the most significant. After

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menopause, it is common for weight growth to be accompanied when the proportion of fat in the body rises and a simultaneous shift in the distribution of fat from peripheral areas towards increasing intra-abdominal depots.[3,4] In fact, it is generally known that women in this stage of life are three times more likely to have metabolic syndrome and obesity than they were before menopause.[5] Main causes of menopausal body composition changes are ethnicity, epigenetic changes, genetic predisposition, Low SHBG levels, relative hyperandrogenemia, and rapid hypoestrogenemia unhealthy dietary habits, minimal physical activity, drugs (like insulin and steroids) and diseases changes in adipose tissue metabolism are linked to aging and the menopause transition, which may help explain why body fat builds up after menopause.[6] Although there are wide variations in average weight gain, 20% of women who go through this transition period gain 10 pounds or more[7] However, greater visceral and abdominal subcutaneous adipose tissue deposition is linked to menopause.[2] Gaining abdominal obesity raises the risk of breast, colon, and endometrial malignancies in post-menopausal women. The obesity's general prevalence in Punjab has been noticed as 72.43%.[8]HIIT is a form of high-intensity interval training. Of physical activity that features brief, strong spurts activity alternating with rest or low-intensity exercise.[9] Exercise carried out at an intensity of >65% of maximum capacity is referred to as HIT.[10] Resistance training refers to working out your muscles against an opposing force, such as using dumbbells, resistance bands, exercise machines, or even just your own bodyweight. The mass index of a person (BMI); waist circumference, waist-to-hip ratio were used to evaluate body composition.[11, 12]

## Aim

To evaluate the effectiveness of High intensity interval training and Resistance training in altering body composition of obese postmenopausal women.

## Material and Method

It was an experimental feasibility study. A Total of 20 obese post -menopausal women who met the requirements for inclusion and exclusion were sourced from Poongothai hospital, Karur. Convenient sampling was used in the study.

**Inclusion criteria:**

- Age: 45 to 60 years
- Sex: Postmenopausal Women
- Body mass index (BMI): Obese: BMI >30 kg/ m2

**Exclusion criteria:**

- Hypertension.
- Hepatic and renal disease.
- Diabetes mellitus types 1 and 2.
- Psychosis.
- Thyroid condition.
- Dyslipidemia.
- Usage of drugs affecting weight, e.g., thyroid dietary supplements, central nervous system depressants, and diuretics
- Chronic Neurological Conditions
- Joint Inflammation at Lower Limb
- Recent Fracture
- A weight decrease of at least 5 kg over the previous 6 months.
- Psychosocial contraindications

**Outcome measures:**

- Body mass index (BMI)
- Waist Circumference (WC)
- Waist Hip Ratio (WHR)

**Procedure**

Before beginning the intervention, the individuals were educated about the study and a formal written informed consent was obtained from them. The participants were then separated into two groups Group A (HIIT group) and Group B (RT group) using convenient sampling. Each group consists of 10 participants. Assessment was performed at baseline and after 4 weeks of study.

**Group A - High Intensity Interval Training Group**

Group A was given Cycling HIIT for 30 min, Monday, Wednesday, and Friday for a period of four weeks. Before and after performing HIIT some warm up stretches are performed (Leg Swings, Heel Toe Walk, Shoulder Stretch, cat-cow stretch, chest stretch).

**Protocol:**

- Minutes of medium resistance warming up
- High resistance pedaling for 20 seconds, then low resistance pedaling for 40 seconds. 5 times in a row.
- 30 seconds of high-intensity pedaling is followed by 30 seconds of low-intensity recuperation. 5 times in a row.
- High resistance for 20 seconds, followed by low resistance for 40 seconds of recovery. 5 times in a row.
- High resistance for 30 seconds, then low resistance for 30 seconds of recuperation. 5 times in a row.
- For the final five minutes of stretching, slow your pace and use medium resistance.

**Group B - Resistance Training Group**

For four weeks, the resistance training was done thrice every week (Monday, Wednesday, Friday), lasting 30 minutes total with 5 minutes for initiation and wind-down and 20 minutes of the primary activity. Static stretching was a part of the warm-up and cool-down. Additionally, there were several workouts in the resistance training program. The resistance exercise's level of difficulty was gradually increased from 40% to 50%. Maximum of one repeat (1RM) with rate of perceived effort of 11–12 in weeks 1–4

**Protocol:**

**Basic Squat**

- Crouch with your butt back straight and legs bent.
- You may maintain your knees behind your toes by primarily keeping your weight evenly distributed between both heels.
- Achieve the squat's lowest possible point, pause, then stand back up and perform the same exercise again.
- Core, glutes, hamstrings, and quadriceps are the muscles worked.

**Modified Pushup**

- Put your hands below your shoulders, knees underneath your hips, and in a knelt position to begin.
- Slowly drop yourself to the ground while maintaining a 45-degree angle at the back of your elbows.
- Return to the beginning posture by pushing yourself up.
- Repetition till the appropriate number of times.
- Bicep and triceps muscles, the shoulders, back, chest region, and core muscles are targeted.

**Reverse Grip Double Arm Row**

- Bringing both of your legs closer, Sit back and squat slightly. While contracting the abdominal region and glutes.
- Weights will be held by arms that will be extended out in front of the body, palms upward.
- Draw your elbows back, drag them gently past your hips to feel your chest and shoulders contract, and then controllably go back to your starting place.
- Upper body, triceps, back, and shoulders are the muscles worked.

**Full Body Roll Up**

- Begin by supine raising the arms beyond the level of your head.
- Breathe in as you raise your arms and start to tuck the chin towards the chest. Breathe out while you lift up and across every part of your body. Maintaining the legs straight, your abdomen tight, and lowering yourself to your toes.
- Repeat utilizing your abdominals to lift and lower yourself slowly and without using your strength.
- Core, shoulders, and back muscles are the focus of this exercise.

**Dumbbell Deadlift**

- To begin, Place your lower extremities halfway apart as you upright and your weights facing in the direction of your thighs.
- As you make a soft bend to your knees and descend the dumbbells to the floor, contract your abdominal muscles and maintain a flat back.

- To lift and come back to an upright position. Contract the glutes and activate the hamstrings.
- The muscle groups that this exercise targets are: Glutes and Hamstrings

**Forward Lunge With Bicep Curl**

- Step forward with both of your feet approximately hip-width wide with high standing. Utilizing one's right leg, take a big step forward while bringing the rear knee all the way to the ground. At the bottom of the lunge, perhaps both of your legs are supposed to be approximately 90 degrees flexed.
- During the lunge's descent, hold weights onto your shoulders to complete the bicep curl. Then to go back to the position of beginning, push off your leading foot.
- Quads, glutes, hamstrings, and biceps are the muscle groups that are targeted

**Shoulder Overhead Press**

- When you first stand, stand with hip width wide. Bring your elbows out to the side to maintain the arms-at-the-goalpost position. With a directly back and tight abs, you'll hold your elbows at shoulder level.
- Lift dumbbells straight up until your arms are parallel to the ground. Return with control and gradually to the starting position.
- Shoulders are the targeted muscle groups

**Bird Dog**

- Crouch on all fours on an exercise mat.
- Extend the opposing leg far behind you while extending one arm long and contracting your abs.
- Continue on the opposite side.
- Target Muscles: Low Back and Abdominals

**Plank**

- Lay down on the floor with your forearms parallel to the surface to start your elbows should be the distance between your hands.
- Maintain a straight body through the top of your head to your toes in a straight line by engaging your core and pressing all the way down to the elbows, clench your glutes and pull the navel into your spine.
- Hold for 30 seconds to 1 minute.
- This exercise targets: the core/abdominals, shoulders, upper back, pectoral, arms, and legs

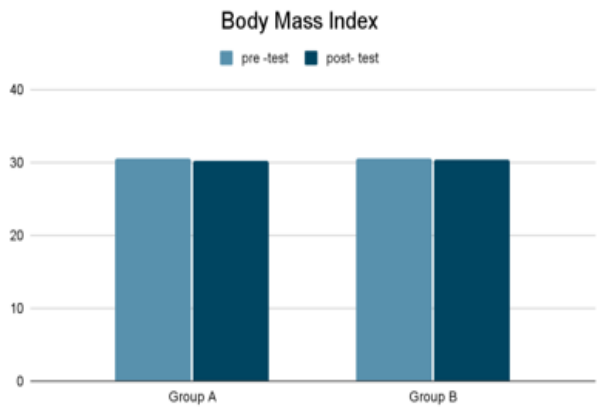
**Leg Raise**

- Lie flat on your back with your legs aligned.
- Maintaining a straight posture, raise your legs all the way to the roof until your butt is raised off the ground.
- Gently reposition your legs so that they are slightly above the floor. Hold on for a second.
- You may strengthen your cores and oblique's

**Glute Bridge**

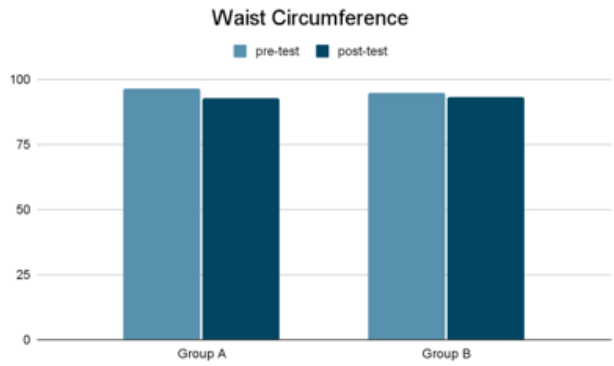
- Place your feet flat on the floor with your knees bent while lying on your back. Make sure your heels are 6 to 8 inches from your glutes and that your toes are pointed straight ahead. Your palms should be facing up.
- Slowly elevate your hips while squeezing your core and using your glutes.
- Be careful not to arch your back as you lift your hips as possible. Elevating the hip region till torso an even path beginning with your shoulder up to your knee is necessary for a complete glute bridge.
- Squeeze your glutes as hard as you can once you've reached the top of the glute bridge, then hold for a few seconds.
- Without letting up on the strain in your glutes and core, slowly lower your hips back to the ground.
- Tighten your abdominal and glute muscles

**Data Analysis**



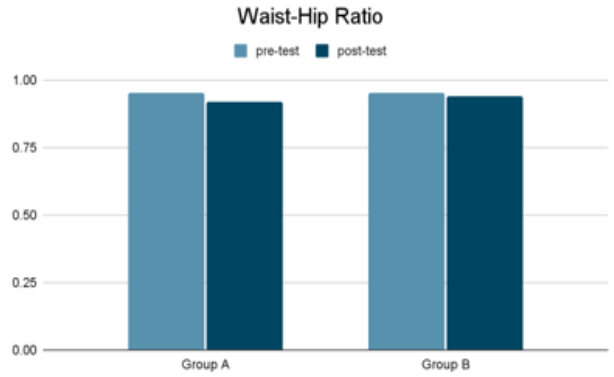

**Graph No. 1**

Interpretation: Graph no. 1 shows that values are extremely statistically significant




**Graph no .2**

Interpretation: Graph no 2 shows that the values are extremely statistically significant




**Graph no.3**

Interpretation: Graph No.3 shows that the value is extremely statistically significant.

## Result

It was discovered that there is a substantial difference between pre-test and post – test results after statistical examination of the quantitative data. There is significant difference within the groups yet there was no apparent difference among the groups.

- Comparing the pre-test and post-test values of HIIT using BMI, WC, and WHR. The mean value of pre-test was 30.6 and the post-test was 30.2 using BMI, the pre- test and post-test mean values were 96.30 and 92.90 using WC, the pre-test and post-test mean values were 0.95 and 0.92 using WHR. As a result, the findings are considered statistically significant when the p value is <0.0001.
- Comparing the pre-test and post-test values of RT using BMI, WC, and WHR. The mean value of pre-test was 30.57 and the post-test was 30.4 using BMI, the pre-test and post-test mean values were 94.70 and 93.00 using WC, the pre-test and post-test mean values were 0.95 and0.94 using WHR. As a result, the findings are considered statistically significant when the p value is <0.0001.
- Comparing the post-test values of HIIT and RT groups, the mean value of HIIT group was 30.2 using BMI, 92.90 using WC, 0.92 using WHR, whereas the mean values of RT was 30.4 using BMI, 93.0 using WC, 0.94 using WHR. p-value is 0.24 using BMI, 0.96 using WC, 0.22 using WHR. As a result, the findings are not statistically significant.

This shows that both HIIT group and RT group are statistically significant within the groups but not between the groups.

## Discussion

In the current study, High Intensity Interval Training and resistance based exercise in postmenopausal individuals with obesity in altering body composition was examined. Both interventions improved body composition (BMI, WC, and WHR), But HIIT increased the proportion of fat mass reduction. Moreover, in short duration abdominal fat mass was reduced only in HIIT groups, and were substantially different from RT.Wewege et al. discovered that HIIT & MICT training improved FM and waist size while not having any changes in body weight. Furthermore, they demonstrated that while MICT training and HIIT exercises were equally effective, HIIT exercise needed about 40% less time. Maillard et al.'s (2018).[13] meta-analysis concentrated on the benefits of HIIT on total FM of the body and (intra)-abdominal reduction, HIIT is also a time-effective way to reduce abdominal and visceral FM. Socha et al. were able to indicate that a period of eight weeks of exercise with resistance substantially decreases the percentual body fat in women beyond the age of 50.

Gillen et al. (2013) after a 6-week low-volume HIIT exercise (10 seconds at 90% of one's maximal Heart rate variability, then a 60-second period of relaxation), Dexa scans disclosed a decrease rises in leg lean muscle mass and degrees of abdomen and general adiposity.

Jonathan D Bartlett et al., Stated that High-intensity interval training's higher level of enjoyment may be useful for boosting exercise adherence. Dupuit et al Particularly for postmenopausal women, cycling HIIT appears to be more beneficial than running, and training regimens lasting more than 8 weeks should be recommended, with three sessions per week.

Our result has shown that High intensity interval training and resistance training both has significant effect on body composition but High Intensity Interval Training reduces composition of the body in lesser period of time whereas resistance training need more duration to show significant response

Limitations:

1. Patients is trained via online meeting
2. Metabolic outcomes could have been added

Recommendations:

1. Further studies are recommended to consider other potential risk factors
2. Follow up with large sample size may be more commendable

## Conclusion

According to the findings, individuals in HIIT Group are better than individuals in RT Group in altering body composition in short duration as HIIT is found to be more enjoyable and is a quick approach to decrease body fat deposits, particularly visceral and abdominal fat mass. Taking that into account that following menopause, resistance training can enhance quality of life and muscle performance, hence it is recommended to implement High intensity interval training and Resistance training.

**Ethical Clearance:** Taken from institutional ethical committee 03/ 022/ 2022/ ISRB/ SR/ SCPT.

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Effects of Stacking Breathing Techniques on Respiratory Efficiency of Post COVID-19 Patients

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**Abstract**

**Background:** Long COVID is a term used to describe persistent symptoms and complications experienced by individuals after recovering from acute COVID-19 infection. Respiratory impairment, defined by diminished lung function, exercise intolerance, and diminished respiratory muscle strength, is one of the frequent long-term consequences of COVID-19 which can significantly impact the quality of life. Hence, exploring effective interventions to improve respiratory efficiency in this population is crucial.

**Purpose:** The purpose is to evaluate the effectiveness of stacking breathing techniques on respiratory efficiency in post COVID-19 patients.

**Material and Method:** This is an experimental study done using convenient sampling technique with inclusion criteria of age between 18 to 60 taken from siva physiotherapy clinic. Patients having SPO2 level of 95. History of Post Covid Patients with secondary disease and irregular heartbeat were excluded. The sampling size of the study is (n=60) subjects for a period of 4 weeks. The entire process was conducted from November 2022 to March 2023.

**Results:** According to the statistical analysis, Deep Breathing Techniques are successful in improving respiratory rate among Post Covid-19 Patients. The statistical analysis of both the groups with respect to the post-test values (mean ± SD) for respiratory rate 17.1700 ± 1.2600 and 15.47± 1.07 and showed that the p value is statistically significant <0.0001. Post intervention (mean ± SD) for post Covid -19 functional status scale(PCFS) 0.83 ± 0.75 and 1.40± 0.77and showed that the p value is statistically significant <0.0001.

**Conclusion:** This study finally concluded that deep breathing techniques have a high impact in improving Respiratory rate and Post Covid 19 functional status scale (PCFS) among Post Covid-19 Patients.

**Keywords:** Covid 19,Deep Breathing Technique, Respiratory rate, Pulse oximeters, Post Covid 19, Stacking Breathing Techniques.

## Introduction

Since 2019, The SARS-CoV-19 coronavirus, which was first discovered in Wuhan, China, has now spread to all corners of the globe. India was infected by the virus in January 2020. Coronavirus disease 2019 (COVID-19) is a highly contagious

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respiratory ailment caused by coronavirus 2 (SARS-CoV-2) that is very contagious.[1,2] The virus mainly spreads through direct contact between people when respiratory droplets are secreted. It spreads considerably more quickly than it is detected, according to research findings.[3] The COVID-19 virus has spread rapidly throughout every country. However, those who haven't received a vaccination or those with weakened immune systems are more susceptible to contracting this virus. One or more of the symptoms of COVID-19 include shortness of breath, fever, cough, tiredness, dizziness, and a loss of taste .

The use of breathing exercises, which included forced expiratory technique (feat), diaphragmatic breathing, deep breathing, or chest expansion exercise, as well as breathing control. Data on the median values of respiratory rate (breaths/minute), and heart rate (beats/minute).[4] Numerous studies have demonstrated that physiotherapy is beneficial for COVID-19 patients, but they have also made some recommendations for its use in terms of preventing the spread of the virus. This case report will describe a case of a COVID-19 patient with shortness of breath that improved by serial breathing exercise and chest physiotherapy.[5]

Stacking breathing techniques involve a series of controlled breath-holding maneuvers, followed by slow and controlled exhalation and inhalation. These techniques aim to optimize respiratory muscle function, increase lung capacity, improve ventilation-perfusion matching, and enhance overall respiratory efficiency. While stacking breathing has been investigated in other respiratory conditions, limited research has specifically examined its effects on respiratory efficiency in long COVID patients.

Therefore, examining the effect of combining breathing techniques on the respiratory effectiveness of long-term COVID patients is the goal of this study. We can learn a lot about the potential advantages like respiratory muscle strength, exercise tolerance, forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and dyspnea levels.[6]

Understanding the effects of stacking breathing techniques on the respiratory efficiency of long COVID patients has important implications for their rehabilitation and recovery. If found to be effective, this intervention could provide a safe, accessible, and cost-effective approach to manage respiratory impairments and improve quality of life in long COVID patients.[7]

The primary outcome measures in this study include Respiratory rate (number of breaths per minute), and the Post Covid 19 Functional Scale (PCFS), which evaluates individual functional goals and their achievement.[8] These outcome measures capture key aspects of respiratory efficiency and functional abilities in post COVID-19 patients. Respiratory rate is another crucial outcome measure as it reflects the efficiency of the respiratory system. This study seeks to determine the effects of stacking breathing on respiratory muscle control and effectiveness by measuring respiratory rate. A reduction in respiratory rate would indicate improved respiratory efficiency and reduced energy expenditure associated with breathing.[9]

The Post COVID-19 Functional Status (PCFS) scale is an outcome measure used to assess the functional status of individuals who have recovered from COVID-19. It is designed to evaluate the impact of COVID-19 on various aspects of daily functioning, including physical, cognitive, and emotional well-being. The PCFS scale provides valuable information about a patient's recovery and helps healthcare professionals understand the extent of functional impairment caused by the virus.[10]

## Aim

To evaluate the effectiveness of stacking breathing techniques on respiratory efficiency in post COVID-19 patients.

## Material and Method

This is an Experimental study done using convenient sampling technique with inclusion criteria of age between 18 to 60. Patients having SPO2 level of 95. History of Post Covid Patients with secondary disease and irregular heartbeat were excluded. The sampling size of the study is (n=60) subjects for a period of 4 weeks.

**Study period:** November 2022 to March 2023.

**Inclusion criteria:**

1. SPO2 level of 95
2. Subjects with age between 18 - 60 years
3. Both male and female
4. BMI 25-29
5. Sleep Disturbance

**Exclusion criteria**:

1. Post Covid-19 Patients with Secondary disease
2. Co-morbidity patients
3. Rib fracture
4. Pneumothorax
5. Irregular heartbeat.

**Outcome Measure**

Assessment was done at initial and at the end of the study using

1. Respiratory Rate
2. Post COVID 19 functional scale

**Procedure**

This study's recruitment process resulted in a final participant count of 60 using a convenient sampling technique. According to the inclusion and exclusion criteria, all subjects were chosen for enrollment. All subjects received information sheets about the study protocols before the study's start, and informed consent was obtained. The enrolled subjects were divided into Groups A (n = 30) and B (n = 30), and they underwent pre-test analysis on respiration rate using a pulse oximeter to determine whether they had any breathing problems when doing ADL tasks and functional activity using the Post Covid-19 Functional Status Scale. Following the pre-test analysis, Group A subjects got Stacking Breathing Techniques for 4 weeks during 3 sessions per week, whereas Group B subjects received Deep Breathing Techniques during 3 sessions each week. After 4 weeks, the Post- test analysis was carried out and data were tabulated through SPSS. They will be well informed about the study and treatment protocols and informed consent will be obtained. The 60 subjects will be divided into group A and groupB where Group A is the experimental group (n=30) and they will be given stacking breathing exercise for weeks two times per days with 3 sets and 5 repetition for 20 minutes and Group B is the control group (n=30) and they will be given deep breathing exercises for 4 weeks two times per day with 3 sets and 5 repetitions for 20 minutes.

**Exercise Protocol**

**STACKING BREATHING PROGRAMME:**

Participants in the Group-A (n=30) will undergo a structured stacking breathing program, consisting of specific breathing techniques designed to optimize respiratory efficiency. Here are two types of stacking breathing techniques that can be incorporated into a program to improve Respiratory rate in post-COVID-19 patients:

**Inspiratory Breath Hold Technique**

The inspiratory breath hold technique focuses on enhancing lung capacity and oxygen uptake. Here's how to perform this technique:

1. Sit or stand in an upright position.
2. Take a slow, deep breath in through your nose, filling your lungs as much as possible.
3. Hold your breath for a short duration, around 2-3 seconds, at the end of inhalation.
4. Exhale slowly and fully through your mouth, emptying your lungs completely.
5. Pause briefly after the exhalation.
6. Inhale slowly and deeply again, repeating the cycle of breath hold, exhale, and pause.
7. Aim to gradually increase the duration of breath holds and the depth of inhalations over time as tolerated.

**Expiratory Breath Hold Technique**

The expiratory breath hold technique focuses on improving oxygenation and lung function by maximizing the elimination of carbon dioxide. Here's how to perform this technique:

1. Sit or stand in an upright position.
2. Take a slow, deep breath in through your nose, filling your lungs completely.
3. Exhale slowly and completely through your mouth, emptying your lungs as much as possible.
4. Hold your breath at the end of exhalation for a short duration, around 2-3 seconds.

5. Inhale slowly and deeply through your nose, maintaining a controlled and relaxed pace.
6. Pause briefly after the inhalation.
7. Repeat the cycle of exhale, breath hold,and inhale, gradually increasing the duration of breath holds and the depth of inhalations over time, as tolerated.

**DEEP BREATHING PROGRAMME:**

Participants in the Group-B (n=30) will undergo a deep breathing program, consisting of specific breathing techniques designed to promote relaxation and reduce stress. The program includes instructions on diaphragmatic breathing, pursed lip breathing, and box breathing.

**Diaphragmatic Breathing**

Gut breathing or abdominal breathing are other names for diaphragmatic breathing, involving consciously engaging the diaphragm muscle to promote deep inhalation and exhalation. This technique helps improve oxygen exchange and lung capacity. Here's how to perform diaphragmatic breathing:

1. Sit or lie down in a comfortable position.
2. Place one hand on your abdomen, just below your ribcage, and the other hand on your chest.
3. Take a slow, deep breath in through your nose, allowing your abdomen to rise as you inhale.
4. Exhale slowly through your mouth, feeling your abdomen fall naturally.
5. Focus on the movement of your abdomen, ensuring that it rises more than your chest as you inhale and falls as you exhale.
6. Repeat this deep breathing pattern for several minutes, aiming for a slow and relaxed pace.

**Pursed Lip Breathing**

Pursed lip breathing is a technique that helps regulate breathing, prevent air trapping, and enhance oxygenation. It involves inhaling slowly through the nose and exhaling gently through pursed lips. Here's how to perform pursed lip breathing:

1. Relax your facial muscles.
2. Breathe in through your nostrils slowly and deeply while counting to two.
3. Pucker your lips as if you were going to blow out a candle.
4. Exhale slowly and steadily through your pursed lips, counting to four.
5. Focus on making the exhale twice as long as the inhale.
6. Repeat this cycle of inhaling through the nose and exhaling through pursed lips for several minutes.

**Box Breathing**

Square breathing is another name for box breathing, is a technique that helps regulate breathing patterns and induce a state of relaxation. It involves equalizing the duration of inhalation, holding the breath, exhalation, and holding the breath again, creating a square-like pattern. Here's how to perform box breathing:

1. Find a comfortable position and relax your body.
2. Inhale slowly through your nose for a count of four, filling your lungs completely
3. For four counts, hold your breath.
4. For a count of four, softly exhale through your mouth, letting all the air out of your lungs.
5. Hold your breath again for a count of four.
6. Repeat this pattern of inhaling, holding, exhaling, and holding for several minutes.

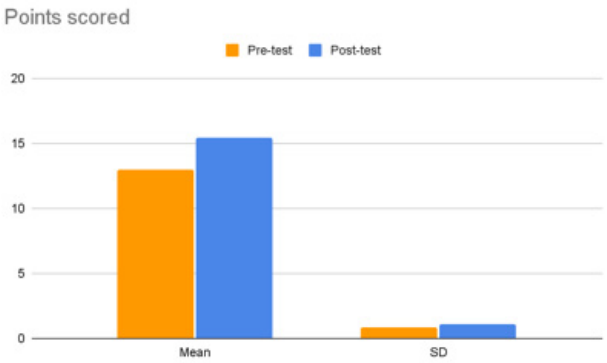
**Data Analysis**

Pre-test and post-test values of respiratory rate and Post Covid-19 Functional Status Scale (PCFS) using pulse oximeter.

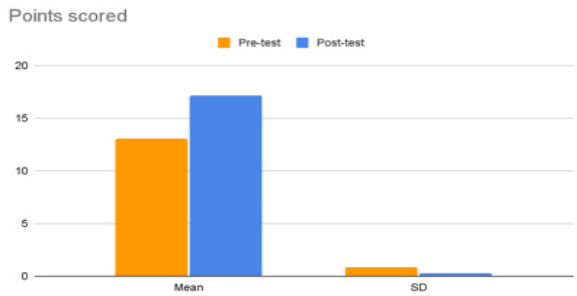
## Result

The Pretest mean of Respiratory rate Level for Group A Stacking breathing technique showed 13.00, the standard deviation 0.87, whereas the Post-test mean of Respiratory rate Level for Group A Stacking breathing technique showed 15.47, the standard deviation 1.07.This showed statistically significant in p-value of less than 0.0001.The Pre-test mean of Respiratory rate for Group B Deep breathing technique showed 13.10, the standard deviation 0.84, whereas the Post- test mean value of the Respiratory rate Level for Group B Deep breathing

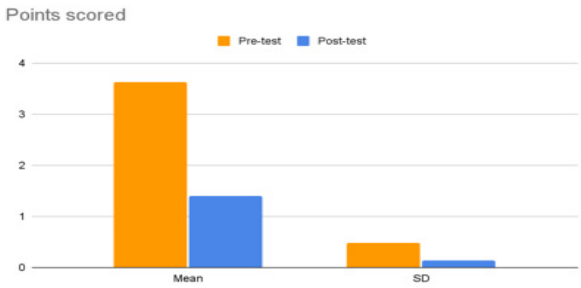
technique showed 17.17, the standard deviation 1.26.This showed statistical significance in p-value of less than 0.0001.The Pre-test mean of Post Covid 19 Functional Status Scale (PCFS) for Group A Stacking breathing technique showed 3.63, the standard deviation 0.49, whereas the Post-test mean of Post Covid 19 Functional Status Scale (PCFS) for Group A Stacking breathing technique showed 1.4, the standard deviation 0.77.This showed statistical significance in p-value of less than 0.0001.The Pre-test mean of Post Covid 19 Functional Status Scale (PCFS) for Group B Deep breathing technique showed 3.60, the standard deviation 0.50, whereas the Post-test mean of Post Covid 19 Functional Status Scale (PCFS) for Group A Stacking breathing technique showed 1.40, the standard deviation 0.77. This showed a statistical significance p-value of less than 0.0001. Post intervention, Respiratory rate of the participants those who received deep breathing for 4 weeks Mean (17.1700), standard deviation (1.2600) showed better results when comparing with participants those who underwent stacking breathing for 4 weeks Mean (15.47), the standard deviation (1.0700).This showed statistically significant in p- value of less than 0.0001.Post intervention, Post Covid 19 Functional Status Scale (PCFS) of the participants those who received deep breathing for 4 weeks Mean (0.83), the standard deviation (0.75) showed better result when comparing with participants those who underwent stacking breathing for 4 weeks Mean (1.40), the standard deviation (0.77).This showed statistical significance in p-value of less than 0.0001.



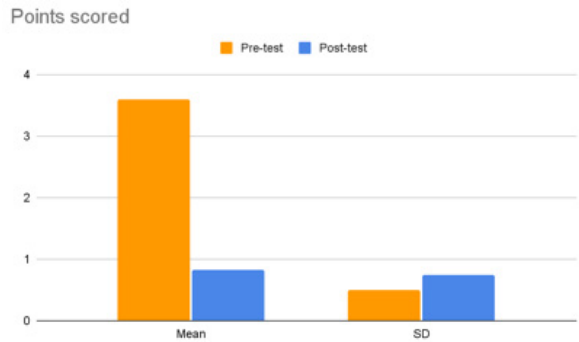

**Graph-1: Comparison between pre-test and post-test values of respiratory rate Group A stacking breathing**



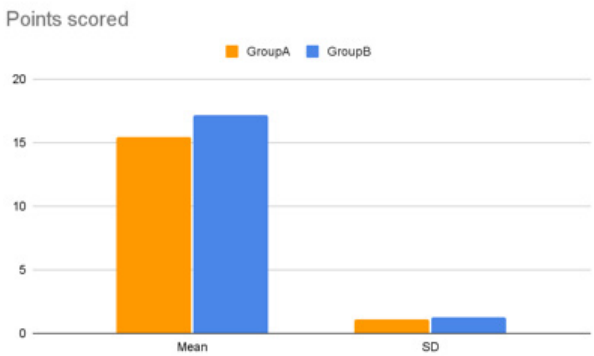

**Graph-2: Comparison between pre-test and post-test values of respiratory rate Group B deep breathing.**



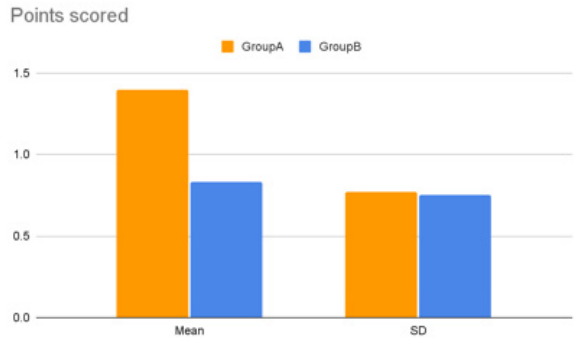

**Graph-3: Comparison between pre-test and post-test values of post Covid 19 functional status scale.**




**Graph-4: Comparison between pre-test and post-test values of post Covid-19 functional status scale (PCFS) Group B deep breathing .**




**Graph-5: Comparison between the post- test values of group A and B of respiratory rate**




**Graph-6: Comparison between the post- test values of group A and B of Post Covid-19 functional status scale**

## Discussion

The results of this study demonstrated significant improvements in respiratory efficiency parameters among post- COVID-19 patients who underwent the deep breathing intervention compared to the stacking breathing technique. This finding suggests that deep breathing exercises contributed to enhanced respiratory muscle strength and improved ventilation in post-COVID-19 patients.

M. Widnyana, Ida Bagus, and colleagues (2021) conducted a single case study on a 53-year-old female who had been diagnosed with COVID-19 infection.. Chest physiotherapy is useful in assisting COVID-19 patients with sputum clearance and enhancing ventilation. By strengthening the respiratory muscles, increasing chest expansion, and decreasing sputum buildup in the airways, this physical treatment can increase the respiratory system's effectiveness. Breathing exercises and chest physiotherapy may also be used. As per this conclusion my study also concluded that deep breathing exercises are effective when compared to stacking breathing among post covid-19 patient.[11]

Another Study Saif Ullah Sheikh, Aneesa Rehmani et.al. (2023), they conducted a Quasi-experimental study on effectiveness of Deep breathing exercises regarding dyspnea among Post Covid 19 patients with a subject of 120 patients and the study. The experimental group received a 25 minute deep breathing exercise intervention twice a day and the dyspnea was evaluated using a modified Borg Balance scale. The study concluded that Deep breathing exercises are useful in reducing respiratory problems in covid-19 patients.[12] This study also shows that deep breathing exercises are more effective than stacking breathing techniques among post covid 19 patients.

## Conclusion

This study finally concluded that deep breathing techniques have a high impact in improving Respiratory rate and Post Covid19 Functional Status Scale among Post Covid-19 Patients.

**Ethical clearance;** Taken from the institutional ethical committee.

ISRB number-03/060/2022/ISRB/SR/SCPT

**Source of Funding:** Self

**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# Assessing the Quality of Life with Cardiovascular Training and Pilates for Breast Cancer Survivors

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**Abstract**

**Introduction:** It has been estimated that over 15 million women suffer from breast cancer. Consequently, there is a lot of interest in physical treatment for breast cancer recovery. This study aims to find the impact of aerobic exercises and Pilates on improving QoL, fatigue, pain and physical fitness in breast cancer patients. The study is focussed on assessing the quality of life with cardiovascular training versus Pilates exercise for breast cancer survivors.

**Methods**: Total of 12 participants were chosen from Saveetha hospital (Chennai) and Global Hospital (Madanapalle), by random sampling. They were asked for a written consent form. The patients were randomly divided into two groups after completing pre-tests for QoL and FACIT-F. GROUP A received cardiovascular training (aerobic exercise program) alone and GROUP B received a combined program (aerobic exercise and Pilates). After 8 weeks of training with combined exercise and aerobic exercise alone QoL and FACIT-F scores were re-evaluated and post-test was reported. The collected data were tabulated and analysed. (Study period : September 2022 to June 2023).

**Result**: A significant difference in terms of statistics was found between GROUP A and GROUP B as well as within the group, based on the statistical examination of the quantitative data.

**Conclusion**: The findings of the present study demonstrate improvements in both Pilates exercise and cardiovascular training among women with breast cancer. However, GROUP B shows an extremely significant improvement compared to GROUP A.

Keyword : Fatigue, quality of life, breast cancer, aerobic exercise, Pilates exercise

## Introduction

Breast cancer is the most prevalent cancer diagnosed in women and the second most common cause of cancer-related mortality. It is also regarded as a chronic sickness with a prolonged survival time.[1] In fact, it has been estimated that over 15 million women suffer from problems brought on by this cancer.[2] Surgery, systemic chemotherapy, and radiation therapy are all cancer treatments that have successfully decreased mortality rates, but the elevated levels of weariness during treatment compromises their physical performance and quality of life, continue to be a concern.3-6 Cancer-

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related fatigue (CRF) is a complex concept that is believed to be the most common adverse impact for cancer patients;[7] it has a profound negative effect on patients' quality of life (QOL)[8,9] In cancer patients, performing physical activity has been suggested as a significant component of adjuvant therapy in BC care to improve QOL.[10,11] We are going to compare the effectiveness of Pilates and aerobic exercise in a variety of interventional approaches. Running, jogging, cycling, and walking are all forms of aerobic exercise that primarily rely on the aerobic energy-generating mechanism.[12] The Pilates method consists of exercises inspired from karate, yoga, zen medication helps in achieving physical and mental perfection.[13] The promotion of Pilates, a form of mind-body training, helps to build core muscle strength, which can then improve posture. The chances of cancer patients being cured and surviving are expected to increase as a result of improving the QOL.[14] Thus, the purpose of this study was to identify how CRF affected breast cancer patients' quality of life.

**Purpose**

Assessing the quality of life with cardiovascular training versus Pilates for breast cancer survivors.

## Materials and Methods

It was an experimental pilot study conducted on 12 participants from Saveetha

Medical College and Global hospital using Random sampling. The participants were separated into two equal groups based on random allocation

**Inclusion Criteria:**

- Breast cancer survivor women treated with chemotherapy or radiotherapy. Age group: 45 to 60 years.
- Not mixed with other forms of exercises.
- Currently not undergoing any chemotherapy or radiation therapy
- Having a fatigue score above 2.

**Exclusion Criteria:**

- Patients undergoing active therapy
- People with uncontrolled cardiovascular or vascular disease
- Patients regularly exercise

**Outcome Measure:**

FACIT-F Scale

EORTC QLQ C-30 Scale

**Procedure**

The study participants who met the inclusion and exclusion criteria were selected from Saveetha medical college and hospitals, Chennai, and Global hospitals, Madanapalle. Because of a lack of individuals who were willing to commit themselves to the training period, a total of 12 subjects were selected which were divided into two groups. Before beginning the treatment procedure, the individuals and caretakers are educated well about the study and obtained a formal written informed consent. After obtaining pre-test measurement of QoL and FACIT-F the patients who are having fatigue score greater than 2 are selected and were categorized into two groups using random sampling technique. Control group received cardiovascular training (aerobic exercise program) alone and the experimental group received a combined program (aerobic exercise and Pilates). After 8 weeks of training with combined exercise and aerobic exercise alone QoL and FACIT-F scores were re-evaluated and post-test was reported. The results, as well as the data gathered were tabulated and analysed. The pre-test and post-test values are compared and evaluated statistically. And comparison is done within the groups.

TREATMENT PROTOCOL:

Pilates GROUP B - Pilates exercise along with cardiovascular training. Group B was given Pilates exercise for 2 sets every session and each set contains 10 repetitions. Treatment given for 3 days a week continued for 8 consecutive weeks.

PROCEDURE: The treatment session is divided into 3 phases.

PHASE 1:

NOTE: Maintain pain free ROM

- Breathing exercises - Get the body ready for workout
- Neck stretches

-left and right neck

-yes and no stretch

-ear to shoulder stretch.

GOAL: stretching neck muscles improve neck and shoulders mobility as well as flexibility

- Seated chest opener

GOAL: to stretch the shoulder and chest muscles, strengthen middle back muscles and improve posture

- Interlace hands in front and overhead GOAL: to stretch your forearms, wrist, upper back, and shoulders
- Standing wall angels

GOAL: to increase shoulder range of motion and to stretch the pectoralis major and minor muscles

- Pendulum GOAL: This is a great exercise to help with swelling from lymphatic fluid that may have built up.
- Seated biceps curl GOAL: learn how to effectively use your arm muscles and develop upper arm strength.

PHASE II: For regaining strength, power, endurance.

- Shoulder shrugging exercise

GOAL: strengthening your shoulder muscles and upper arms

- Mermaid stretch

GOAL: stretches and engages our mid-lower back muscles as well as your primary breathing muscles

- Toe taps

GOAL: enhancing speed, balance, and foot-handling skills while increasing heart rate, working the muscles in your lower body, and burning calories.

- Leg circles

GOAL: help strengthen hip flexors and leg muscles including the quadriceps, hamstring, abductors, and adductors.

- Single leg kick
- Double leg kick

GOAL: works on the hamstrings and helps with stretching the muscles and improving endurance.

- Criss cross

GOAL: challenges pelvic stability and control

- Side lying chest opener

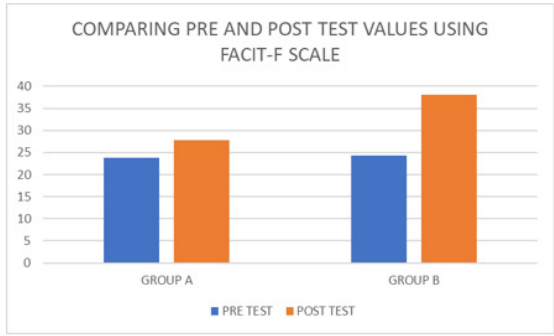
GOAL: Improves overall posture and shoulder flexibility while requiring minimal effort.

PHASE III:

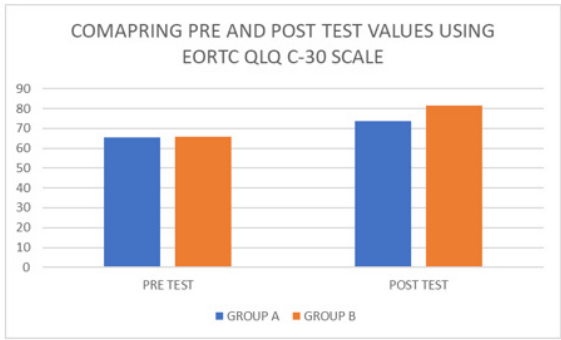
- Breathing exercise
- Slow march
- Marching with arm lift
- Mild stretches

**Data analysis**

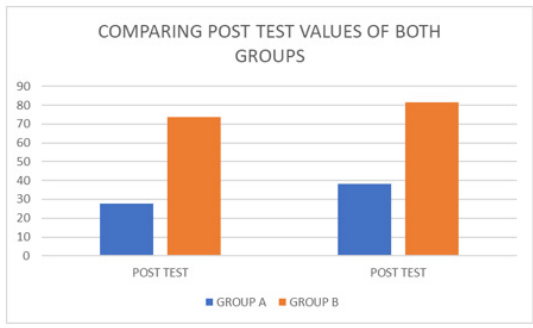
The collected data were tabulated and assessed using descriptive and inferential statistics. The parameter was subjected to a mean and SD calculation. The analysis of significant variations between pre-and post-test measures were done using a paired t-test. A significant change between two groups was examined using an unpaired t-test. Within the groups, P value of <0.05 Was used.




**Graph 1**




**Graph 2**




**Graph 3**

## Results

When compared to the pre-assessment, the post assessment shows that there is a significant decrease in fatigue and increase in quality of life using FACIT-F and EORTC QLQ-C30 scales. The Statistical mean value for FACIT-F cardiovascular training pre intervention was 23.83 and SD was 2.93. Whereas statistical mean value for cardiovascular post intervention was 27.83 and SD was 2.79. There is a significant P value less than 0.0001 with a T value of 15.4919. The Statistical mean value for FACIT-F Pilates pre intervention was 24.33 and SD was 3.27. Whereas statistical mean value for Pilates post intervention was 38.00 and SD was 1.67. There is a significant P value less than 0.0001 with a T value of 12.5930. Hence the post intervention Pilates mean value show higher significant value than the post intervention cardiovascular mean on FACIT-F. The Statistical mean value for EORTC QLQ C-30 cardiovascular training pre intervention was 65.50 and SD was 2.88 whereas statistical mean value for cardiovascular post intervention was 73.50 and SD was 3.08. There is a significant P value less than 0.0001 with a T value of 30.9839. The Statistical mean value for EORTC QLQ C-30 Pilates pre intervention was 65.83 and SD was 2.48 whereas statistical mean value for Pilates post intervention was 81.50 and SD was 1.22. There is a significant P value less than 0.0001 with a T value of 19.5171. Hence the post intervention Pilates mean value shows higher significant value than the post intervention cardiovascular mean on EORTC QLQ C-30.

## Discussion

This study sought to identify the elements that contributed to cancer patients' QoL and the degree of their weariness. In results there is a significant improvement on increasing QoL and decrease in fatigue, were observed. For breast cancer patients, the study's proposal is to present a Pilates and cardiovascular training protocol for women with breast cancer and compare its effects between two groups. The main conclusions of the current literature are that an organized program in Pilates technique exercises is appealing to a clinically applicable. There is a significant increase in physical standards, such as shoulder mobility, as well as improvements in psychological parameters, such as QoL, have been noted in the experimental group (Pilates with cardiovascular training). The impact for aerobic exercise (particularly walking) in Breast cancer survivors, the findings demonstrated that improving the physical activity, quality of life, and sleep characteristics with Aerobic activity was superior to standard treatment. The observed rise in physical activity levels significantly corresponds to an improvement in quality of life. Cancer patients undergoing biological response modifiers, radiation therapy, or chemotherapy for their disease frequently have CRF (cancer-related fatigue).15,16 With a prevalence rate of up to 99%, fatigue is a common side effect of cancer treatment for almost all patients. Significant improvements on increasing QoL and decrease in fatigue were observed. The majority of cancer patients reported that weariness prevented them from engaging in social activities like hanging out with friends or going out to eat as well as performing their routine daily responsibilities 17,18. A patient's QoL may also be significantly impacted by weariness brought on by chemotherapy, which also exacerbates and causes a number of side effects. Additionally, treatment dissatisfaction and anxiety about metastases may lower quality of life (QoL).20 Courneya et al (2007), shows evidence that physical activity in general improves QoL, mood, fatigue. According to Murtezani (2014), there are significant improvements on increasing QoL and decrease in fatigue, which were observed with aerobic exercise, particularly walking. Saarto et al., (2012) reported no change in significance between the exercise and control groups. This is accounted for by the patients in the control group's high levels of motivation and active lifestyles, which had a ceiling impact on the recognition of the health advantages of exercise. (2003), Papalardo and Reggio,19 discovered that weariness affected patients' daily activities, lowering their quality of life. The results of the logistic regression study showed that patients with breast cancer who received combination regimens were four times more likely than those who received a single regimen to have extreme fatigue. Quality of life can be an important predictor of better treatment outcomes. Over the past ten years, there have been numerous developments in the tools used to measure the standard of living for those with breast cancer. In

the study by Eyigor et al (2010), The six-minute walk test, depression, quality of life, and functional scores for the Pilates group all show statistically significant improvements following the intervention, but not for the control group. Only the six-minute walk test revealed a statistically significant improvement after the intervention, favoring the Pilates group over the control group.20 There has been a lot of interest in studies and reviews on physical activity over the last ten years. Reviews revealed that physical activity-based treatments could lessen symptoms such breast, arm, and early menopausal symptoms in addition to improving standard of living for breast cancer patients. Following the practice of physical activity following breast cancer therapy, systematic studies have noted better quality of life, cardiorespiratory capacity, and reduced fatigue. Given that these are two types of activities that value mind and body and can have a variety of effects and benefits. Daniela L. Stan et al, according to this study they observed at both follow-up visits, the data showed a strong correlation between the degree of weariness and QoL domains This study has conducted for 12 weeks on structured Pilates mat exercises for 15 breast cancer patients. The principal findings of this study are that a structured program in Pilates is of 60 % clinically relevant. However, combining Pilates exercise with cardiovascular training for an 8 weeks intervention program yields far greater outcomes than cardiovascular training alone in terms of reducing fatigue and enhancing standard of life.

## Conclusion

The findings of the present study demonstrate improvements in both Pilates exercise and cardiovascular training among women with breast cancer. However, (GROUP B) Pilates with cardiovascular exercise shows an extremely significant improvement compared to (GROUP A), cardiovascular training, which was found to be supportive in enhancing breast cancer survivors' quality of life.

**Ethical Clearance**: Taken from the institution of ethical committee

ISRB number: 03/099/2022/isrb/sr/scpt

**Source of funding**: Self

**Conflict of interest:** There is no conflict of interest during this research

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Original Article

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# Effectiveness of Mindfulness Yoga and Progressive Resistance Exercises on Anxiety and Depression among Parkinson's Disease

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**Abstract**

**Background:** This study was designed to inspect the effectiveness of Mindfulness Yoga and Progressive resistance exercise on anxiety and depression among Parkinson's disease.

**Purpose:** To compare the effectiveness of Mindfulness Yoga and Progressive resistance exercise on anxiety and depression among Parkinson's disease

**Materials and Methods:** The study was conducted with a sample size of 28 participants . The subjects were selected from Sri Saga Physiotherapy Centre, according to inclusion and exclusion criteria. Patients were completely explained about the safety and simplicity of the procedure and informed consent were obtained from the patient. For all the subjects Pre-test outcome measure were assessed using Hamilton anxiety and Hamilton depression scale. The subjects was divided into two groups based on concealed envelope method .Group A were given mindfulness yoga for 4 weeks of duration of 30 mins and Group-B were given Progressive resistance exercise for 4 weeks (10 reps*3 sets where 10RM=1kg) .At the end of $4^{th}$ week post outcome measures were analyzed using Hamilton anxiety and Hamilton depression scale and statistically tabulated.

**Result:** Statistical analysis of Hamilton anxiety and Hamilton depression scale examination post-test values revealed the constantly significant differences, with P value of $< 0.0001$.

**Conclusion:** Mindfulness yoga was found to be more effective than progressive resistance exercise in reducing anxiety and depression symptoms among Parkinson's patients.

**Key Words:** Mindfulness yoga progressive resistance exercise, anxiety, depression, Parkinson's disease, HAM-A, HAM-D.

## Introduction

The clinical syndrome known as Parkinson's disease is distinguished by tremor, rigidity, bradykinesia (slowness of movement), hypokinesia (reduced movement), and akinesia (loss of movement), as well as postural issues. The clinical manifestation of Parkinsonism, which is connected to a rare disorder that includes the degeneration of pigmented brain stem nuclei, including the dopaminergic Substantia nigra, is Parkinson's disease[1]. Parkinson's disease patients experience depression at a rate of 40%, which

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is different from other depressive disorders in that it is characterized by more anxiety and fewer thoughts of self-punishment [2].

According to the preliminary research, yoga helped people with PD improve their functional mobility, balance, and lower limb strength. This has effects on gait, postural stability, trust in one's capacity to maintain balance, and functional deficits brought on by inactivity. Yoga has been shown to promote flexibility in the upper and lower body, which can reduce rigidity, shuffled gait, and flexed posture in people with Parkinson's disease. The evidence given also revealed favorable results for mood and sleep, proving yoga's advantages for self-efficacy and social support [3].

Resistance training, for example, has been shown to lessen the symptoms of anxiety in adults and those with various chronic diseases. Resistance training and other types of physical activity, according to studies, are useful for the management of both motor and nonmotor symptoms of Parkinson's disease[4]. The impact of PRET on Parkinson's disease patients' quality of life and both motor and nonmotor symptoms, including depression, cognitive, sleep issues, and autonomic nervous system dysfunction[5].

## Aim

To find out the comparison between mindfulness yoga and progressive resistance exercise on anxiety and depression among Parkinson's disease.

## Materials and Methods

This research is an experimental study. The study was conducted with a sample size of 28 participants. The participants were selected from Shri Saga Physiotherapy Centre, according to inclusion and exclusion criteria. Participants received an extensive overview of the method, and a formal informed consent form was acquired.

**Materials required**: Yoga mat, Resistance band, Weights, Timer, Sand bags.

**Inclusion criteria:**

- Patient with stage I-III(Hoen and Yahr scale [6]) Parkinson's disease
- Gender: both males and females
- Age: 60 and above.

**Exclusion criteria:**

- Recent fractures in lower limb
- Unstable cardio-vascular disease
- Other neurological disease

**Outcome measure:**

The HAM-A and HAM-D was one of the first rating scales developed to measure the severity of anxiety symptoms, and is still widely used today in both clinical and research setting.

a) Hamilton anxiety rating scale (HAM-A[7])

b) Hamilton depression rating scale (HAM-D [8])

**Procedure**

Total of 28 participants were selected according to inclusion and exclusion criteria. Patients were explained in-depth about the safety and simplicity of the procedure and informed consent was obtained from the patients. The subjects were divided into two groups based on concealed envelope methods. Group A – 14 subjects and Group B -14 subjects. These subjects were assessed through Hamilton anxiety rating scale and Hamilton depression rating scale as a part of pre-assessment. Group A was given mindfulness yoga for 4 weeks duration of 30 minutes and Group B was given Progressive resistance exercise for 4 weeks ( 10 reps* 3 sets, where 10 RM= 1 kg). At the end of 4$^{th}$ week post outcome measures will be analyzed using Hamilton anxiety rating scale and anxiety depression scale and statistically tabulated.

**Group-A: Mindfulness Yoga**

Mindfulness yoga positively affects one's capacity to perceive and accept bodily sensation . A structured approach to mind-body training, mindfulness yoga reduces emotional disturbances by reducing sensory-perceptual evaluations and enhancing the connection between the mind and body. Due to its ability to promote stress tolerance, mindfulness yoga may be particularly useful for treating depression and anxiety. Mindfulness yoga focuses on the connection between the brain, mind, body, and behavior with the aim of using the mind to influence how the body functions and improve wellness.

Duration: 30 mins

Poses of Mindfulness Yoga:

- Tadasana
- Uttanasana
- Navasana

Tadasana:

A fundamental standing stance in yoga is tadasana, sometimes referred to as mountain pose. The word "Tada" (which means mountain in Sanskrit) alludes to the posture's power and steadiness. Tadasana is an excellent stance for developing strength, balance, and body awareness and is sometimes used as a springboard for subsequent standing postures. It supports better alignment, greater stability, and a calmer, more centered state of mind. Tadasana can help with overall alignment, balance, and mindfulness when practiced regularly.

Uttanasana:

The Standing Forward Bend pose, also known as Uttanasana, is a common yoga pose that promotes flexibility, relaxation, and mindfulness. It is a forward bending pose that stretches the hamstrings, calves, and lower back while also relaxing the mind and promoting a sense of calm. The pose has a calming effect on the nervous system and can help reduce stress, anxiety, and mild depression.

Regular practice of Uttanasana can help improve overall posture and balance by strengthening the muscles along the spine and core.

Navasana:

Navasana, also known as Boat Pose, is a popular yoga asana that offers a range of physical and mental benefits. It is a seated posture that resembles a boat, and it requires core strength and balance to perform correctly. Balancing in Navasana requires concentration and focus, helping to improve mental clarity and stability. While Navasana primarily targets the core, it also stretches the hamstrings and lower back, improving overall flexibility.

Practicing Navasana cultivates mindfulness, as it requires concentration on maintaining balance and posture. Being present in the moment can help individuals with anxiety and depression break free from ruminative thought patterns and foster a stronger mind-body connection.

**Group-B: Progressive Resistance Exercise**

Progressive resistance training is defined as exercise that involves fewer repetitions till tiredness, enough recovery time in between workouts, and an increase in resistance as the patient's capacity for force production grows[6]. Progressive resistance training sessions lasting 20 to 30 minutes were done three different days of the four-week intervention exercise programme. The progressive resistance training programme calls for three sets of 10 repetitions,(where,10RM=1kg) .Between each set, there was a 30 second break, and the activity lasted one to two minutes.

Bench Press:

Bench press is a popular strength training exercise that primarily targets the muscles of the chest, shoulders, and triceps. It is typically performed lying on a bench, pushing a barbell or dumbbells upwards from the chest to arm's length and then lowering it back down. Like other forms of strength training, bench pressing can have positive effects on mental well-being, including reduced stress, improved mood, and increased self-confidence.

Dead-Lift:

Deadlifts are a popular and effective exercise that can offer numerous benefits, not only for physical health but also for mental well-being. Deadlifts, being a compound movement that engages multiple muscle groups, can trigger a significant endorphin release, leading to reduced stress and improved mood.

Deadlifts require a strong mind-body connection, where you need to be aware of your body positioning, muscle engagement, and movement patterns. This increased awareness can translate to improved mindfulness and a better ability to stay present, reducing anxious thoughts about the past or future.

Unilateral Rowing:

Unilateral rowing, also known as single-arm rowing, is an exercise where you perform rowing movements using one arm at a time. This exercise is typically done with a dumbbell, kettlebell, or cable machine. Unilateral exercises like the single-arm row offer several benefits for both physical and mental health. Like any physical activity, rowing (unilateral

or bilateral) can trigger the release of endorphins, which are natural mood lifters and stress reducers. Regular exercise, including unilateral rowing, can help alleviate symptoms of anxiety and depression. Performing unilateral rowing requires concentration and focus to execute the movements correctly and maintain proper form. This focus can have a meditative effect, allowing you to shift your attention away from stressors and distractions, promoting mindfulness during the exercise.

Standing calf raise:

The standing calf raise is a simple yet effective exercise that primarily targets the calf muscles (gastrocnemius and soleus) in the lower legs. Performing calf raises, like other forms of exercise, can serve as a distraction from daily stressors and worries. Focusing on the exercise and feeling the muscles working can provide a mental break and reduce the impact of stress on the mind.

The act of performing standing calf raises involves concentrating on the body and its movements. Developing a stronger mind-body connection through exercise can enhance mindfulness and promote a greater sense of self-awareness, which is beneficial for mental health.

Lower Abdominal Exercise:

1. Reverse Crunches: Patients are made to lie on their back with their legs bent and raised in the air so that their thighs are perpendicular to the floor. Ask them to place their hands on the floor or behind their head for support. Asked them to contract their abs to lift their hips off the ground while pulling their knees toward their chest. Slowly lower the hips back down without fully touching the ground, and repeat.

2. Leg Raises: Patients are made to lie flat on their back with their legs straight. Placed their hands palms down on the floor beside you or under their lower back for support. Keeping your legs together and straight, lift them off the ground using your lower abs until they are perpendicular to the floor. Slowly lower them back down without touching the ground, and repeat.

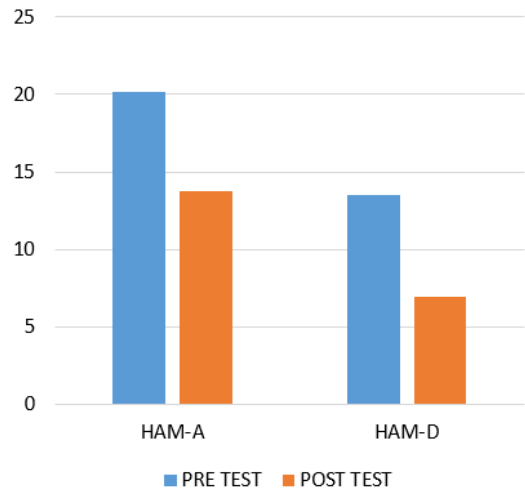
3. Mountain Climbers: Started with a high plank position with their arms extended and their body in a straight line. Engage their core muscles and one knee brought up to their chest then swiftly switch legs, bringing the other knee to their chest while stretching the other leg back. Maintaining a firm core throughout the exercise, continue running while alternating legs

4. Bicycle Crunches: With their hands behind their heads and elbows pointing out to the sides, the patient is forced to lie flat on their back. As the patient stands with their right leg straightened, instruct them to lift their shoulders off the floor and bring their right elbow to their left knee. Then switch, bringing their left elbow to their right knee and stretching their left leg straight. Then cycle back and forth between the two sides.

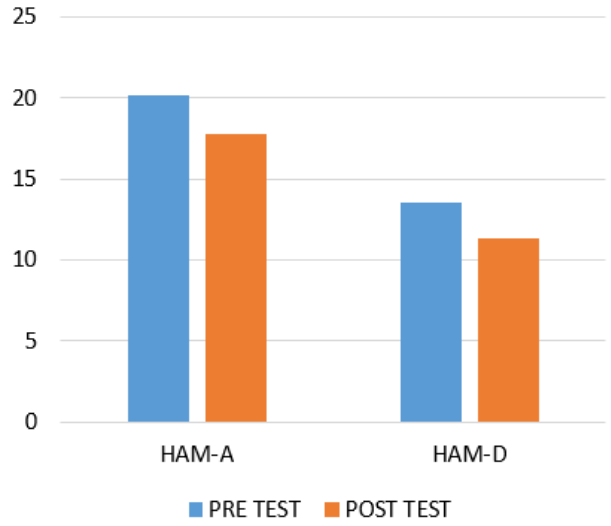
5. Plank Variations: Planks are excellent for targeting the entire core, including the lower abdominal muscles. Start in a push-up position and lower yourself onto forearms. Keep the body in a straight line from head to toe, engaging their core muscles. Patients are made to hold the position for as long as they can maintain proper form. To increase the difficulty can try side planks, plank with leg lifts, or planks with knee tucks.

**Data Analysis**

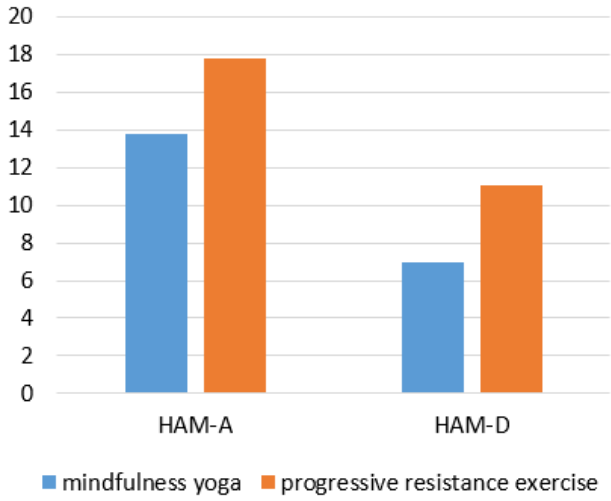
Using descriptive and inferential statistics, the acquired data was tabulated and evaluated. The mean and standard deviation (SD) were applied to all parameters. The significant differences between pre-test and post-test measures were analyzed using a paired t-test. The significance level of $p < 0.0001$ was judged statistically significant when using the unpaired t-test to examine significant changes between two groups.




**GRAPH 1: Comparison of pre-test and post-test values of Mindfulness yoga**




**GRAPH 2: Comparison of pre-test and post-test values of Progressive resistance exercise**




**GRAPH 3: Comparison of post-test values of Mindfulness Yoga and Progressive resistance exercise**

## Result

The collected data was tabulated and analyzed using descriptive and inferential statistics. Statistical analysis with quantitative data revealed significant difference values. A sample of 28 was taken.

In the HAM-A post-test the mean value in the group-B was 17.81(1.82), while it was 13.76(1.95) in the group-A. This indicates that the progressive resistance exercise group HAM-A scores were noticeably greater than the mindfulness yoga group, with a P value of <0.0001. (Table -3).

In HAM-D, the post-test mean value of progressive resistance exercise group was 11.05 (+1.97), whereas the mindfulness yoga group was 6.95 (+1.63). This indicates that the progressive resistance exercise group HAM-D score were noticeably greater than the mindfulness yoga group, with a P< 0.0001. (Table -3).

Statistical analysis of the HAM-A and HAM-D post-test results revealed that the mindfulness yoga and progressive resistance exercise showed similar statistically significant differences. As a result, the mindfulness yoga Group exceeds the progressive resistance exercise group statistically.

## Discussion

The goal of the present study is to compare the effectiveness of mindfulness yoga and progressive resistance exercise on anxiety and depression among Parkinson's disease and also assess the effectiveness in terms of reducing anxiety and depression symptoms. This comparison is demonstrated with a duration of 4 weeks. The outcome results were measured by HAM-A and HAM-D scale before and after treatment. Beneficial effects were significantly greater in Mindfulness yoga than the Progressive resistance exercise. When the responses were compared between both groups, the result showed a significant difference in the Mindfulness yoga group than Progressive resistance exercise group.

Based on the statistical analysis, both groups showed improvement in both the outcome measures. However, subjects in the Mindfulness yoga group showed better improvement in both the outcome measure than the subjects in the Progressive resistance exercise group.

An early study by Guillaume Lamotte, Elizabeth Skender(2015), in this highly supervised PRET programme may be effective for those with mild to moderate Parkinson's disease, according to a systematic review that synthesize the data that PRET can enhance strength and motor indications of Parkinsonism in PD patients as well as may be helpful for physical functions [5].

## Conclusion

According to the study, mindfulness yoga and progressive resistance exercise both reduces anxiety and depression symptoms. The findings suggest that mindfulness yoga is more advantageous than progressive resistance exercise in lowering anxiety and depression symptoms in Parkinson's patients.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations . (Application Number : 03/024/2022/ISRB/SR/SCPT ).

**Fundings:** This study is a self-funded study.

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**Conflicts of Interest:** The authors state that there is no conflict of interest.

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Original Article

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# Effectiveness of Jacobson Relaxation Technique and Bhastrika Pranayama on Sleep Quality in Elderly Subjects

**Gopika[1], Kumaresan[2], Prathap Suganthirababu[3], Vignesh Srinivasan[4], Surya Vishnuram[5], Priyadharshini[6], Jagatheesan Alagesan[7]**

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**Abstract**

**Background:** Insomnia continues to be one of the most prevalent sleep disorders seen in geriatric clinic population. It is typically characterized by the subjective complaints of trouble falling asleep, or experiencing nonrestorative sleep. This study was developed to determine the effectiveness of Jacobson relaxation techniques and Bhastrika pranayama on sleep quality in elderly subjects.

**Purpose:** To compare the effectiveness of jacobson relaxation techniques and Bhastrika pranayama on sleep quality in elderly subjects.

**Materials and Methods:** This study is an experimental study . A total of 86 people participated in the study based on inclusion and exclusion criteria, the participants were chosen from the old age home . The subjects who were willing to participate were divided into two separate groups as Group A (43 subjects) received jacobson relaxation techniques and Group B (43 subjects) received Bhastrika pranayama. All the 86 subjects were assessed with insomnia severity index scale. This techniques was given for 2 weeks , 5 days per week. Pre and post test values were calculated and tabulated.Study period: November 2022 to June 2023.

**Results:** According to statistical analysis Jacobson relaxation techniques are effective in improving the sleep quality in elderly subjects with p value of <0.0001.

**Conclusion:** This study finally concluded that Jacobson relaxation techniques have a higher impact "compared to Bhastrika Pranayama " in improving sleep quality in elderly subjects and also the quality of life in elderly subjects.

**Key Word:** Insomnia, Jacobson relaxation techniques, yoga technique,Insomnia severity index.

## Introduction

Insomnia is broadly described as a lack of satisfaction with either the quality or quantity of sleep. This is frequently accompanied by one or more of the following: having trouble falling asleep and staying asleep, difficulty staying asleep as evidenced by numerous awakenings or difficulty falling asleep again after awakenings, and early morning awakening with difficulty falling back to sleep.[1] Insomnia may also be brought on by a sleep-wake switch that is less effective. During sleep, REM

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sleep cycles gradually take the place of non-rapid eye movement (non-REM) sleep stages. According to the AASM, there are five stages of sleep. Stage W (awakening) Stage N1 (calm awakeness) N2 stage light sleep Stage N3 (slow-wave or deep sleep) REM sleep stage R, also known as dreaming.2 Problems falling asleep or maintaining sleep after waking up in the middle of the night or earlier than necessary or desired are characteristics of insomnia. Having trouble falling asleep, having trouble staying asleep, and waking up early are the three terms used to describe these problems.[3] Hyperarousal during sleep and awakeness is a result of the pathophysiology of insomnia disease. A high level of hyperarousal is a sign. An increase in cortisol and adrenocorticotropic hormone during the early stages of sleep, a decrease in parasympathetic tone in heart rate variability, and both sleep and wakefulness are associated with an increase in the body's metabolic rate.[1] Patients who claim to have insomnia frequently have a number of issues, such as difficulty falling asleep and sleep that is neither restorative or refreshing or to continue dozing off. Important diagnostic implications arise from a patient's insomnia's duration. Acute stress, acute sickness, jet lag, or self-medication are frequently causes of transient insomnia, which lasts only a few days. In patients who are terminally ill, sleep disruption is a common and stressful issue. Poor sleep has an impact on life satisfaction and can amplify symptoms like pain, depression, or anxiety. Women experienced insomnia more frequently than men. Multiple causes frequently contribute to insomnia in terminally ill patients, and both physical and psychological variables are thought to be significant etiological factors.6.A significant risk exists for older persons with insomnia symptoms to also experience sadness, anxiety, and pain issues. Therefore, preventative interventions that focus on mild sleep complaints have the potential to delay the development of various morbidities in older adults as well as clinical insomnia in this population at risk. Sadly, resources that give cognitive behavioral treatment (such as highly skilled clinicians) may not be practical or cost-effective in places where normal care is provided, especially for older persons with moderate sleep complaints but not syndromal insomnia. Furthermore, rather than focusing on disease treatment, older persons are increasingly looking for lifestyle changes that promote health.[7] Progressive muscular relaxation is effective because it allows your muscles to release tension. When you are completely relaxed, your body will naturally transition from an alert state to a resting state. In conjunction with steady, diaphragmatic breathing, you can relax each muscle group. Progressive Muscular Relaxation thus provides long-term effects that enhance patients' quality of life.[12] The breathing exercises are known as pranayama, a Sanskrit word for prana (life force) and ayama (control). It refers to a set of voluntarily performed breathing exercises that affect the respiratory frequency, inhalation frequency, retention frequency, exhalation frequency, and body locks frequency (bandh). Bhastrika pranayama is the only method for taking full breaths in and out so that our body obtains enough oxygen so that our body obtains enough oxygen. The regular breathing pattern and the movement of cerebral fluid is accelerated by exhalation, creating Brain compression and decompression. Rhythmic Diaphragmatic breathing activates the heart and lungs' muscles blood circulation is improved.[11]

## Aim

To find out the effectiveness of Jacobson relaxation technique and Bhastrika pranayama on sleep quality in elderly subjects.

## Material and Methods

It was an experimental study conducted on 86 subjects with sleep disturbance among older age group participants taken from Sai Sri Old Age Home. Concealed envelope method randomized controlled trial method was used in the study.Study period: November 2022 to June 2023.

**Inclusion criteria:**

- Patients with sleep problem are included
- Both the genders were included in the study.
- Score of greater than 10 in insomnia severity index scale.
- Over 30 minutes have passed since the start of sleep.
- Being unable to go back to sleep after an early wakeup.

**Exclusion criteria:**

- Participants in other interventional studies.
- Patients who refuse to sign consent forms or a lack of ability to adhere to study instructions.
- Patients with acute heart failure and restless leg syndrome.

**Procedure**

This study is an experimental study The study included a total of 86 participants. The participants were chosen from an old age home based on inclusion and exclusion criteria. A formal informed consent form was signed after each participant had a detailed description of the procedure. Group A (43 subjects) and Group B (43 subjects) were created out of the willing participants. Total of 86 participants were assessed using insomnia severity index scale for both pre and post test.Jacobson relaxation technique was given to Group A, whereas Bhastrika pranayama was given to Group B. For two weeks and five sessions a week. Values from the pre- and post-tests were calculated and tabulated.

**Group A: Jacobson relaxation technique**

Jacobson relaxation technique: Subject position: Supine lying. Therapist position: To perform Jacobson relaxation technique the therapist stands at the side of the bed.

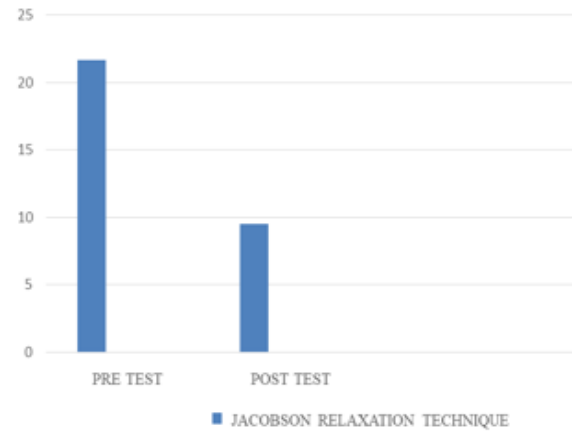
Technique: Ask the patient to Tighten the foot muscles and curl the toes starting from the feet. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Contract the lower leg muscles. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Contract the hip and buttock muscles. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Contract your chest and stomach muscles. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Contract the shoulders. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Contract your facial muscles, such as by tightly closing your eyes. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Make a fist by contracting the hand's muscles. Hold for five seconds, then gradually let go for ten. Pay close attention and the sensation of relaxation as you release. Contract the lower leg muscles. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Contract the hip and buttock muscles. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Contract your chest and stomach muscles. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Contract the shoulders' muscles. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Contract your facial muscles, such as by tightly closing your eyes. Hold for five seconds, then gradually let go for ten. Pay close attention to the tension being released and the sensation of relaxation as you release. Make a fist by contracting the hand's muscles. Hold for five seconds, then gradually let go for ten. Pay close attention.

**Group B: Bhastrika pranayama:**

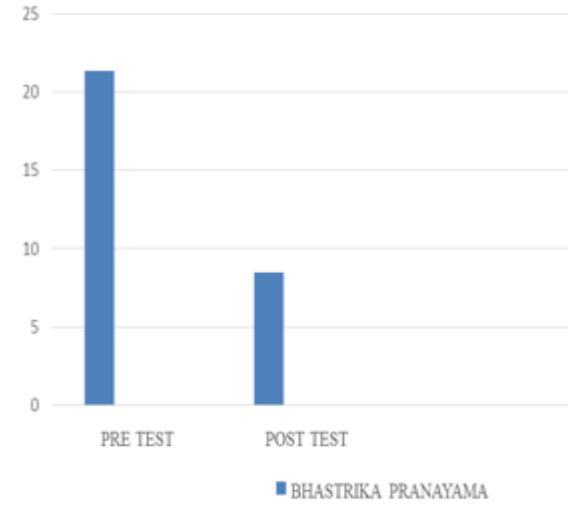
Subject Position: Half lying. Therapist Patient front facing the subject . Technique: Make sure both the nostrils are open. Ten times, aggressively inhale and exhale through both nostrils, count each breath. Inhale deeply through both nostrils for a long time. Hold your breath for a few seconds while closing both sides of your airways. Breathe out gradually through your joint nostrils. The most rounds possible should be performed. Progressively extend the retention period until it is at most 30 seconds after inhaling via the left, right, and both nostrils. Make no effort. Duration: 5 sessions for 2 week. Study period: November 2022 to June 2023.

**Data Analysis**

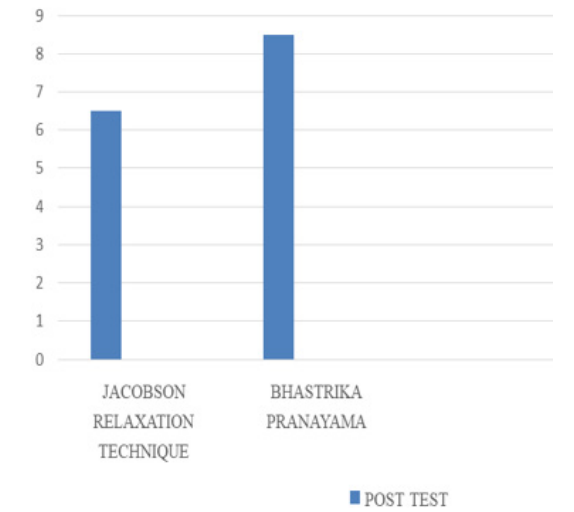
A statistical analysis is made with quantitative data revealed a statistically significant difference between the jacobson relaxation techniques group and the Bhastrika pranayama group,




**Graph-1: Comparison between pre-test and post test value of jacobson relaxation techniques.**




**Graph-2: Comparison between pre-test and post-test value of Bhastrika Pranayama.**




**Graph-3: Comparison between Post test value of jacobson relaxation techniques and Bhastrika pranayama.**

## Results

The statistical analysis of Group A by using insomnia severity index scale, pre-test and post-test Mean values of 21.65 ± 7.49; and SD values of 4.15 ± 0.51; SEM values of 0.63 ±0.08 ; T value of 22.6863 with P value less than 0.0001 ; and the statistical analysis of Group B by using the insomnia severity index scale pre-test and post-test Mean values of 21.35 ± 8.49 ; and SD values of 4.15 ± 0.51; SEM value of 0.63± 0.08 ; and T value of 20.5521; with P value less than 0.0001 and the difference between the two groups a and b by using the insomnia severity index scale were evaluated by post- test Mean values are 3.50 ± 2.10; and SD values of 0.51 ± 1.02; and SEM values are 0.11 ± 0.23; and T value of 5.4802 with P value less than 0.0001 ; These differences indicates that Group A which is treated with Jacobson relaxation techniques was highly benefited compared to Group B who was provided with Bhastrika pranayama

## Discussion

The goal of the present study was to compare the effectiveness of Jacobson relaxation technique and Bhastrika pranayama on sleep quality in elderly subjects. This comparison is demonstrated with a duration of 2 weeks. The outcome results were measured by insomnia severity index before and after treatment. Beneficial effects were significantly greater in Jacobson relaxation techniques than the Bhastrika pranayama. When the responses were compared between both groups, the result showed a significant difference in Jacobson relaxation technique than Bhastrika pranayama. Zahi Amon, PhD et, al (2008) concluded that, music relaxation appears to be more effective than progressive muscle relaxation in treating insomnia in older persons. The findings do, however, indicate that while determining the best course of action, emotional and personality characteristics must be taken into consideration. There is a need for additional research utilizing other techniques given the small sample size and the use of only two relaxation techniques.[9] Wafaa Taha Ibrahim Elgzar et, al (2018) concluded that post-c-section women who use the progressive muscle relaxation technique have lower post-c-section pain, better sleep quality, and lower physical activity levels than those who just received normal nursing care.[10] Evangeline

Sally Jeyasigh et, al (2022) concluded that a method or procedure for calming the mind is pranayama. An overall healthy body and mind may be attained through pranayama. Through the process of Prana (vital force), one can walk a route to higher degrees of reconnection and live a healthy existence. When practicing pranayama, there are some guidelines that must be observed. In some circumstances, it may be utilized as a therapeutic technique.[12] Tejal C. Nalawade (2016) concluded that this study raises the possibility that using Jacobson's Progressive Muscle Relaxation could help older persons feel happier and less depressed while also lowering their symptoms of depression. When Progressive Muscle Relaxation is performed and incorporated into a 27 Person's lifestyle, it can assist in reducing bodily tension and reducing some of the symptoms of stress reaction.[11]

## Conclusion

According to the findings of this study, Jacobson relaxation techniques were found to be more beneficial than Bhastrika pranayama in improving the quality of sleep in elderly people. As a result, it is suggested that this procedure be explored further in clinical practice to improve sleep quality in elderly subjects.

**Ethical clearance:** Taken from institutional ethical committee. ISRB number -03/025/2022/ ISRB/SR/SCPT.

**Funding:** This study is a self-funded study.

**Acknowledgements:** The author would like to express their sincere thanks to the study participants, the authors whose works are referenced and cited in our manuscript, and the creators of the TIS

**Conflict of interest:** The authors state that there is no conflict of interest

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Original Article

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# Effectiveness of Climbing UP and Down Stairs Exercise on Frailty among Geriatric Population: Quasi Experimental Study

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**Abstract**

**Background:** This study was developed to determine the effectiveness of climbing up and down exercise on frailty among geriatric population.

**Purpose:** To find the effectiveness of climbing up and down stairs exercise on frailty among geriatric population.

**Materials and Methods:** This research is the Quasi experimental study. The subjects were collected from Jeevan Jothi Home for Aged and Destitute, Kanyakumari.There are 54 subjects were selected based on inclusion and exclusion criteria. All the subjects were assessed with Edmonton frail scale as pre test and the same test was performed for post test at the end of 4 weeks from May 2023 to July 2023. 5 days per week 11 steps* 3 repetition* 3 sets. Each set 5 min rest is given. Pre test and post test values were calculated and tabulated.

**Results:** The collected data was statistically analyzed using the paired t-test. Statistical analysis of Edmonton frail scale examination post value revealed the constantly significant differences, with the p value of <0.0001.

**Conclusion:** According to the study, climbing up and down exercise is effective for reducing frailty among geriatric population.

**Key Word:** Frailty, Edmonton frail scale, climbing up and down exercise, elderly patients

## Introduction

Globally, population ageing is a common phenomenon. The percentage of adults 65 and older is expected to increase from 15% in 2015 to 24% in 2060, according to the U.S. Census Bureau.[1] The sentence emphasizes the significance of frailty as a prominent indicator of population aging. Frailty is a clinical condition that arises due to the natural decline of various physiological systems associated with aging. This decline renders individuals more susceptible to experiencing sudden changes in health when exposed to relatively minor stressors. It is estimated that frailty affects around 25% to 50% of people who are 85 years old and above. Furthermore, individuals experiencing frailty face significantly elevated risks of mortality, requiring long-term care, developing disabilities, and experiencing falls. [2,3]

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The concept of frailty as a stage of vulnerability that is commonly associated with the process of aging. It explains that frailty is considered a biological condition that occurs prior to the onset of disability. In other words, it suggests that as individuals age, they may experience a period of frailty characterized by increased susceptibility to health problems and a decline in physical and functional capabilities. This phase of frailty is seen as a precursor to the development of disabilities or other age-related health issues.[4]

The existence of at least three particular criteria constitutes the frailty syndrome's fundamental idea. These requirements include low levels of physical activity, slow energy, poor endurance, and frailty. A healthcare condition known as frailty syndrome is marked by reduction in physical capability and an increased susceptibility to unfavourable health outcomes.[5] Chronic illnesses that affect older people's bodies over time, like diabetes, osteoarthritis, and heart conditions, can leave them vulnerable and feeble.[6]

Physical, psychological, and social aspects are all included in the concept of fragility, which is seen as a multidimensional phenomenon.[7] Multiple functioning areas, including locomotion and mobility, equilibrium, muscular strength, aerobic capacity, and motor processing are all significantly impacted by frailty.[8]

A geriatric syndrome known as falls is linked to both extrinsic and intrinsic variables. Rugs, staircases, and inadequate lighting are just a few examples of the extrinsic reasons that are typically connected to the inside of the home. while the underlying factors include postural hypotension, chronic disease, muscle weakness, diminished visual acuity, cognitive deficiencies, changes in balance or gait, and the use of psychoactive drugs. [9]

Multi-component exercises (i.e., endurance, simultaneous strength, and balance training), Tai Chi, and resistance training have all had positive benefits on a number of functional indices in fragile, older participants. However, due to the fact that resistance training stimulates a number of physical health factors, including strength, cardiorespiratory fitness, and balance, multi-component exercise programmes that include it appear to produce larger overall improvements.[10]

The following elements can help prevent or lessen frailty: nutritional assistance emphasizing calorie consumption and vitamin intake; high blood pressure management; atherosclerosis prevention; isolation evasion through social interaction; pain management; depression treatment; and a range of exercises to increase equilibrium, dexterity, strength, and power.[11]

There is growing proof that fitness training can lessen physical weakness. Recent research, for instance, has demonstrated that exercise training can significantly enhance balance, strength, range of motion, and tasks like getting up off the ground and stepping out of the chair in frail older people.[12] Exercise appears to be helpful in enhancing physical abilities in older persons, including sit-to-stand performance, balance, agility, and ambulation. [13,14]

In comparison to clinical impression of the geriatric specialists following their thorough evaluation, the Edmonton Frail Scale (EFS) was a reliable indicator of frailty. The EFS demonstrated adequate internal consistency, good reliability, and good construct validity. The interview has ten sections since fragility is presented in many different ways. A scale called Edmonton Frail Scale (EFS) is used to quantify changes in frailty. The EFS evaluates nine subscales, including cognition, general health status, functional independence, social support, medication use, diet, mood, continence, and functional performance. The maximum potential score is 17 points, which equates to the frailest state.[15] The aim of the study is to managing frailty among geriatric subjects from climbing up and down exercise.

## Aim

To find the effectiveness of climbing up and down exercise on frailty among geriatric population.

## Material and Methods

This research is quasi experimental study. The study was conducted with sample size of 54 participants. The participants were selected from Jeevan Jothi old age home, according to inclusion and exclusion criteria. Participants received an extensive

overview of the method and a informed consent form was acquired.

**Materials required:** Stairs with handrail support.

**Selection criteria**

**Inclusion criteria:**

- Age group of 65 years and above,
- Both the gender,
- Edmonton frail scale mild frailty (8-9), moderate (10,11).

**Exclusion criteria**:

- Unconscious patients,
- Patients with heart problems,
- Patients who refused to participate in research.

**Outcome measures:**

- Edmonton frail scale

An instrument for determining an older adult's level of frailty is the Edmonton Frail Scale (EFS). It is intended to assess senior people's functional and cognitive conditions, general health, and social support. The EFS aids healthcare providers in identifying frail people who may be more susceptible to negative health consequences or who need more care and support. The nine items that make up the Edmonton Frail Scale evaluate several aspects of frailty. Each item is given a value between 0 and 2, with higher scores signifying greater fragility. The nine domains are cognition, general health status, functional independence, social support, medication use, nutrition, mood, continence, functional performance.

**Procedure**

This study is a Quasi experimental study. The study involved a total of 54 subjects, with 33 females and 21 males, who were selected based on specific inclusion and exclusion criteria. Prior to the study, the patients were provided with a thorough explanation of the safety and simplicity of the procedure, and their informed consent was obtained.

All the subjects underwent an assessment using the Edmonton Frail Scale both before and after the intervention, which lasted for a duration of 4 weeks. The intervention involved climbing up and down stairs and was conducted five days per week. The specific exercise protocol consisted of climbing 11 steps, performing 3 repetitions, and completing 3 sets.

For the climbing up exercise, a sturdy staircase was chosen, and participants were instructed to use the handrail for support while climbing. They initially started with one step and gradually progressed to multiple steps. Patients were advised to maintain stability and support by holding the handrail, taking one step at a time, and ensuring their entire foot was placed on each step before proceeding to the next. This approach aimed to ensure safety by maintaining a steady and slow pace.

When performing the climbing down exercise, participants were instructed to face the steps while standing at the top of the staircase. They were advised to place one foot firmly on the first step, followed by bending the knee and hip, lowering the body, and transferring the weight to the foot on the step. The process was repeated for each subsequent step, with participants being reminded to control their descent and ensure both feet were firmly placed on each step before proceeding to the next. As with the climbing up exercise, participants were encouraged to use the handrail for stability and support.

Before initiating the exercise program, precautions were taken to ensure the safety of the participants. This included clearing the pathway of any obstacles or hazards that could cause slipping and ensuring that participants wore comfortable footwear with good traction to prevent falls. Participants were also encouraged to communicate any pain, aches, or nausea they experienced during or after the activity. Prompt attention and resolution of any issues were deemed essential for safeguarding the participants' well-being.

**Data analysis**

Using descriptive and inferential statistics, the acquired data was tabulated and evaluated. The mean and standard deviation (SD) were applied to all parameters. The significant differences between pre-test and post-test measures were analyzed using a paired t-test. The significance level of $p < 0.0001$ was judged statistically significant.

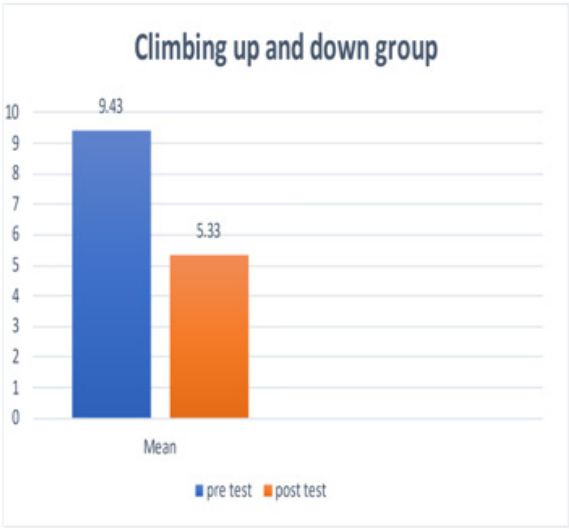



**Fig 1: Comparison of pre-test and post-test values of climbing up and down exercise using Edmonton frail scale**

## Results

The process of data analysis and presents the findings related to the effectiveness of a specific exercise for frailty patients. The collected data was tabulated and analyzed using descriptive and inferential statistics. The data collected for the study was organized and examined using two types of statistical analysis: descriptive statistics and inferential statistics. The data necessary are statistically significant between pre-test and post-test, with a mean value of 9.43 in the pre-test and 5.33 in the post-test and a standard deviation of 1.13 in the pre-test and 1.08 in the post-test. This part indicates that a statistical analysis was performed to compare the data obtained from the pre-test and post-test measurements. The data is statistically significant, suggesting that the observed differences between the pre-test and post-test results are unlikely to occur by chance. The mean value of 9.43 in the pre-test and 5.33 in the post-test indicates the average scores for the participants in each test. Additionally, the standard deviation of 1.13 in the pre-test and 1.08 in the post-test represents the variability or spread of the scores around the mean in each test. As a result, climbing up and down exercise is effective for frail patients. This implies that the exercise has had a positive impact on the participants' conditions, possibly improving their frailty status.

## Discussion

This study is to find out the effectiveness of climbing up and down exercise on frailty among geriatric population. Frailty is the common geriatric condition which is assessed by Edmonton frail scale which includes nine subscales, including cognition, general health status, functional independence, social support, medication use, diet, mood, continence, and functional performance. Total of 54 samples were selected using Edmonton frail scale scoring of mild (8-9) and moderate (10-11) based on inclusion and exclusion criteria. Patients were made to do climbing up and down exercise for 4 weeks 5 days per week 11 steps* 3 repetition* 3 sets. The pre- test and post -test values are calculated using Edmonton frail scale.

John E Morley et.al. (2020) concluded that the likelihood of having one or more geriatric symptoms of frailty, dementia and loss of weight among older adults across all care horizons was found to be high by the RGA, a reliable screening tool. Although these syndromes have a negative impact on mortality, functional status, and quality of life, they are frequently underdiagnosed and undertreated. To enable the adoption of multifaceted, tailored therapies to stop future morbidity and disability and encourage effective ageing in place, geriatric syndrome screening is done.[16]

Catarina LN Pereira et.al. (2008) concluded that to maximise the advantages of intervention, physical activity should be a component of an interdisciplinary approach to fall prevention and its effects. Although fall risk factors have been precisely identified, certain control techniques have been researched and, in some circumstances, applied, most approaches are inconsistent.[17]

Simone Perna et.al. (2017) concluded that assessing frailty using the EFS is a useful performance measure for classifying the level of fragility in a sample of institutionalised seniors. As a matter of fact, research has demonstrated that the EFS is linked to a number of geriatric problems, including independence, drug use, mood, mental function, and nutritional status.[18]

Maria Giné-Garriga et.al. (2014) concluded that elderly individuals who are frail can benefit from exercise, while it's unclear which exercise qualities

(kind, frequency, and duration) are most beneficial. Such studies should examine the long-term impacts of physical activity interventions, particularly task-oriented or functional practise programmes, while adding methods to improve adherence and gauging medium- and long-term performance results. Despite tremendous effort over the past ten years, the literature has failed to produce a clear consensus definition of frailty. A crucial issue that needs more study is whether or not disability should be viewed as a cause or effect of frailty. The study and practise suggestions for precisely defined, homogeneous groups will be guided by a consensus on what constitutes frailty and the standards to be used in clinical practise.[19]

## Conclusion

The results of the study on the impact of climbing up and down stairs on frailty in the geriatric population before and after using the Edmonton Frail Scale to compare the data showed that p0.0001 in all parameters. This study demonstrates that the activity of climbing up and down stairs was more beneficial for post-treatment recovery.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/026/2022/ISRB/SR/SCPT).

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**Conflict of interest:** The authors state that there is no conflict of interest

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Original Article

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# Awareness Through Movement and Swiss Ball Exercise on Muscle Weakness among Subjects with Postural Syndrome

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**Abstract**

**Background:** A general definition of Postural syndrome is a lack of muscle strength or the quality or quantity of movements. This is typically accompanied by one or more of the following all of the joints in the body have an effect on body posture, which is the alignment of a person's body parts with respect to one another and their surroundings at a specific moment in time.

**Purpose:** To compare the effectiveness of Awareness through movements and swiss ball exercise on postural syndrome patients.

**Materials and Methods:** A total of 28 individuals were chosen based on the inclusion and exclusion criteria from Sai Charan physiotherapy clinic ,Arakkonam, Ranipet, Tamil Nadu ,India. After explaining the treatment's safety and ease of use to the participants, a signed agreement was acquired. Group A [14N] Awareness through movements are given GroupB[14N] Swiss ball movements are given. The pre test and post test results were obtained through Patient specific functional scale.Study duration : 4 Weeks . The entire process was performed from November 2022 to March 2023.

**Results:** As a result, swiss ball exercise is more effective than awareness through movement by analyzing the statistical values of pre test and post test.

**Conclusion:** The study's goal is to evaluate its effects. of swiss ball movement exercise and awareness through movements postural syndrome individuals in the society.

**Key Words:** Postural syndrome ,swiss ball exercise, pelvic clock ,cat and camel stretch.

## Introduction

Postural syndrome is a discomfort that occurs between the inferior gluteal folds and the superior scapula level and it may or may not be accompanied by back pain and it occurs due to dysfunction of soft tissues due to prolong abnormal postures, 10% of instances have a known cause, however the majority of cases are generic. Modern imaging methods like magnetic resonance imaging (MRI) scans and computed tomography (CT) scans are rarely able to pinpoint the source of discomfort.

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The ideal strategy to handle this challenging pain problem is now somewhat of a conundrum for both the patient and the practitioner. A simple measurement of a patient's gait and posture can reveal information about the musculoskeletal system's capacity to adjust to physical stimuli. Understanding the basics of gait and posture is essential for diagnosing and treating musculoskeletal pain. It also discusses typical musculoskeletal problems and the links between them and aberrant posture and gait[1]. There's some debate among the researchers, ergonomics specialists, and the general public on replacing office chairs with gym balls and using them as seating options at home[3]. Part of the issue stems from lack of understanding and expertise regarding this use of the gym ball. Both of the patients in this case had low back pain, but their conditions improved as soon as they started using the gym ball on a regular basis. Case presentations are used to describe how a condition was treated as well as to encourage discussion that could result in future research. Swiss therapists were the first to use the gym ball to help children with cerebral palsy gain better balance and equilibrium. The gym ball can help to influence how muscles perform, according to recent research[5]. Benefits have been noticed by trainers and therapists in their patients and clientele. Gym balls have also been proposed as a learning aid by educators. One benefit of utilizing balls, according to Janda and Vavrova, is that they are secure, reduce the risk of harm to nearly nothing, and activate proprioception, balance, and equilibrium control[9]. Through gentle exercises and motions, the feldenkrais aims to enhance movement and body awareness[10]. These exercises are meant to improve your general physical and mental health as well as your flexibility and coordination. Instead of aiming towards particular ends or aims, feldenkrais technique promotes movement inquiry and awareness. If at all feasible, it's best to have instruction from a qualified feldenkrais practitioner who can lead you through the exercises and offer tailored advice depending on your requirements and capabilities[11].

## Aim

To compare the effect of awareness through movements and swiss ball exercises among postural syndrome.

## Material and Method

A total of 28 individuals were chosen based on the inclusion and exclusion criteria from Sai charan physiotherapy clinic,Arakkonam,Ranipet,Tamil Nadu ,India.After explaining the treatment's safety and ease of use to the participants, a signed agreement was acquired. Group A [14N] were givenAwareness through movements and Group B [14N] were given Swiss ball exercise .The pretest and post test results were obtained through Patient specific functional scale.

Study Duration:4 weeks. The entire process was performed from November 2022 to March 2023.

Materials required: [swiss ball, mat]

**Inclusion criteria**

- Subjects who has been diagnosed with postural syndrome
- Age between 20-35 years
- Both male and female
- Muscle weakness and stiffness
- Chronic pain

**Exclusion criteria**

- Open wounds
- Fracture Dislocations
- Infective Lesions
- Disc herniations
- Age below 17 years

**Outcome measures**

Assessment was performed at before and after the treatment.

Patient specific functional scale[PSFC].

**Procedure**

Subjects who were willing to take part in the study were sort-out based on the selection criteria and informed consent was obtained after explaining about the process of study and the safety of the procedure. A total of 28 subjects were recruited and using the odd even ratio were divided into Awareness through movement group A (n=14) treated with Feldenkrais exercises and group B (n=14) treated with Swiss ball exercises. The pre-test value was measured using the

PSFC and the same were recorded as post-test after four weeks of intervention

**Awareness through movement: Group[A]**

**For** subjects who were treated with Feldenkrais exercise technique ,the following movement patterns were performed-

Pelvic clock, Shoulder rolls, Cat camel stretch.

These exercises can be performed in sitting, and lying on your back.

**Pelvic clock**

To do the pelvic clock, lie on your back with your legs bent and your feet flat on the floor.. Imagine the middle of a clock to be in your pelvis. Imagine that your pubic bone is advancing toward 12 o'clock as you slowly tilt your pelvis forward. After that, tuck your pelvis so that your tailbone is pointing toward six o'clock. Explore the range of motion by repeating this action many times while letting your pelvis settle into a balanced posture.

**Shoulder rolls**

Arms at your sides while you comfortably sit or lie down. Roll your shoulders gently up toward your ears while inhaling, then roll them back and down while exhaling. Repeat this motion while concentrating on moving your shoulders in smooth, controlled circles. As you complete the exercise, be aware of any stress or discomfort and make an effort to let it go.

**Cat and camel stretch**

With your knees hip-width apart and your hands directly beneath your shoulders, assume a hands-and-knees position. Deeply inhale, and then, as you exhale, round your spine upward like an enraged cat, tucking your chin in into your chest. Slowly arch your back, lowering your tummy to the floor and rising your head to look forward as you take a breath. Repeat this motion, switching effortlessly between the camel and cat poses.

Always be mindful of your body's signals and refrain from any movements that make you feel pain or discomfort. It's always better to seek advice from a licensed healthcare provider or a trained Feldenkrais practitioner before beginning a new fitness regimen if you have any particular worries or ailments.

**Swiss ball: Group [B]**

It includes the exercises like;

**Forward and backward rocking movements**:

A yoga mat is laid on the ground, and the individual is instructed to sit straight on the swiss ball while maintaining a 90-degree angle, keeping both hands on the low back and smoothly forward and backward tilting the pelvis. Repeat the motion with your hands guiding 30 times

**Sideway rocking movements:**

Same as above sit straight and maintain 90`tilt the pelvis sideways right to left smoothly repeat the movement 30 times.

**Back strengthening exercises:**

**Bridging movements:**

The subject is to lie on their back with one leg over a Swiss ball and the other knee bent 90 degrees, slowly raise their back straight like a bridge, hold the position for 10 seconds, then lower it back down. Repeat this process 20 times.

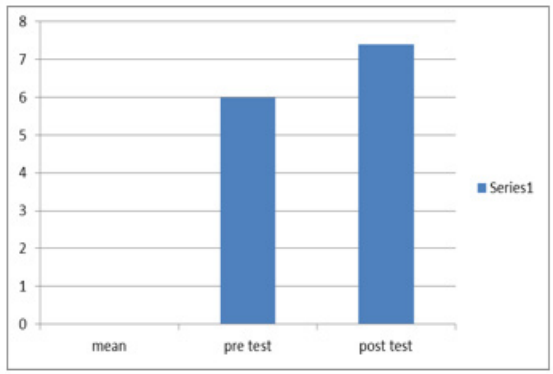
**Straight leg raise:**

Keep the swiss ball as close to the subject's body as possible and instruct them to lie over it. Leg should be raised slowly, with the knee straight. hold for ten seconds. Slowly lower it and then alternatively lower the other leg. ten times each time. Three sessions are complete when they raise one leg while lifting the opposing hand by extending over the ball to simulate a superman posture for 10 seconds.

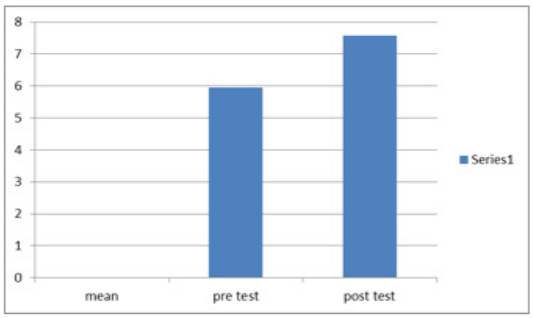
**Back stretching exercises:**

Ask the subject to lie down, place one leg over the ball at a 90-degree angle, and carefully roll the ball to one of the subject's body sides. Hold the ball there for five seconds before rolling it to the other side. Exercise is to be performed 20 times in three sessions.

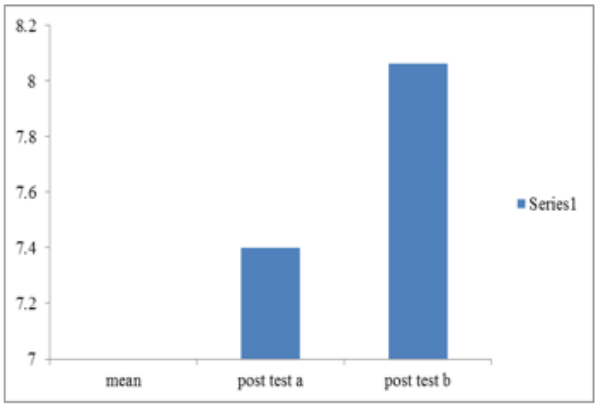
**Data Analysis**




**Graph 1: Pre and Post-test values of Awareness through movements for PSFC.**




**Graph 2: Pre and Post-test values of Swiss ball exercises for PSFC.**




**Graph 3: Comparison of post test values of both groups.**

## Result

The Pretest mean of Awareness through movements showed 6.000 the standard deviation 0.849, whereas the Post-test mean value of the awareness through movements showed 7.400 the standard deviation 1.010 This showed statistically significant p-value of greater than 0.0005.

The Pretest mean of swiss ball exercise showed 5.943, the standard deviation 1.111, whereas the Post-test mean value of the swiss ball movements showed 7.451, the standard deviation 1.054. This showed a statistically significant p-value of greater than 0.0005.

The post test comparison of awareness through movement and swiss ball exercise mean value of AWT is 7.400, the standard deviation 1.010 where as the swiss ball movement mean value is 8.064 , standard deviation is 1.041 .shows p value showed 0.0985,as a result shows swiss ball exercise is effective than awareness through movement

## Discussion

For this study, it was expected that four weeks of awareness through movement and swiss ball movements training would benefit Postural syndrome patients in improving their movements, depending on the scale used to measure the patient's overall impression of change[6]. This study demonstrates that swiss ball movements training was successful in boosting patients with postural syndrome's movement strength. The increase in movement range after swiss ball movement training is consistent with the results of earlier investigations. Concentric ,eccentric muscular contraction, coordination, and postural control were all shown to be enhanced in various exercises of the swiss ball training program, according to Dootchai Chaiwanichsiri[7]. A thorough Swiss ball stretching routine for the back muscles increases the range of motion in the spine and the extremities, according to Sekendiz B, Cug M, and Korkusuz F's findings from 20108. Swiss ball movements to the spine have been shown to enhance posture stability and build back muscle strength, according to Yoon JS, Lee JH, and Kim .According to previous studies, a variety of factors may weaken muscles, which could account for LBP.

## Conclusion

The study's goal is to evaluate its effects. of swiss ball movement exercise and awareness through movements postural syndrome individuals in the society. This study finally concluded that the awareness through movement and swiss ball movement training has an impact in improving muscle strength, as well as the overall functionality of the spine. This study findings states that awareness through movement and swiss ball movements are encouraged to treat postural syndrome in young individuals.

**Conflict of Interes**t: The authors state that there is no.

**Conflict of interest:** No

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**Source of Funding:** This study is a self-funded study.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (ApplicationNumber03/027/2022/ISRB/SR/SCPT)

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Original Article

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# Effect of Aerobic Exercise and Progressive Resistance Exercise in Pittsburgh Sleep Quality Index Among Insomnia: A Comparative Study

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**Abstract**

**Background:** A general definition of insomnia is a lack of satisfaction with either the quality or quantity of sleep. This is typically accompanied by one or more of the following: difficulty falling asleep, difficulty staying asleep, difficulties awakening frequently or having trouble going back to sleep after awakening, and difficulty awakening in the early morning and having trouble going back to sleep.

**Purpose:** To compare the effect of aerobic and progressive resistance exercise in Pittsburgh sleep quality index among patients with insomnia

**Materials and Methods:** This was an experimental study. The 30 subjects were taken from the srisaithajam old age home.The subjects were split into two distinct groups as Group A (15 Subjects) and Group B (15 subjects). All the 30 subjects were assessed with Trunk Impairment Scale. Group A received task oriented training and Group B received Swiss ball exercise along with convention therapy given for both the groups. Exercise were given for 4 weeks, 5 days per week, 10 repetition * 3 sets. Pre test and post test values were calculated and tabulated.The intervention was given four weeks. The study period was from September 2022 to July 2023.

**Results:** The collected data was statistically analyzed using an unpaired t-test. When comparing the Aerobic group(Group A) to the progressive resistance group(Group B), the aerobic group indicates significant effects (p 0.01) in Insomnia and improving the quality of life as assessed by the Pittsburgh Scale Quality Index among Insomnia

**Conclusion:** According to the research Resistance exercise training is less effective than aerobic exercise training at reducing inflammation and improving sleep quality in subjects with insomnia.

**Key Word:** MCA Stroke, Trunk balance, Insomnia, PSQI questionnaire, Aerobic and Resistance exercise.

## Introduction

A general definition of insomnia is a lack of satisfaction with either the quality or quantity of sleep. This is commonly accompanied by one or more of the following symptoms: trouble becoming asleep, trouble remaining asleep, trouble waking up often or having trouble falling back asleep after waking up, and trouble waking up in the early morning and

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having trouble falling back asleep [1]. What causes it is a delicate interplay between sleeplessness and altered circadian and homeostatic processes, psychological arousal, and cognitive arousal.

Insomnia may also be brought on by a decreased ability of the sleep-wake switch to work. The Rapid eye movement (REM) sleep cycles increasingly replace non-rapid eye movement (non-REM) sleep phases when we sleep. The AASM categorizes sleep into stages that progress in complexity. Wakefulness stage (Relaxed Wakefulness Level) phase (slight slumber) stage (slow-wave or deep slumber) (REM sleep, also known as dreaming)[2]

A third of the general population at least occasionally exhibits signs of sleeplessness. Insomnia symptoms include difficulty falling asleep or having trouble falling back to sleep after waking up during the night or sooner than wanted or necessary. The terms "difficulty initiating sleep," "difficulty maintaining sleep, and "early morning awakening," respectively, refer to these problems [3]. Patients who are terminally sick frequently have the uncomfortable condition of sleep disruption.

Poor sleep lowers quality of life and can make symptoms like pain, depression, or anxiety worse. Women were more likely than men to experience insomnia[4]. The literature supports this; being a woman is recognized as a risk factor for the onset of insomnia. In terminally ill patients, insomnia is frequently brought on by a variety of circumstances, and both medical and psychological issues are thought to be significant etiological contributors [5].

Older persons with insomnia symptoms are far more likely to experience sadness, anxiety, and pain issues in addition to syndromal insomnia. .In addition to delaying the onset of clinical insomnia in this vulnerable demographic, this target moderate sleep complaint has the potential to delay the onset of various morbidities in older persons[6]. Sadly, resources that deliver cognitive behavioral treatment (such as highly qualified clinicians) may not be practicable or cost-effective in locations where conventional care is provided, particularly for older persons who have moderate sleep complaints caused by syndromal insomnia. Additionally, rather than focusing on disease treatment, older persons are increasingly looking for lifestyle treatments that are linked with health promotion [7].

Currently, there are four stages of sleep, which can be distinguished from one another by the electroencephalogram (EEG) waveforms and other physiological data[8]. Non-rapid eye movement (NREM) are the first three phases, while rapid eye movement (REM) sleep is the fourth . NREM is the lightest stage, and it makes about 18% of the sleep period for older people .NREM , which makes up 48% of the total sleep duration, and NREM, which makes up 16% of the total sleep time in older people and is also known as slow-wave sleep (SWS) because of its slow, high-amplitude EEG signal, both contribute to the depth of sleep[9]. Over the past 20 years, a great deal of research has been done on young adults to learn more about the connection between sleep and human cognitive functioning[10].

## Aim

1. To find out the effect of aerobic exercise and Progressive resistance exercise on quality of Pittsburgh.
2. To find out the effect of aerobic exercise and Progressive resisted exercise on quality of Pittsburgh.

## Material and Methods

Materials: Dumbbell, ball, Chair, Yoga mat.

Total of 86 subjects were selected based on inclusion and exclusion criteria. Patients were completely explained the safety and simplicity procedure and informed consent was obtained from the patients. The subjects were divided into two groups based on concealed envelope method.Group A(n=43) were given Aerobic exercise and Group B were given progressive resistance exercise for 2 weeks, 5 days per week, 10 repetition* 3 sets. Aerobic exercises such as walking (10 mins), yoga (10 mins), ball game (10 mins). Progressive resistance exercises were Biceps curl(10 reps* 3 set), Squats(10 reps* 3 set), Deadlift dumbbell press (10 reps* 3 set). At the end of 4th week post outcome measures were analyzed using the Pittsburgh sleep quality index scale.

**Inclusion criteria:**

- Both men and women

- Age group of 50 above
- Significantly daytime impairment due to sleep difficulties.
- Subjects willing to participate in the study.
- Diagnosed with primary insomnia.
- Sleep efficiency (%) * if <85

**Exclusion criteria:**

- Obese Patient with neurodegenerative disease
- Sleep disorder other than insomnia
- Patient with psychology problem
- Medication affecting sleep
- Tobacco use.
- History of cancer

**Outcome measure:** PSQI, or Pittsburgh Sleep Quality Index A 19-item questionnaire called the PSQI measures sleep disruptions and quality over the previous month.12 The first four items are open-ended questions, whereas items five through nineteen are scored using a Likert scale. Scores for individual elements provide 7 components. The sum of the 7 component scores yields a final score, with values ranging from 0 to 21. A score of more than five indicates poor sleep.The PSQI was chosen because it assesses a construct (sleep quality) relevant to insomnia but broader than the severity of the condition. Only the community sample received the administration.

**Procedure**

Total of 86 participants were selected according to the inclusion and exclusion criteria and the participants were explained about treatment safety and simplicity of the procedure and written consent was obtained.

Subjects willing to participate were randomly allocated into two groups: aerobic group and resistance group. All the subjects underwent pre-test measurement with PSQI questionnaire and the same repeated for post- test at the end of 2 weeks.

**Group A (Aerobic exercise)**

**1. Walking**

Ask the patient to move along on foot walk straight for 10 mins

**2. Yoga**

Place Ask the patient to seated forward bending hold onto your big tones. This technique is otherwise called as Paschimottanasana

**3. Ball Game**

Ask the patient to hold the ball take upward to the head slowly put the ball down to the ground

**Group B (Resistance exercise)**

**1. Biceps curl**

The patient is asked to stand and maintain a neutral position and taketwo dumbbells on the hand and flex elbow and return back to the normal position then slowly extend the neck into the back and return to the beginning stage.The patient should do the exercise 3 sets per day. Each set consisted of 10 repetitions and it is continued for 2 weeks.

**2. Squats**

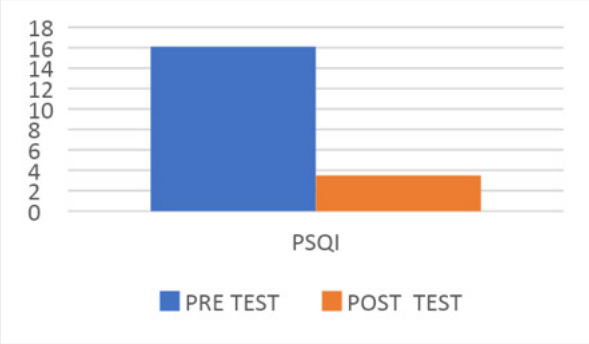
Ask the patient to place the feet shoulder-width apart while standing tall. Toes may point slightly outward or forward. For balance, either keep your arms out in front or hold onto your chair with both hands. Sit back as if you were in a chair, engage your core, and hinge (bend) at the hips.The patient should perform three sets of the workout each day. Five repetitions were performed in each set, which lasted for two weeks.

**3. Dead Lift Dumbbell Press**

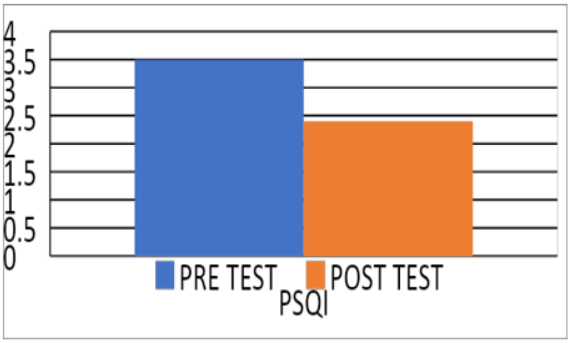
Ask the patient to Maintain their position, plant their heels, and contract their abs. Straighten their legs, stand up tall with your chest out, head forward, and shoulders back. Patients should bend at the waist and knees, lowering the weight until it almost touches the ground. Repeat the process for the next repetition. The patient should do the exercise 3 sets per day. Each set consisted of 5 repetitions and it continued for 2 weeks.

**Data analysis**

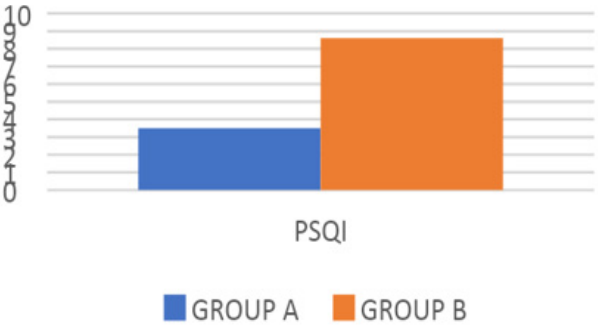
A statistical analysis made with quantitative data revealed a statistically significant difference between Aerobic exercise group and the resistance group which is also evaluated in the groups.




**Graph 1: Comparison of pre-test and post-test values of Aerobic Group**




**Graph 2: Comparison of pre-test and post-test values of Resistance Group**




**Graph 3: Comparison of post-test values of Aerobic and Resistance Group**

## Results

A In Table 1, the statistical analysis of GROUP A by using Pittsburgh sleep quality index scale, pre-test and post-test Mean values of 16.10 ± 17.40; and SD values of 3.21± 1.58 ; T value of 13.67 with P value less that 0.0001 ; and In Table 2, the statistical analysis of GROUP B by using the Pittsburgh sleep quality index scale pre-test and post-test Mean values of 3.50 ± 8.60; and SD values of 0.97 ± 1.65; and T value of 13.61; with P value less than 0.0001; and In Table 3, the difference between the two groups a and b by using the pittsburgh sleep quality index scale were evaluated by post-test Mean values are 3.50 ± 8.60 ; and SD values of 0.96 ± 1.65 ; and and T value of 8.43 with P value less than 0.0001.These differences indicates that GROUP A which is provided with aerobic training was highly benefited compared to GROUP B that performedresistance exercise. Additionally, it could be employed as ainexpensive, longlasting, and side.effect.free therapy technique for treating insomnia in older perss.

## Discussion

The goal of the present study is to compare the effectiveness of Aerobic exercise and progressive resistance exercise in Pittsburgh scale quality index among insomnia. This comparison is demonstrated with duration of 4 weeks. The outcome results were measured by Pittsburgh scale quality index among insomnia.Before and after treatment. Beneficial effects were significantly greater in Aerobic Exercise compared to the progressive resistance exercise. When the response was compared between both groups, the result showed a significant difference in Aerobic group compared to the progressive resistance group.Inaerobic group pre-intervention mean of was16.1.After treating the subject with Aerobic Exercise the mean value is decreased to 3.50 which shows statistically significant difference between the groups. In progressive resistance group the pre-Test value is 17.4, After treating the subject with progressive resistance Exercise the mean value is decreased to 8.06 which shows statistically significant difference between the groups. Based on the statistical PSQI analysis, both groups showed improvement. However, subjects who received Aerobic exercise showed better improvement in PSQI than the subjects in the progressive resistancegroup. KathrynJReid, KellyGlazerBaron, BrandonLu, ErikNaylor, LisaWolfe, PhyllisCZeeat 202 In older persons with persistent insomnia, aerobic exercise combined with sleep hygiene instruction is an effective therapy strategy to enhance mood, quality of life, and sleep.

Ahmad Ali Akbari Kamrani, Amir Shams, Parvaneh Shamsipour Dehkordi, Robabeh Mohajeri,

2014 In general, the results of the current study indicated that moderately intense aerobic exercise (6070% MaxHR) had a favorable and significant impact on sleep quality and itsconstituent parts. As a result, it was suggested that older persons in the community engage in cardiovascular activity at a moderate level to enhance their sleep and its components. Naomi Takemuraetal, 2020 Cancer patients who exercise can have improvements in their quality of life and reductions in sleep disorders. Both aerobic exercise (AE) and mindbody exercise (MBE) have several methods for enhancing sleep, although it is yet unknown ifthey are actually useful.This systematic review and metaanalysis is the first to investigate how well AE and MBE work for improving sleep outcomes, particularly for cancer patients who have sleep problems. MEZubia Veqarat 2021 forall age groups, exercise is a helpful behavioralmodification technique that can improve the quality of sleep. In elderly populations, exercisecan be quite beneficial for treating various illnesses as well as bettering sleep.While, there hasn't. beenmuch research done, the ones that have been done aren't very conclusive either. Acute workouts don't seem to be very effective in enhancing sleep quality. The effects of longterm aerobic and weight training may improve the quality of sleep. It appears that exercise done right before bed has a detrimental impact on the quality of sleep.

In 2015 Farkhondeh Sharif, conducted a study on the effect of aerobic exercise on quantity and quality of sleep among elderly people referring to health and aerobic exercise regimen may help the elderly get more and betterquality sleep. Additionally, it could be employed as an inexpensive, longlasting, and sideeffectfree technique for treating insomnia in older perss 12.

In 2021 Ryo Miyazaki, conducted a study on the effects of light-to-moderate older adults who live in the community, three months of aerobic exercise increased the quality of their objectively evaluated sleep11.The degree of changes in sleep qualityand quantity was not significantly influenced by baseline sleep conditionsmay be met.These findings imply that, regardless of baseline sleep qualitylight aerobic exercise can enhance sleep in older persons living in the effect.

## Conclusion

According to the research Resistance exercise training is less effective than aerobic exercise training at reducing inflammation and improving sleep quality in subjects with insomnia. In middle-aged and older persons, participating in a fitness training program had somewhat positive benefits on sleep quality. Exercise may serve as a substitute for or addition to current sleep disorder treatments. This study demonstrates that exercise can enhance patients' sleep quality in addition to conventional insomnia therapies.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number -03/029/2022/ISRB/SR/SCPT).

**Funding:** This study is a self-funded study.

**Conflict of interest:** The authors state that there is no conflict of interest

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Original Article

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# Effectiveness of Task Oriented Training and Swiss Ball Exercise on Balance among Middle Cerebral Artery Stroke Patients: A Comparative Study

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**Abstract**

**Background:** This study was developed to determine the effectiveness of task oriented training and swiss ball exercise on balance among middle cerebral artery stroke patients.

**Purpose:** To compare the effectiveness of task oriented training and swiss ball exercise on balance among middle cerebral artery stroke patients.

**Materials and Methods:** This research is an experimental study. The 30 subjects obtained from SaiCharan Physio Centre were split into two distinct groups as Group A (15 Subjects) and Group B (15 subjects). All the 30 subjects were assessed with Trunk Impairment Scale as a pre test and the same test was performed for post test at the end of 4 weeks following the intervention protocol. Group A received task oriented training and Group B received Swiss ball exercise along with convention therapy given for both the groups. Exercise were given for 4 weeks, 5 days per week, 10 repetition * 3 sets. Pre test and post test values were calculated and tabulated. The entire period was performed from November 2022 to March 2023.

**Result:** Statistical analysis of Trunk Impairment Scale Examination post values revealed the constantly significant differences, With the P value of <0.0001.

**Conclusion:** Task oriented training with conventional therapy is more effective on enhancing the trunk balance among MCA Stroke patients than either using Swiss ball exercise with conventional therapy.

**Key Words:** MCA Stroke, Trunk balance, Task oriented training, Swiss ball exercise, Trunk ImpairmentScale.

## Introduction

Stroke results from the rapid demise of some brain cells from a lack of oxygen, when the blood flow to the brain is cut off by a blocked or ruptured artery.[1] Acute strokes are most often associated with the middle cerebral artery (MCA). It breaks off directly from the internal carotid artery and contains four main arteries with the letters M1, M2, M3, and M4. These veins give blood to deeper brain structures such the caudate, internal capsule, and thalamus as well as portions of the frontal, parietal, and temporal lobes of the brain.[2,3] The ischemic and hemorrhagic stroke are caused by variable risk factors, such as

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hypertension, smoking, obesity, alcohol use, and nutrition.[4,5]

In terms of occurrence, stroke displays notable prevalence rates, ranging from 334 to 424 cases per 100,000 individuals residing in urban areas, while in rural regions, the rates range from 84 to 262 cases per 100,000 people.[6] The ability to keep your center of gravity over your BOS, usually while standing up straight, is known as balance. Stroke patients with balance issues fall into one of two categories: 1) Static Balance, which is the capacity to maintain posture while at rest. 2) Dynamic balance – The capacity to maintain control of posture while carrying out functional tasks. The effectiveness of a task-oriented walking training is raising the self-efficacy of balance in stroke survivors. Self-efficacy is described as a rating of one's capacity for planning and carrying out tasks.[7,8]

According to the task-oriented perspective, movement develops as a result of interactions between various brain systems, is planned around a purpose, and is limited by the surrounding. Task-oriented training encompasses a different set of therapies, including sit-to-stand exercises, ground walking training, ground walking training on a treadmill, cycling programmes, endurance training, and circuit training, as well as reaching activities for balance improvement.[9] Swiss-ball workouts are frequently employed as they contribute to enhancing strength, endurance, flexibility, coordination, and balance. This makes the patient more active and enhances their postural awareness, symmetry, alignment, alertness, and balance. Swiss ball movement enables the performance of both static and more strenuous dynamic stretches.[10]

### Aim

To find out the comparison between task-oriented training and Swiss ball exercise on Trunk Impairment among middle cerebral artery Stroke patients.

## Material and Methods

This research is an experimental study. The study was conducted with a sample size of 30 participants. The participants were selected from SCPT(SMCH Hospital) and Saicharan Physio Centre, according to inclusion and exclusion criteria. Participants received an extensive overview of the method, and a formal informed consent form was acquired.

**Materials required**: Paper cups, Swiss ball, Chair.

**Study period:** from November 2022 to March 2023.

**Inclusion criteria:**

- Age group of 45-60
- Both the gender
- Middle cerebral artery Stroke
- Subjects with score <7 in trunk-impairment scale

**Exclusion criteria:**

- Obese patients (BMI>30)
- Disease of the cerebellum, Parkinson's disease, and vestibular lesion
- Arthritis, degenerative illnesses, and low back pain.
- Visual defect
- Psychosomatic disorders

**Outcome measure:** Following a cerebrovascular accident, the evaluation of trunk motor dysfunction is conducted through the utilization of the Trunk Impairment Scale (TIS). Ranging from 0 to 23, the TIS appraises the coordination of the trunk, as well as the stability and equilibrium during both static and dynamic seated positions.

## Procedure

The subjects willing to participate were randomly split into two distinct groups using concealed envelope methods as Group A (15 Subjects) and Group B (15 subjects). All the 30 subjects were assessed with Trunk Impairment Scale as a pre test and the same test was performed for post test at the end of 4 weeks following the intervention protocol. Group A received task oriented training and Group B received swiss ball exercise along with convention therapy given for both the groups. Exercises were given for 4 weeks, 5 days per week, 10 repetition * 3 sets. Pre test and post test values were calculated and tabulated.

**Group A (Task oriented training)**

**1. Forward reach**

- Place the arms at the sides and sit steadily in a chair with good back support.

- Reach the hands straight ahead toward the therapist's hand while keeping them clenched together.
- Hold for 5 seconds, then recline and sit normally in the chair.
- 10 repetitions of the exercise.

**2. Forward trunk bending and picking object placed on table**

- Place the arms at the sides and sit steadily in a chair with good back support.
- Slowly bend forward from the hips and Reach out with the unaffected hand to grasp the object on the table.
- return back to normal position and do it for 10 reps.

**3. Lateral bending and picking object placed on table**

- Sit in a stable chair with proper back support, with arms at rest.
- Place a small object (such as a pen or a small ball) on a table, within reach.
- Slowly bend to the side from the waist, reaching towards the object on the table.
- Pause for a moment in the lateral bent position while maintaining balance and stability.
- Repeat the movement on the opposite side, reaching for the object placed on the table to the other side.
- Continue alternating sides for 10 reps.

**4. Picking up paper cups placed around the patient from the same position**

- Set up several paper cup around the patient's sitting position, within their reach on the table.
- Explain the task to the patient and demonstrate the activity, providing clear instructions and encouragement.
- Instruct the patient to use their unaffected hand to reach for and pick up one cup at a time.
- Once they have picked up a cup, instruct the patient to bring it back to a designated location.
- Repeat the process, having the patient reach for and collect the remaining cups, one by one, and place them in the designated location.

**Group B (Swiss ball exercise)**

**1. Anteroposterior pelvic tilt**

- Sit on the Swiss ball while ensuring that the feet are planted firmly on the floor, the shoulders are spread apart.
- Ensure to have proper support and stability while sitting on the ball, should assist the patient
- Place the hands on the hips or across your chest for added stability.
- Begin to perform an anterior pelvic tilt, gently tilt the pelvis forward, allowing the lower back to curve slightly.
- And perform posterior pelvic tilt, gently tilt the pelvis backward, flattening the lower back against the Swiss ball.
- Hold the anterior and posterior pelvic tilt for 5 seconds while maintaining the balance on the Swiss ball.
- Repeat the anterior and posterior pelvic tilts for 10 times.

**2. Lateral pelvic tilt**

- Sit on the Swiss ball while ensuring that the feet are planted firmly on the floor, the shoulders are spread apart.
- Ensure to have proper support and stability while sitting on the ball, should assist the patient
- Start by tilting the pelvis to the left side. This movement should be initiated from the hips, not the upper body.
- Hold the left tilt for 5 seconds, focusing on maintaining the balance.
- Slowly return to the starting position, aligning the pelvis in a neutral position.
- Repeat the same movement, Hold for 5 seconds and maintain your balance.
- - Return to the starting position and repeat the exercise for 10 repetitions on each side.

**3. Upper trunk rotation**

- Sit on the Swiss ball while ensuring that the feet are planted firmly on the floor, the shoulders are spread apart.
- Place the hands clasped together, and Start by rotating the upper trunk to the right side. Keep the lower body stable and focus on rotating from the waist up.

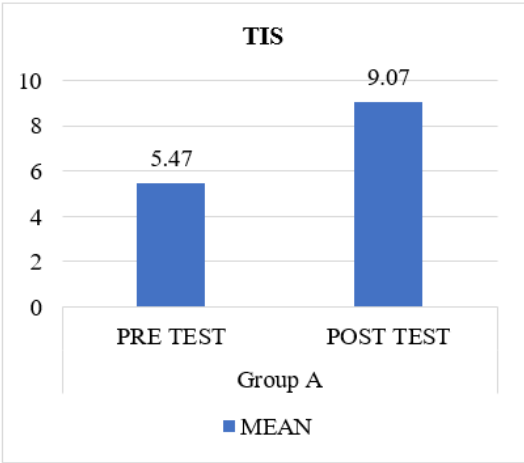
- Hold the right rotation for 5 seconds, Slowly return back to the neutral position, aligning the upper trunk with the lower body.
- Repeat the same movement, this time rotating the upper trunk to the left side. Hold for 5 seconds.
- Return to the starting position and repeat the exercise for 10 repetitions on each side.

**4. Lower trunk rotation**

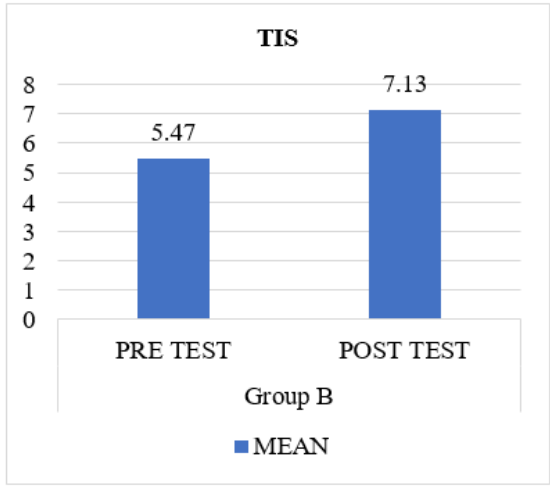
- Sit on the Swiss ball while ensuring that the feet are planted firmly on the floor, the shoulders are spread apart.
- Place the hands clasp together, and Start by rotating the lower trunk to the left side.
- Rotate as far as comfortable and Hold the position for 5 seconds, focusing on maintaining balance and stability.
- Slowly return to the starting position.
- Repeat the same movement, Hold for 5 seconds and maintain balance.
- 10 repetitions of the exercise should be performed on each side before returning to the beginning position.

**Data analysis**

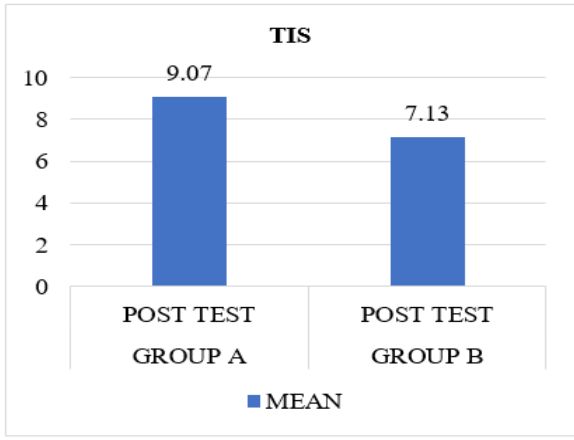
Using tabular and inferential statistics, the gathered data was evaluated. The mean and standard deviation (SD) were utilized for all parameters. The statistically significant differences between pre-test and post-test measures were examined using a paired t-test. When utilizing the unpaired t-test to look at significant changes in the experimental group, the significance level of p 0.0001 was determined to be statistically significant.




**Graph- 1 Comparison of pre-test and post-test values of task oriented training using Trunk Impairment Scale**




**Graph-2 Comparison of pre-test and post-test values of Swiss ball exercise using Trunk Impairment Scale**




**Graph- 3 Comparison of post-test values of task oriented training and Swiss ball exercise**

## Results

A statistical analysis of quantitative data revealed a statistically significant difference in values between the ( Group A)Task oriented training and (Group B) Swiss ball exercise.

Graph - 1 compares the pre and post-test values of (Group A)Task oriented training using Trunk Impairment Scale. The mean value of the pre-test is 5.47 and the post-test is 9.07 using Trunk impairment scale. As a result, the findings are considered statistically significant when the p-value is <0.0001.

Graph - 2 compares the pre-test and post-test values of ( Group B) Swiss ball exercises using Trunk

Impairment Scale. The mean value of the pre-test is 5.47 and the post-test is 7.13 using Trunk Impairment Scale. As a result, when the p-value is less than 0.0001, the results are considered statistically significant.

Graph - 3 compares the post-test values of the Group A and B, revealing that the mean value of Group A was 9.07 using Trunk Impairment Scale, whereas the Group B mean value was 7.13 using Trunk Impairment Scale. As a result, the findings are considered statistically significant when the p-value is less than <0.0001.

This shows that the Task oriented training produces better functional results in the Group A than the Group B.

## Discussion

This study is to find out the comparison between task-oriented training and Swiss ball exercise on balance among middle cerebral artery Stroke patients.

In 2022 Romita R Shah conducted a study on functional mobility in chronic stroke survivors as a result of distributed practice in task-oriented training and concluded that Participants who received both conventional physical therapy and task-oriented training using the distributed practice method improved more than those who only received conventional therapy.[13]

The efficacy of task-oriented training intervention in enhancing balance among patients with middle cerebral artery (MCA) stroke is being examined was studied by Remya M Nair and Jince Augustine in 2021 and concluded that Balance was statistically significantly improved in stroke patients who underwent Task Oriented training in addition to traditional physical therapy compared to the control group. It can be used to manage stroke victims and improve balance. Thus the study determines the long-term effects of task-oriented walking on improving balance in large groups.[7] With the consideration of the result obtained from this study, we made an attempt to provide intervention for 4 weeks, 5 days per week, 10 repetition* 3 sets. With 15 subjects in each group.

In 2009, Marijke Rensink undertook a study focusing on task-oriented training in stroke rehabilitation. The systematic review yielded a conclusion that task-oriented training demonstrated greater effectiveness in aiding stroke patients. In view of this finding we decided to train the MCA stroke patients with task oriented exercises such as Forward reach, Forward trunk bending and picking object placed on table, Lateral bending and picking object placed on table, Collecting paper cups placed around the patient from the same position along with conventional therapy in order to improve the balance among them. As a result, task-oriented training was successful in enhancing trunk control.[11]

In 2004 G Verheyden et al. Clin Rehabil conducted a study on A new approach used to assess motor impairment in the trunk following a stroke is called the Trunk Impairment Scale and concluded that from the assessment, recommendations for treatment and the degree of trunk activity quality can be drawn. So as the above mentioned study says Trunk impairment scale was used to assess the ability of trunk balance in this study. The patients with less than or equal to score 7 in the trunk impairment scale were used. Following the experiment, there was a noticeable difference in the two groups' capacity for trunk control. The experimental group's increase on the Trunk Impairment Scale was considerably superior to the control groups.[12]

## Conclusion

The research findings established that Group A, comprising individuals who underwent a combination of task-oriented training and conventional therapy, demonstrated greater effectiveness compared to Group B, which underwent a combination of Swiss ball exercise and conventional therapy, in enhancing trunk balance among individuals affected by MCA Stroke.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number - 03/029/2022/ISRB/SR/SCPT).

**Funding:** Self

**Conflict of interest:** The authors state that there is no conflict of interest

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Original Article

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# Comparative Study on Russian Current Stimulation Versus Faradic Current in Pain and Functional Outcome in Osteoarthritis Knee

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**Abstract**

**Background:** This study was designed to inspect the effectiveness of a comparative study on Russian Current Stimulation versus Faradic Current in pain and functional outcome in osteoarthritis knee. Russian current is the most commonly used electrical stimulation to improve muscle strength. Faradic current is effective in treating muscle spasms caused by inflammation and in lowering pain

**Purpose:** To compare the effectiveness of Russian current stimulation versus Faradic current using the KOOS scale.

**Materials and Methods:** This experimental study has been conducted from November 2022 to April 2023.A total of 196 adults were collected from APR physiotherapy center with OA knee have been selected using the inclusion and exclusion criteria. They have been split into 2 groups Group A (n=98) and Group B (n=98) were assigned. Group A got Russian current stimulation, whereas Group B received Faradic current and the KOOS scale was used to evaluate the subjects. The treatments were given for 5 sessions per week and continued for 4 weeks.

**Results:** The mean value of Russian current at the post-test was found to be higher than the mean value of Faradic current with a p-value of <0.0001.

**Conclusion:** The result suggests that Russian current stimulation shows a significant effect in reducing pain in the OA knee when compared to Faradic current.

**Key Word:** Russian current stimulation, OA knee, KOOS scale, Faradic current.

## Introduction

Osteoarthritis is a kind of joint deterioration that causes pain and reduced joint mobility, limiting exercise and quality of life. One of the most serious worldwide health concerns connected with noncommunicable diseases (NCDs) is physical activity, which can lead to osteoarthritis. Although osteoarthritis may affect every joint in the body, including the joints of the arm, shoulder area, elbow, wrist, vertebrae, pelvis, kneecap, and foot, the knee is the most prevalent and vulnerable.[1] Osteoarthritis (OA), frequently referred to as a degenerative joint condition, primary osteoarthritis, tear, and damage arthritis, or associated with age-related arthritis, is one of the most prevalent causes of disability. The word "arthritis" is frequently employed by

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physicians to characterize joint inflammation. Knee OA frequently develops gradually over a period of 10 to 15 years. It was thought to be just "wear-and-tear" degeneration of the articular frequently referred to as a degenerative joint condition, primary osteoarthritis, tear, and damage arthritis, or associated with age-related arthritis is one of the most. prevalent causes of disability. The word "arthritis" is frequently employed by physicians to characterize joint inflammation. Knee OA frequently develops gradually over a period of 10 to 15 years. It was thought to be just "wear-and-tear" degeneration of articular cartilage caused by becoming older, with no relation to inflammation. Even though the cause of this condition is unknown and being researched, it has been shown that knee OA has a complicated etiology. Genetics, age, weight or obesity, joint inflammation, innate immunity, lower limb alignment, joint development and dysplasia, stress, and swelling produced by metabolic problems are all factors that contribute to knee osteoarthritis.[2] The etiology and pathophysiology of osteoarthritis are complex and poorly understood. Two of the most prevalent risk factors for osteoarthritis are articular cartilage degradation and adaptive subchondral development of bones with moderate joint inflammation.[3] Patients with knee osteoarthritis frequently experience pain that worsens with movement or physical activity, stiffness, swelling, deformity (knock-knee), and restricted walking distance. One of the key elements that have been demonstrated to impact knee joint function is quadriceps strength. Lower extremity strength is important in absorbing shock at the knee joint during weight-bearing activity. The positive predictive value for narrative knee osteoarthritis alone was 94.0% (95% CI [95% CI] 87.4-100%), while it was 96.0% (90.6- 100%) for coded knee osteoarthritis between 2008 and 2019, the prevalence rate grew from 1.93 to 2.28 times, with a range of 9.98 to 13.8 per 1,000 person-years.[4]

The Russian current is a medium-frequency electrotherapy approach that is used in conjunction with a sinusoidal alternating current of 25,000 hertz. According to one source, Russian current is the most commonly used electrical stimulation to improve muscle strength.[5]

Faradic current is a direct current used to stimulate innervated muscles that have a short pulse, a pulse width of 0.1 to 1 ms, and a frequency of 50 to 100 Hz. However, it has been shown to be effective in treating muscle spasms caused by inflammation and in lowering pain.[6]

## Aim

The aim of the study is to compare the effectiveness of a comparative study on Russian Current Stimulation versus faradic current in pain and functional outcome in osteoarthritis knee.

## Materials and Methods

It was a comparative study conducted on 196 subjects with osteoarthritis knees, aged above 40 years. Convenient sampling with a random allocation method was used in this study.

**Study period:** from November 2022 to April 2023

**Inclusion criteria**

1. People aged 40 years and above
2. Subjects diagnosed with Knee Osteoarthritis grade I & II based on American College of Rheumatology criteria.
3. Chronic Pain in knee For More than 6 months.

**Exclusion criteria:**

1. Recent Surgery in the Lower Limb.
2. Rheumatoid Arthritis.
3. Patient with Sensory Loss.
4. Congenital Deformities in the Affected Lower Limb.

**Outcome measures:**

Assessment was performed at baseline (before starting treatment) and after 4 weeks of study.

- Knee Injury and Osteoarthritis Outcome Score(KOOS).

**Procedure**

Participants were included considering the inclusion and exclusion criteria. The procedure was explained to the participant & participants were asked to sign the consent form. Assessment of all the included participants was done according to the assessment form. Participants were randomly divided into two groups. i.e. Group 'A' and 'B'. The assessment was performed at baseline and after 4 weeks of study.

**Group A: Russian Current**

The participants were given Russian current. During the application, a Hot pack is given to the subjects to reduce pain, and a gel was used for the transmission of Russian current on the subject's skin. The treatment was provided by placing the electrodes around the knee at the frequency of 50Hz, 2.5KHz AC, Intensity of 2.5KHz AC, Mode–Burst, Duration of 10 seconds on followed by 50 seconds off for 10 minutes. Given for 10 minutes; 5 sessions per week.

**Group B: Faradic Current**

The participants were given Faradic current. During the application, a Hot pack is given to the subjects to reduce pain, and the gel was used for the transmission of faradic current on the subject's skin. The treatment was provided by placing the electrodes around the knee at the frequency 80Hz, Pulse Duration of 400 µs Duration of 10 seconds of stimulation followed by 20 seconds of rest for 30 minutes. Given for 10 minutes; 5 sessions per week.

**Strengthening Exercises.**

**Isometric quadriceps exercise**

The quadriceps femoris isometric exercise was performed in the supine position lay on their backs with a towel roll placed under their knees; they were educated to press their knees against the roller. The quadriceps femoris were strengthened for the exercise. was asked to use the thigh to engage as much muscle as possible to keep the knee straight. This exercise was performed in 3 sets of 10 reps.

**Isometric hip adduction exercise.**

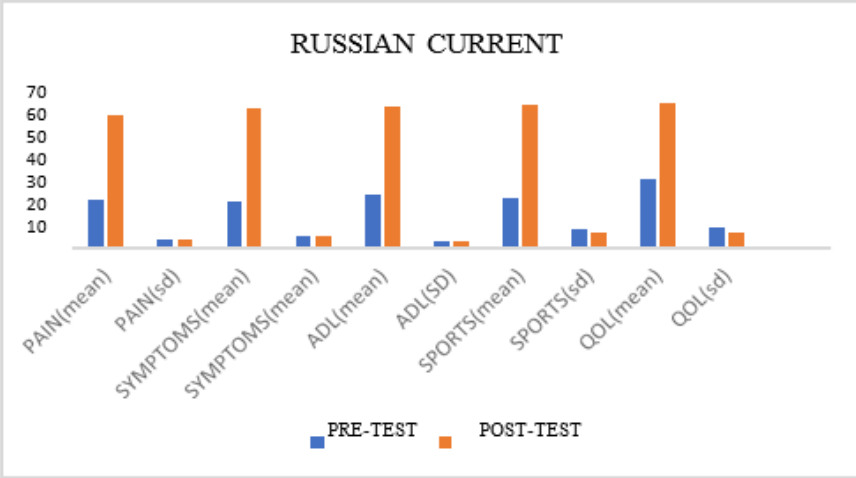
In isometric hip adduction exercise, Patients lie supine with a cushion between their knees for the isometric hip adduction exercise. They are instructed to do isometric hip adduction, place a cushion between their legs, and hold the adduction position for 5 long seconds.

**Straight leg raising (SLR) exercise**

The single leg raise (SLR) exercise was performed while lying down. The patients were asked to attempt a maximal isometric contraction of the quadriceps femoris before the lifting phase (SLR), then raise the leg 10 cm up the socket and then sustain the contraction for 10 seconds.

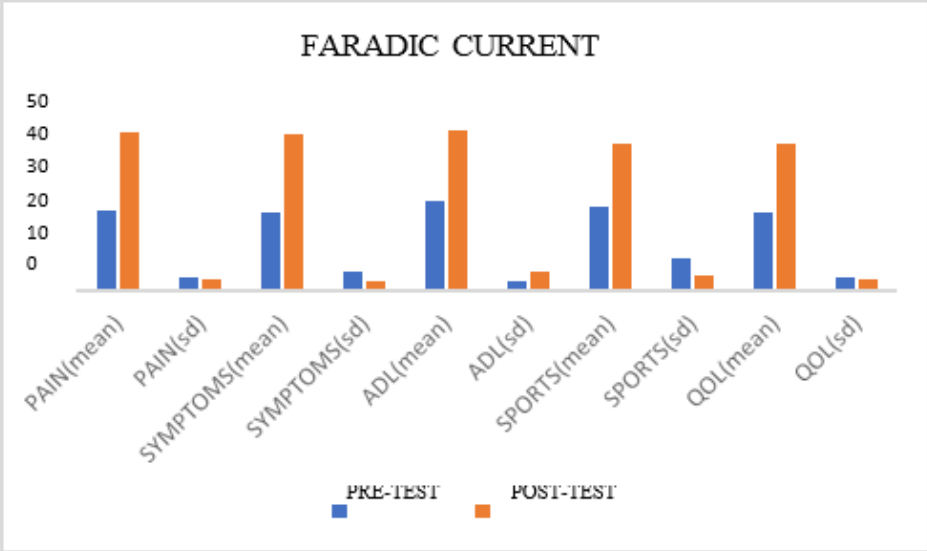
**Data Analysis**

Using tabular and inferential statistics, the gathered data was evaluated. The mean and standard deviation (SD) were utilized for all parameters. The statistically significant differences between pre-test and post-test measures were examined using a paired t-test. When utilizing the unpaired t-test to look at significant changes in the experimental group. The significance level of $p < 0.0001$ was determined to be statistically significant.



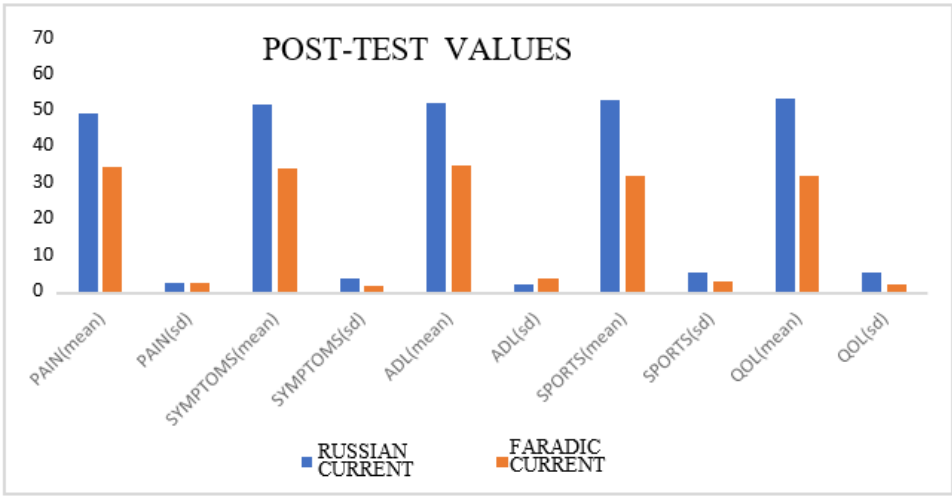

**Graph No. 1:**

**Graph No 1. Comparison of pre-test and post-test values of Russian current stimulation using the KOOS scale.**




**Graph No. 2:**

**Graph No 2. Comparison of pre-test and post-test values of Faradic current using KOOS scale.**




**Graph No. 3:**

**Graph No.3 Comparison of post-test values of Russian current and Faradic current using the KOOS scale.**

## Results

A statistical analysis of data revealed a statistically significant difference in values between the Russian current stimulation group and the Faradic current stimulation group.

**Table-1** compares the pre-test and post-test values of Russian current stimulation using the KOOS scale. The mean value of Russian current stimulation in the experimental group using the Koos scale. the value of pain mean pre-test (21.83) and post-test (60.57) and pain SD pre-test (4.02) and post-test (3.88), symptoms mean pre-test (20.96) and post-test (63.77), and symptoms SD pre-test (5.16) and post-test (5.02) and ADL mean pre-test (24.57)and the post-test(64.29) and ADL SD pre-test(2.89) and the post-test(3.03) and Sports mean pre-test (22.76) and the post-test (65.00) and SD pre-test (8.68) and the post-test(7.14) and QOL mean pre-test (30.93) and post-test (65.63) and QOL SD pre-test (8.81)and the post-test (7.08). As a result, the findings are considered statistically significant when the p-value is <0.0001.

**Table – 2** compares the pre-test and post-test values of Faradic current stimulation using the KOOS scale. The mean value of Faradic current stimulation in the experimental group. Using the Koos scale pain mean pre-test(21.83) and post-test (42.68) and pain SD pre-test (4.02) and post-test (3.37), symptoms mean pre-test (20.96) and post-test (42.4), and symptoms SD pre-test (5.16) and post-test (2.86) and ADL mean pre-test (24.57)and the post-test(43.13)and ADL SD pre-test(2.89) and the post-test(5.14)and Sports mean pre-test (22.76) and the post-test (39.8) and SD pre-test (8.68) and the post-test(4.06) and QOL mean pre-test (30.93) and post-test (39.69) and QOL SD pre-test (8.81)and the post-test (3.04). As a result, the findings are considered statistically significant when the p-value is <0.0001.

**Table – 3** compares the post-test values of the Russian current stimulation group and Faradic current stimulation groups, revealing that the Russian group's mean of pain pre-test(60.57) and post-test (42.68) and pain SD pre-test (3.88) and post-test(3.37), symptoms mean pre-test (63.77) and post-test (42.4), and symptoms SD pre-test (5.02) and post-test (2.86) and ADL mean pre-test (64.29)and the post-test(43.13) and ADL SD pre-test(3.03) and the post-test (5.14) and Sports mean pre-test (65) and the post-test (39.8) and sports SD pre-test (7.14) and the post-test(4.06) and QOL mean pre-test (65.63) and post-test (39.69) and QOL SD pre-test (7.08)and the post-test (3.04). As a result, the findings are considered statistically significant when the p-value is less than <0.0001.

This shows that the Russian current stimulation produces better functional results in the Russian current stimulation group than the Faradic current stimulation group.

## Discussion

The purpose of this study was to compare the effectiveness of Russian current stimulation and if it shows a significant effect in reducing OA knee when compared to Faradic current in subjects with OA knee pain.

In this study, 196 subjects were assigned, 98 were in Group A and 98 in Group B. Group A received Russian current 5 sessions/week, and Group B received Faradic current 5 sessions/week for a duration of 4 weeks. Both these groups received hot packs before the treatment.

The outcome measures were the KOOS Scale performed at baseline and after 4 weeks of study.

According to Graph no.3, the present study shows improvement in both the groups' i.e. Russian current and faradic current for all measured variables but Russian current shows more effectiveness in reducing pain and improving functional outcome.

The most common cause of disability is osteoarthritis (OA), which affects at least 12-16% of the population. Furthermore, as a result of the obesity epidemic and aging, the prevalence of osteoarthritis is rapidly increasing. Although knee osteoarthritis is common, there is no cure and only a few non-surgical treatments exist to slow the disease's progression. The pathogen's disease progression distinguishes primary arthrosis from secondary arthrosis. Subchondral bone modifications include gradual expansion of the subchondral plate, Trabecular bone refers to alterations in the subchondral architecture of the bone and the development of new bone at the joint edges. Furthermore, changes in articular cartilage composition and shape induce chondrocytes to create more metabolic chemicals implicated in cartilage degradation.[7-13] Pain and increased intra-articular fluid, which are frequent in OA, intensify areola mechanoreceptors, which activate inhibitory interneurons in the spinal cord, limiting muscle activation.[14] Chronic pain, inflammatory phenotypes, phenotypes connected to bone and cartilage metabolism alterations, metabolic syndrome, mechanical phenotypes, and limited joint damage are all associated with knee OA. The mechanical formation of the knee arthrosis type is triggered by mechanical stress and earlier trauma. minor degeneration, minor clinical symptoms, and moderate progression characterize little joint involvement.[15]

Heggannavar AB et al. concluded that Russian current stimulation is effective in increasing quadriceps muscle strength and thereby improving the functional ability in subjects with primary osteoarthritis of the knee.[16]

Hadeer Nabil et al. concluded that faradic stimulation improved quadriceps muscular strength

while decreasing pain and functional impairment in Osteoarthritis knee subjects.[17]

Zeng C et al. concluded that Russian current is more beneficial for pain relief in knee osteoarthritis: systematic review and network meta-analysis.[18]

## Conclusion

In conclusion, this study provides evidence that Russian current is useful as a therapeutic technique for Osteoarthritis knee. The findings demonstrate significant improvements in pain relief and functional outcomes following intervention. These positive outcomes align with recent research emphasizing the benefits of Russian current. Russian currents show a potential increase in relieving pain and improving functional outcomes. Further research and long-term follow-up studies are necessary to validate these results and assess the long-lasting effects of Russian current in the management of Osteoarthritis Knee.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, and institutional regulations. (ISRB number-03/030/2022/ISRB/SR/SCPT)

**Funding:** This study is a self-funded study.

**Conflict of interest:** Nil

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Original Article

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# Comparison of Physiological Profiles among Collegiate Football Players with and Without Musculoskeletal Pain: A Case Controlled Study

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**Abstract**

**Background:** The physiological data cannot be the only predictor of competitive performance, much like in other sports where abilities are crucial. On the other hand, it's important to remember that these physiological norms and standards are prerequisites for success in football competition at the highest levels. When choosing talent, conventions are crucial. For athletes who train and compete at the greatest levels of performance, pain management is a critical concern.

**Purpose:** To evaluate the comparison of physiological effects among collegiate-level football players with and without musculoskeletal pain.

**Materials and Methods:** The subjects were selected from the Saveetha physical education department based on inclusion criteria from January 2022 to April 2022. They explained about the study. 25 collegiate football players were involved: group A (n = 7) with musculoskeletal pain and group B (n = 17) without musculoskeletal pain. The pro agility shuttle, vertical jump, standing broad jump, 40-yard test, and three cone drill were assessed, and the body composition was assessed using a skinfold caliper.

**Result:** The statistical analysis made with quantitative data revealed no statistical difference between groups A and B.

**Conclusion:** The present study shows there is no significant difference in the physiological profiles of football players with or without musculoskeletal pain.

**Key words:** Football players, Physiological profiles, Anthropometric measurements.

## Introduction

The physiological data cannot be the only predictor of competitive performance, much like in other sports where abilities are crucial. On the other hand, it's important to remember that these physiological norms and standards are prerequisites for success in football competition at the highest levels. Despite the increasing interest in training and competitive environments, sports injuries are quite common. About one-third of adults suffer from chronic musculoskeletal pain, which is a serious public health issue. A simple biological approach might not be sufficient because pain is frequently

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present in the musculoskeletal system without any obvious results.[1] A biopsychosocial approach might provide novel therapeutic goals and a better understanding of symptoms. For preventive and early intervention, it is crucial to identify chronic risk factors. 20% of visits to primary care doctors and 80% of visits to sports medicine clinics are for musculoskeletal issues.[2] The chronic musculoskeletal pain often found were fibromyalgia, overtraining syndrome, and reflex sympathetic dystrophy. Primary care visits are frequently prompted by musculoskeletal complaints of various kinds, such as neck pain, limb pain, low back pain, joint pain, and persistent generalized pain.[2] The management guidelines provided also apply to generalized non-specific musculoskeletal problems. Pain complaints in football-related dangers prior to becoming chronic, pain concerns are often self-limiting, but they might have major repercussions. These include the distress of patients and their families and consequences for employers in terms of sickness.[3] Reasons discovered include level of competition, season, playing surface, player position, playing experience, and prior injuries. Unfortunately, only a few of these factors can be changed to reduce the chance of damage. Body mass index (BMI), strength, and flexibility are some modifiable characteristics that have historically been linked to injury risk in football.[4] Strength by itself does not appear to be associated with an increased risk of injury among football players, according to prior study BMI results are equivocal. Functional testing techniques that look at many body-related movement domains have recently been able to identify professional football players who are more susceptible to injury. Looking at tests that need a greater level of dynamic balance, including single-limb balance at the stability.[4] Professional football players who are more prone to injury have lately been identified using functional testing approaches that examine numerous body-related movement domains. Considering tests that need a greater degree of dynamic balance.[5] One of the most popular sports in the world is football, and that popularity is only growing. Regarding its physiological requirements, there is still a great deal of confusion and disagreement. Football is a challenging sport to analyse scientifically because of the coaching emphasis on skill development, deficits in fitness training, and conservative training approaches.[6] The average amount of movement each player makes in a single game is over 10 kilometres.[7] Considering the injuries in football sports from the literature, the present study is focused on the physiological effects among collegiate-level football players with and without musculoskeletal pain.

## Aim

To find the difference in physiological profile between players with and without musculoskeletal pain among collegiate-level football players.

## Material and Method

The subjects were selected from the Saveetha physical education department based on inclusion criteria from January 2022 to April 2022. They explained about the study. 25 collegiate football players were involved: group A (n = 7) with musculoskeletal pain and group B (n = 17) without musculoskeletal pain. The participant's musculoskeletal pain was recorded using the Modified Nordic musculoskeletal Questionnaire to understand their pain level for the past 7 days and 12 months. The pro agility shuttle, vertical jump, standing broad jump, 40-yard test, and three cone drill were assessed, and the body composition was assessed using a skinfold caliper. Collegiate football players under the age level (18-24), With and without musculoskeletal pain were included. Players with recent surgery and players with fractures were excluded.

### Procedure

The data were gathered at the Saveetha College of Physical Education Department. The tests include a 40-yard sprint, height and body mass measurements, a vertical leap, a standing broad jump, a pro-agility shuttle, and a three-cone drill. These tests were chosen because they are frequently employed in the evaluation of football players. The standing broad jump, 40-yard sprint, and vertical leap were all tested on the field. The pro-agility shuttle and three-cone drill were conducted on a patch of unmanicured grass in the ground.

### Vertical Jump:

Performance in vertical jumps was gathered using Vertec equipment (Yardstick, Swift Performance).

Standing side-on to the Vertec at first (on the subject's dominant side), the subject fully elevated their shoulder to displace as many vanes as they could while keeping their heels on the ground. As the zero reference, the final vane movement. Height was measured from the highest vane moved after the individual leaped as high as they could without taking any preceding steps. The knee angle attained during the eccentric part of the jump was unrestricted. The standing reach height was subtracted from the leap height to determine the vertical jump height. The best trial from each subject's two trials was utilised for the analysis of power.

**Pro Agility Shuttle:**

The pro-agility shuttle course is depicted. Prior to the test, subjects were permitted to have a practice run used as a single timing gate. Between the timing gates, subjects assumed a three-point stance while straddling the middle line. The patient was stabilised in the laser beam before starting, and this technique was known as an "in-beam start." To begin the test, the individual ran five yards (4.57 m) to one side before turning and touching the line with one hand. The individual then made a U-turn, ran 10 yards (9.14 m) to the opposite side, touched the opposite line, and then returned via the starting/finish line. The pro-agility shuttle has researchers stationed at either end to make sure the individuals touch the line.

**Standing Broad Jump:**

The standing broad jump involved the athlete placing the toes of both feet on the back of the starting line. With a simultaneous arm swing and crouch, the subject then leaped forward as far as possible, ensuring a two-footed landing. Subjects had to stick to the landing for the trial to be counted. The distance was measured using a standard tape measure from the front of the start line to the back of the back heel at the landing for the trial to be counted. If the subject did not do this, the trial was disregarded and another trial was completed. No restrictions were placed on body angles attained during the preparatory phase of the jump. Each subject completed two trials, and the best trial was used.

**Three Cone Drill Test:**

The subjects were made to practice before test, The subjects starts in three point position at marker 1, 30cm back from the starting line at the instructions participants sprinted to marker 2, bent down and place their hand(right) on the floor then they hurried back to marker 1,and repeated the procedure the participants then returned to marker 2,circled it again and ran through marker 3,around marker 2 and ended the procedure, the subjects jogged in front of the test changing directions at each marker they completed correctly, the participants opened the entryway for the first time and time was recorded from that point until subjects closed the gate once more at conclusion of the test, two trials were completed in first trial subjects turned to left.

**Data Analysis**

A statistical analysis was done to note and evaluate the physiological profile with and without musculoskeletal pain among collegiate football players. The selected variables were assessed using Mann-Whitney U test. The mean and standard deviation were calculated.

## Results

The 25 collegiate foot players were recruited in a specific age group (18–24) with a BMI (mean 21.61; SD 4.87). The participant's body composition variables do not show any significant difference between musculoskeletal pain and no pain, as shown in Table 1. Whereas the participant's pro agility test showed a significant difference between musculoskeletal pain and no-pain football players, as shown in Table 2.

**Table 1: Body Composition**

| Without Musculoskeletal Pain (N=18) | | | With Musculoskeletal Pain (N=9) | | | |
|---|---|---|---|---|---|---|
| **Variables** | **Mean** | **SD** | **Mean** | **SD** | **Z value** | **P value** |
| triceps | 9.00 | 1.749 | 9.71 | 2.628 | -0.408 | 0.683 |
| midaxillary | 8.8889 | 1.23140 | 9.5714 | 2.63674 | -0.249 | 0.803 |
| chest | 8.5556 | 1.42343 | 9.1429 | 2.19306 | -0.375 | 0.708 |
| Subscapular | 9.8333 | 2.14887 | 10.4286 | 2.57275 | -0.461 | 0.645 |
| abdomen | 11.3889 | 2.78945 | 11.2857 | 2.75162 | -0.123 | 0.902 |
| Iliac crest | 9.9444 | 1.55193 | 10.2857 | 2.28869 | -0.647 | 0.518 |
| Thigh | 9.5556 | 2.21055 | 10.1429 | 1.95180 | -0.773 | 0.439 |
| calf | 8.6111 | 1.24328 | 9.0000 | 1.82574 | -0.785 | 0.432 |

**Table 2: Agility Tests**

| Without musculoskeletal pain | | | With musculoskeletal pain | | | |
|---|---|---|---|---|---|---|
| **Variables** | **Mean** | **SD** | **Mean** | **SD** | **Z value** | **P value** |
| 40 yards sprint | 37.3244 | 133.43816 | 5.8243 | 1.70927 | -0.546 | 0.585 |
| Pro agility shuttle | 4.3328 | 2.5111 | 1.31195 | 1.12536 | -1.879 | 0.015 |
| Vertical jump | 2.5111 | 1.19369 | 1.19369 | 1.19836 | -2.423 | 0.060 |
| Standing broad jump | 2.5417 | 1.20712 | 2.4786 | 1.14803 | -0.667 | 0.505 |
| Three cone drill | 8.9894 | 1.60377 | 8.6914 | 1.42835 | -1.120 | 0.263 |
| | | | | | | |

## Discussion

This study compared the physiological profiles of collegiate-level football players with and without musculoskeletal pain; physiological profiles were observed (skinfold caliper for measuring body composition of subjects). Using a calibrated scale, body mass was measured to the nearest 0.1 kg. Both measurements were performed without shoes. The body mass index was determined by dividing the body weight in kilograms by the square of the height in meters.[8] On the right side of the body, double-thickness subcutaneous adipose tissue was measured using skin fold calipers Triceps, pectoralis, subscapular, abdominal, midaxillary, suprailiac, and thigh anatomical locations were all measured. Some tests were kept for the subjects like 40-yard sprint, vertical jump, pro-agility, standing board jump, and three cone drill.[9] The subjects were not fair in performance tests; there were significant differences in subjects BMI, heights, and body composition measured, and tests were seen between subjects with and without pain. The pro-agility shuttle and three cone drill tests showed greater impact, while other tests did not show more impact. Compared to these tests, the three cone drill and pro-agility showed the pain tolerance in performing the tests, whereas subjects with musculoskeletal conditions did not have the same tolerance level to these tests the three cone drill and pro agility shows the pain tolerance in performing the tests, whereas subjects having musculoskeletal pain did not have same tolerance level to perform.[9] However, the participants in the present study do not have any difference in the body composition between the football players with pain and no pain. In 2017, Maren Hjel et al. observed that participation in endurance sports may be especially advantageous and that a moderate physical activity level was associated with fewer neck and shoulder pains and lower back pain.[10] The findings showed that while assessing teenagers' musculoskeletal discomfort, medical providers must take into account the types of sports they engage in. Muhammad Hasnain Murtaza et al., reported that the most common musculoskeletal disorders in football strikers were shoulder (56.5%), neck (55.1%), and ankles (53.6%), whereas the most common musculoskeletal disorders in defenders were ankles (68.7%), knees (57.8%), and hips and thighs (54.2%). 11 In 2019, Ross Zafonte et al. conducted a study on football players at Harvard University. The study's design and objectives led them to conclude that an extensive and ambitious research and translation programme at Harvard University aims to safely collect data on the everyday facet of life of former ASF players. While some parameters are fully recovered (e.g., hormonal and technical), our systematic review shows that a period of 72 hours post-match play is not long enough to completely restore homeostatic balance (e.g., muscle damage and physical and well-being status).[2] This study aimed to provide a physiological profile of the top soccer player.[12] protocols were created to measure muscle strength, flexibility, body composition, anaerobic power, and lower extremity functional performance. Chin MK, Lo YS, Li CT, Western Europe, and North America produce the majority of elite soccer players with certain physiological profiles.[6] Since this present study addresses only the collegiate level football players, the result obtained in the present study may not be generalizable to the football players in other levels.

## Conclusion

Findings indicate that a football player's musculoskeletal pain does not affect their

physiological profile. However, the study's results are limited due to the small number of participants. The author recommends future studies be carried out in elite athletes and other sports to understand the relationship between the physiological profile and pain discomfort.

**Ethical clearance:** Taken from institutional Ethical committee. ISRB number-03/031/2022/ ISRB/SR/SCPT.

**Funding:** This study is a self-funded study.

**Conflict of Interest:** The authors state that there is no conflict of interest

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Original Article

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# Compare the Effectiveness of Ultrasound Versus Trigger Point Release on Cervicogenic Headache

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**Abstract**

**Background:** Cervicogenic headache is a unilateral, fixed, or side-locked headache that commonly affects adults. The studies had tried therapeutic and hands-on therapy for managing the Cervicogenic headache. The intent of this current study is to identify whether ultrasound or trigger point is more effective for Cervicogenic headaches.

**Purpose:** To compare the effectiveness of ultrasound versus trigger point release on patients with cervicogenic headache.

**Materials and Methods:** This experimental study has been conducted from November 2022 to April 2023. 30 cervicogenic headache subjects were taken from Shanthi physio clinic selected based on the criteria of inclusion and exclusion. Numerical pain rating scale (NPRS) was used to measure pain and Neck disability index (NDI) was used to identify head and neck function of the participants. The subjects were divided into Group A (15 Subjects) and Group B (15 Subjects). Group A were treated with Trigger point release with trigger point localization and Group B were treated with Ultrasound with trigger point localization.The treatments were given for 5 days per week and continued for 4 weeks.

**Result:** The pretest and post test values were analyzed ,results suggest that trigger point release with trigger point localization has significant improvement when compared with ultrasound with trigger point localization with p value <0.001.

**Conclusion:** It is suggested that trigger point release with trigger point localization can be more effective for reducing the pain.

**Keywords:** Ultrasound, trigger point release, pain,Cervicogenic headaches, NPRS , NDI.

## Introduction

Cervicogenic headache is a unilateral fixed or side locked headache that has non throbbing pain that radiates to the ipsilateral side of the temporal region. An uncommon but still debatable type of headache caused by neck tissues is called a cervicogenic headache. Usually the estimated prevalence of this disorder is 0.7% to 13.8% which is rather wide[1]. Because it is thought that cervicogenic headache refers to pain brought on by irritation caused by cervical structures, any form that is caused by the cervical from 1 to 2 of the nerves of the body [2,3,4].

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The physiological cause of this discomfort is the convergence of the top three cervical spinal neurons' afferents and trigeminal afferents. There are several factors that might contribute to this form of headache, including arteries and other factors. These factors are what make the person's headache so severe[5]. It is a rare form of headache that most commonly affects adult between the age range of 30 and 44 years[6]. The symptoms include visual disruption, dizziness and difficulty in swallowing[7]. The spine of the cervical and its associated element such as bones and soft tissues can become dysfunctional, leading to the syndrome known as the cervicogenic headache[8].

Stress on muscle fibres and the development trigger point may be caused by acute trauma or recurrent microtrauma. Patients may have localized ongoing pain that limits the range of motion in the afflicted muscle-these include the pelvic girdle,neck,shoulder and other muscles involved in maintaining good posture[9]. Localized and referred pain are the key characteristics of muscle absorption. The role of sensitization mechanisms is supported by the neurophysiological underpinnings of myalgia. TrP has the potential to activate the trigeminal nucleus, which in turn will cause a migraine or cluster headache. People with this headache have responded well to appropriate treatment that targets trigger point deactivation, but the studies are required to fully understand the role[10].

In most cases, the pain of CEH starts in the brain and spreads everywhere and it can cause reduced activities of our body and increase by more movements of the persons[11]. Ultrasound has been used widely because of its use in various fields in reducing pain[12]. Ultrasound treatments can be categorized as having "high" or "low" energy. Low energy uses include ultrasound and bone mending. Ultrasound therapies are used outside of physical therapy[13].

## Aim

To compare the effectiveness of ultrasound versus trigger point release on patients with cervicogenic headache.

## Material and Methods

This study is an experimental study done for 30 subjects from the age range of 30 and 44 years. Convenient sampling technique is used in this study.

**Study procedure:** from November 2022 to April 2023.

**Materials required**: Chair, Ultrasound, acoustic gel, cotton, pillows.

**Inclusion criteria:**

- Both the gender
- Be in the 30-44 age range
- Participants having an NPRS score from 4 to 10
- Neck movement_aggravated by pain.
- Limited cervical motion
- The muscle contains an active trigger point.

**Exclusion criteria:**

- Other headaches like migraine and TTH
- Two_sided headache
- Had treatment for the head and neck in the previous year
- Any ailments that could make manual therapy ineffective
- Patients with visual disruption and dizziness are excluded.

**Outcome measure:**

Assessment was done before the treatment and after 4 weeks of intervention

- Numerical pain rating scale(NPRS)
- Neck disability index(NDI).

**Procedure**

The 30 subjects were selected based on the criteria. The detailed procedures for performing the study were clearly explained to the subjects, and the informed consent form was collected from them before proceeding the study. The pre and posttest values are measured using the pain scale and NDI. The subjects were divided into 2 groups. Control group received ultrasound with trigger point localization alone and the experimental group received a trigger point release with trigger point localization. The trigger point release group is considered as a group A and ultrasound group is considered as a group B. Group A consists of sample size(n=15) and group B consists of sample size(n=15).

**Group A (Trigger point release group)**

This group received trigger point release with trigger point localization. The procedure was concentrated on the trapezius, SCM, cervical, and temporal muscle. The patient was positioned in a sitting position and then the treatment was given. The Palpation can be done using the thumb and index finger, and the participant will be responding verbally by saying local and referred pain they felt. The "n " was marked on the collection sheet of the data if the muscle does not have a trigger point. The Trigger point was located, then the hand was positioned and compression was given perpendicular to the target Muscle. The trigger point was released until the tissue felt lightened or softened. The subjects described a decrease in symptoms as the point releases. 90 seconds holding produces the best drastic change and result but 30 seconds is enough to produce a change.

**Group B (Ultrasound group)**

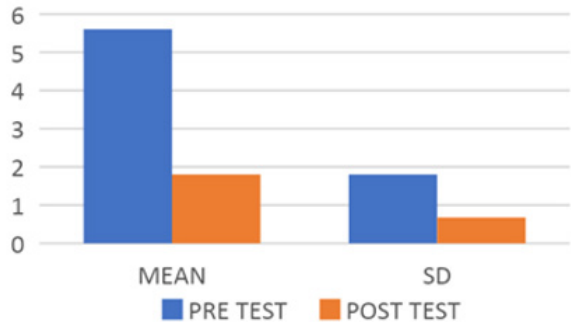
This group received Ultrasound with trigger point localization. The modality was performed with the informed consent by the patient. The electrodes with the gel were placed on the region on the trapezius, levator scapulae, scalene and suboccipital extensor based on pain. During this procedure the patients were positioned in a sitting position. The whole procedure typically lasted for 20 minutes and the ultrasound was given for 5-8 minutes. After the procedure the machine was turned off. The protocol was clearly informed to the patient that they should not undergo any other electrotherapy while participating in this treatment.

Parameters:

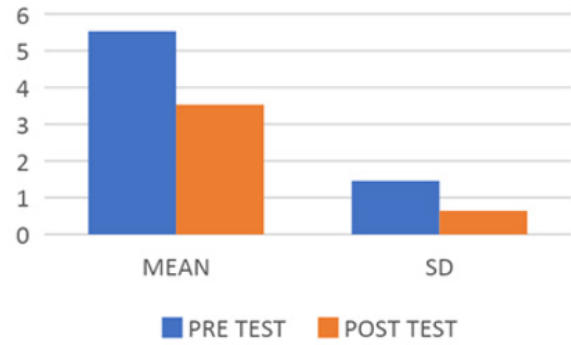
- Frequency – 1MHz
- Duration – 5 to 8 minutes
- Intensity – 1.5W/cm2
- Mode – pulsed mode [18]

**Data analysis**

Using descriptive and inferential statistics ,the acquired data was tabulated and evaluated.



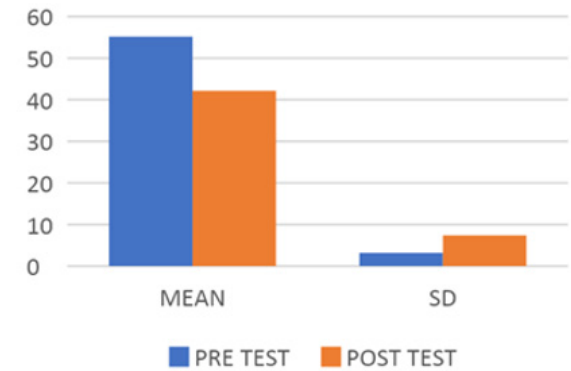

**Graph - 1: Comparison of pre and post value of group A by using NPRS by paired t-test**



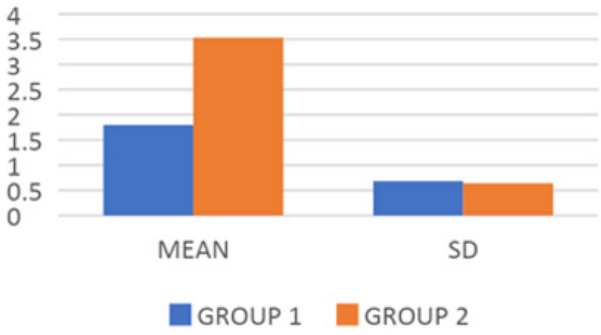

**Graph - 2: Comparison of pre and post value of group B by using NPRS by paired t-test**



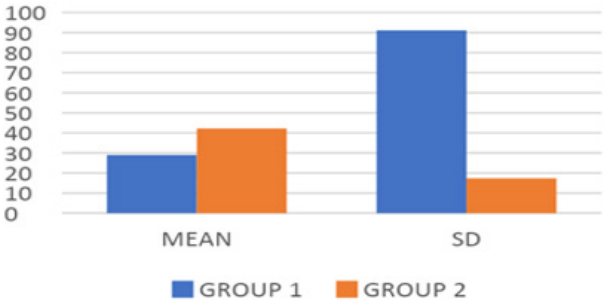

**Graph - 3: Comparison of pre and post value of group A by using NDI by paired t-test**




**Graph 4: Comparison of pre and post value of group B by using NDI by paired t-test**




**Graph - 5: Comparison of post value of group A and B by using NPRS by unpaired t-test**




**Graph - 6: Comparison of post value of group A and B by using NDI by unpaired t-test**

## Results

An analysis made with the data collected revealed a difference between the trigger point release group and ultrasound group and was also evaluated within the groups. The paired and unpaired t-test were used to statistically analyze the values. A significant difference was found between the trigger point release group and ultrasound group as well as within the group, according to the statistical analysis performed on the quantitative data. In the trigger point release group the post-test mean and standard deviation values for NPRS and NDI are 1.80 ± 0.68 and 29.00 ± 9.17 while in the ultrasound group the values are 3.53± 0.64 and 42.13 ± 7.36. This demonstrates that the experimental group's final result shows a reduction in pain.

## Discussion

The current study is to compare the effectiveness of trigger point release with trigger point localization and ultrasound with Trigger point localization to reduce headache and pain and also to assess the effectiveness in terms of reducing pain and disability. The comparison is demonstrated with a duration of 4 weeks. The results were measured by the pain scale and NDI questionnaire before and after the treatment. Beneficial effect in Group A (Trigger point release with trigger point localization) is more than in Group B .(ultrasound with trigger point localization). When the responses were compared between both groups, the result showed a significant difference in trigger point release with trigger point localization than the Ultrasound with trigger point localization group.

In Group A (Trigger point release with trigger point localization) pre-intervention mean of NPRS in group A was 5.60± and 1.80 ± After the treatment , the mean value of NPRS is reduced to 1.80± and 0.68± and in NDI the pre _value is 55.47 ± and 8.85± and in post value it is 29.00 and 9.7 which shows significant difference between the groups. In Group B (Ultrasound with trigger point localization ) pre-intervention mean of NPRS 5.53± and 1.46± .After treating the subject with ultrasound with trigger point localization , the mean of NPRS is reduced to 3.53± and 0.64± ,then with NDI the pre_ value is 55.13± and 3.20± and in post value it is 42.13± and 7.3± which shows difference between the groups.

Based on the results, both groups showed improvement.However, subjects in Group A who received Trigger point release with trigger point localization showed better improvement in NPRS and NDI than the subjects in Group B who received Ultrasound with trigger point localization. An early study by R Michael Gallagher et al.2007 concluded that the headache arises from the neck that is the major reason for this,but the reason for the headache in the neck is pivotal[11].

An early study by Gema Bodes-Pardo et al. in 2013 concluded that hands_on therapy plays a major role in reducing the trigger points on the head and neck when compared to other therapy[14] . An early study by Natalija Stefanovitch-Lawbuary et al. 2019 concluded that the NDI accurate and timely indicators of improvement following physiotherapy for neck pain caused by neck injury[15]. An early study by Zhaokui Jin et al.2017 concluded that scanning of Ultrasound can help in identifying trigger causes and that could be a useful tool for this diagnose[16]. The early study by Matthew Fernandez et al.at 2020 had compared this condition with spinal manipulation exercises and the current study involves ultrasound with trigger point localization and trigger point release with trigger point localization[17]. So, the current study shows that

trigger point release with trigger point localization seems to be more effective for improving head and neck functions. The results obtained from this study has identified that trigger point release with trigger point localization has proved to be effective and this hands on therapy can be incorporated in the recovery for the patients of cervicogenic headache.

## Conclusion

The study concludes that the trigger point release along with trigger point localization and ultrasound with trigger point localization is effective for patients with cervicogenic headache but trigger point release with trigger point localization seems to be more effective than ultrasound with trigger point localization.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/032/2022/ISRB/SR/SCPT).

**Funding:** This study is a self-funded study.

**Conflict of interest:** The authors state that there is no conflict of interest.

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Original Article

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# Compare the Effectiveness of Weight Bearing Exercises and Plyometric Training Improve Joint Position Sense in Osteoarthritis Knee Subjects

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**Abstract**

**Background:** This study was designed to compare the effectiveness of weight bearing exercises and plyometric training to improve joint position sense in osteoarthritis knee subjects.

**Purpose:** To compare the effectiveness of weight bearing exercises and plyometric training improve joint position sense in osteoarthritis knee subjects.

**Materials and Methods:** A total 196 subjects with OA knee were taken from the sri murugan physiotherapy pain and rehabilitation centre-kanchipuram.The subjects are selected based on the inclusion and exclusion criteria.196 subjects were divided into 2 groups. Group A contains 98 subjects received weight bearing exercises and group B contains 98 subjects received plyometric exercises. Both the groups commonly received the IFT. All subjects underwent pre-test measurement with (KOOS) and the same repeated for post-test at the end of 4 weeks**.**The intervention was given for 4 weeks. The entire study process was conducted from November 2022 to April 2023.

**Results:** The pre-test and post-test were analysed, according to statistical analysis weight bearing exercise group were effective in decreasing the pain score and improved functional outcome with p value <0.0001.

**Conclusion:** This study concluded that weight bearing exercises has high impact in improving the joint position sense and functional outcome in OA knee subjects.

**Key Word:** weight bearing exercises, plyometric training, Osteoarthritis knee, IFT.

## Introduction

Osteoarthritis (OA), also known as degenerative joint disorder, primary OA wear and tear arthritis, or age associated arthritis, is one of the leading causes of disability. The word "arthritis" is used by docters to characterize joint inflammation.[1]

Knee OA affects the medial, lateral, and patellofemoral joints, and it normally develops slowly over a period of 10 to 15 years. Osteoarthritis develops over time as the cartilage that protects the ends of your bones in your joints slowly wears away.[1]

Plyometric workouts were first used in sports training to improve jump ability, agility, muscular power, and quick force output older persons can benefit from their benefits as well. For instance, high speed training, which is associated with increases in

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muscle power, has been shown to enhance functional performance and health-related quality of life in older women[5]. Exercises that involve plyometrics are frequently used to evaluate sports performance, increase muscle power, and lower the risk of injury. Given the correlation between plyometric landings and a variety of knee problems, such as tendinosis, anterior cruciate ligament (ACL) damage, and osteoarthritis, the impact from plyometric landings has attracted particular attention.[2]

Weight-bearing exercises can be beneficial for osteoarthritis (OA) of the knee, as they help improve joint stability, maintain bone density, and strengthen the surrounding muscles. However, it's essential to choose the right exercises and perform them with proper form to avoid exacerbating the condition.

A questionnaire called the KOOS is used to evaluate symptoms as reported by patients. Symptoms (7 items), Pain (9 items), Function in Daily Living (16 items), Function in Sports and Recreation (5 items), and Knee-Related Quality of Life (QOL) (4 items) are the 5 subscales that make up the KOOS. Each question receives a score between 0 and 4, and responses are provided via Likert boxes. Each subscale receives a normalized score that ranges from 0 (severe symptoms) to 100 (no symptoms). According to reports, KOOS reliability in an OA population is adequate. The KOOS questionnaire was used both at the beginning and end of the treatment. [6]

## Aim

To compare the effectiveness of weight bearing exercises and plyometric training improve joint position sense in osteoarthritis knee subjects.

## Material and Method

It was an experimental study conducted on 196 subjects. convenient sampling with random allocation method was used in this study. The entire study process was conducted from November 2022 to April 2023.

**Inclusion criteria:**

1. Subject's age 40 years and above.
2. Had chronic knee pain for six months.
3. By using the clinical history and physical examination, OA knee was identified.
4. Subjects diagnosed with Knee Osteoarthritis grade I & II based on American College of Rheumatology criteria.

**Exclusion criteria:**

1. Knee surgery/joint injection in past 6 months or planned surgery in the next 9 months;
2. Past knee fracture or malignancy.
3. Past hip/knee joint replacement/tibial osteotomy.

**Outcome measures:**

Knee injury and osteoarthritis outcome score KOOS scale was used to examine pain, symptoms, activity of daily living, sports and recreation, and quality of life.

**Procedure**

In the comparative study which carry 196 subjects with OA knee were selected based on the inclusion and exclusion criteria. The detailed procedure for performing the test was explained to the subjects. The subjects were made to feel comfortable with the procedure after the explanation. 196 subjects are divided into 2 groups. Group A experimental group contained 98 subjects who received weight bearing exercises and group B control group contained 98 subjects who received plyometric exercises. Both the groups commonly received the IFT. All subjects underwent pre-test measurement knee injury and osteoarthritis outcome score (KOOS) and the same repeated for post-test at the end of 4 weeks.

- IFT PROTOCOL: The patients were explained that a tingling sensation could be felt which should not be unpleasant.
- PATIENT POSITION: Supine lying
- FREQUENCY: 4000HZ
- BASE:90HZ
- BEAT FREQUENCY: 90-130HZ
- CHANNEL: Quadripolar/2 channel
- DURATION:10 minutes.

IN **WEIGHT BEARING EXERCISE GROUP** (n=98) participants were selected and IFT is given for 10 minutes and weight bearing exercise practice such as weight shifting, leg curl, mini squat, single leg standing. Exercises were performed for 30 minutes for each session for 5 days per week. Each exercise performed for 3 sets and 10 repetitions.

**1. WEIGHT SHIFTING**

POSITION: Stand

Stand next to the chair with your feet hip-width apart and your toes pointing forward. Placing one finger on the chair's backrest can help maintain balance.

MOVEMENT & FORM

Maintain keeping the chin tucked, the blades set, and the core set. Exhale, shift weight on one leg and hold. Breath in, shift the weight to another leg. Repeat.

**2. MINI SQUAT**

POSITION: Stand

Stand with feet hip-width apart against the wall, rest the back on the wall, arms crossed over your chest.

FORM & MOVEMENT

Maintain a tucked chin, set blades, and core set. Exhale, bend the knees, lower down towards the floor by 30 degrees, such as sitting on a chair, back in contact with the wall. Inhale, tighten the buttocks, and stand up to starting position. Repeat.

**3. LEG CURL**

POSITION: Stand

FORM & MOVEMENT

Stand facing back of a chair. Slowly bend one leg up toward your buttock, about 90 degree, then straighten it again. Repeat.

**IN PLYOMETRIC TRAINING GROUP**

(n=98) participants were selected and IFT is given for 10 minutes. Plyometric was done for 30 minutes each session 5 days per week. The program includes Towel calf stretch, hamstring stretch, gastrocnemius stretch each exercise were performed for 3 sets and 10 repetitions.

**1. TOWEL CALF STRETCH**

POSITION**:** Long sitting

FORM & MOVEMENT

Keep your back straight and your shoulders down and away from your ears as you gently pull the towel towards you.

**2. HAMSTRING STRETCH**

**POSITION: Long sitting**

FORM & MOVEMENT

Bend forward from your waist as far as possible while keeping your legs straight.

**3. GASTROCNEMIUS STRETCH**

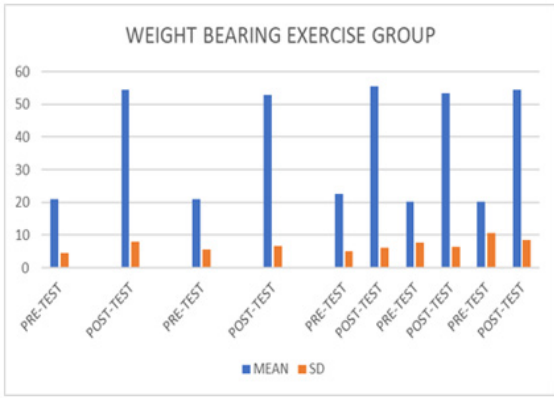
POSITION: stand

FORM & MOVEMENT

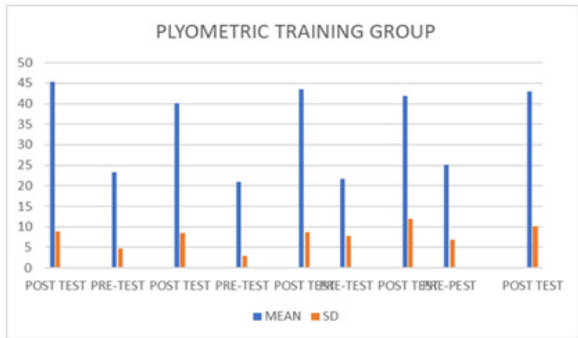
Place yourself approximately an arm's length away from the wall. Lean forward and position your hands roughly shoulder-width apart on the wall.

Extend one foot (the stretched side) behind you, one heel on the ground and the other closer to the wall. Lean your hips into the wall until you feel a stretch in the calf of the extended leg. Hold this stretch for about 30 seconds before switching sides. Move your foot further back for a deeper stretch.

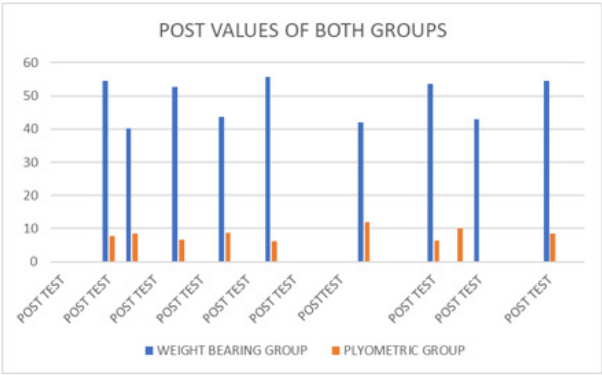
**Data Analysis**




**Graph-1: Comparison of pre-test and post-test values of weight bearing exercise group using KOOS Scale.**




**Graph-2: Comparison of pre-test and post-test values of plyometric training group using KOOS Scale.**




**Graph-3: Comparison of post values of both the groups using KOOS Scale.**

## Result

Using descriptive and inferential statistics, the acquired data was tabulated and evaluated. The mean and standard deviation (SD) were applied to all parameters. The significant differences between pre-test and post-test measures of same group were analysed by paired t-test. The significance difference between the post- test values of both the group were analysed by unpaired t-test to examine significant changes between two groups.

The KOOS pre -test and post-test mean value for pain in bearing group was 20.86 (+4.46) and 54.46 (+7.85), whereas it was 21.00 (+3.20) and 45.27 (+8.86) in the plyometric training group. The KOOS pre- test and post-test mean value for symptom in the weight bearing exercise group was 21.09 (+5.45) and 52.76 (+6.54), where as it was 23.37 (+4.62) and 40.18 (+8.44) in the plyometric training group. The KOOS pre-test and post-test mean value for ADL in the weight bearing exercise group was 22.63 (+5.06) and 55.61(6.06), where it was 20.88 (+2.81) and 43.60 (+8.69) in the plyometric training group. The KOOS pre-test and post-test mean value for SR in the weight bearing exercise group was 20.10 (+7.67) and 53.32 (+6.43), where it was 21.73 (+7.74) and 41.99 (+11.97) in the plyometric training group. The KOOS pre -test and post-test mean value for QOL in the weight bearing exercise group was 20.06 (+10.06) and 54.59 (+8.36), where it was 25.09 (+6.90) and 43.08 (+10.17) in the plyometric training group. The results suggest that findings are considered to be statistically significant with p-value<0.0001.

The KOOS post-test mean value for pain in the weight bearing exercise group was 42.83 (+11.5), where it was 54.45 (+7.85) in the plyometric training group. The KOOS post-test mean value for symptoms in the weight bearing exercise group was 40.18 (+8.44), where it was 52.76 (+6.54) in the plyometric training group. The KOOS post-test mean value for ADL in the weight bearing exercise group was 43.60 (+8.69), where it was 55.61(+6.06) in the plyometric training group. The KOOS post-test mean value for SR in the weight bearing exercise group was 41.99 (+11.97), where it was 53.52 (+6.43) in the plyometric training group. The KOOS post-test mean value for QOL in the weight bearing exercise group was 43.04 (+10.15), where it was 54.59 (+8.38) in the plyometric training group. The results suggest that findings are considered to be statistically significant with p-value<0.0001.

## Discussion

The purpose of the present study is to compare weight bearing exercise and plyometric training in pain and functional outcome in osteoarthritis knee subjects. The comparison is demonstrated with a duration of four weeks. The results were measured using KOOS before and after intervention. Beneficial effects were significantly greater in the weight bearing exercise group than the plyometric training group.

According to Christiansen & Stevens-Lapsley et al., (2010) weight-bearing asymmetry during standing-from-sitting transitions can be a clinically meaningful marker of both knee impairment and functional mobility for those with unilateral knee OA.[3]

NJ Chimera et al., (2004) found that pre-programmed motor strategies that were learned during plyometric training include adductor-to-adductor coactivation and stronger anticipatory adductor activity. These results offer strong support for the use of hip-muscle activation strategies to dynamically control and constrain lower extremity posture when making contact with the ground. Female athletes' training regimens should incorporate plyometric exercises since they increase the functional joint stability in the lower extremity, which may reduce the risk of injury.[4]

Mahalle et al., (2022) has stated that Short-term IFT therapy may significantly lessen pain and improve physical function in people with knee OA. These results imply that physical methods can be used to treat knee OA pain as an adjunct to medicine or as an alternative to it.[5]

Ewa M Roos et al., (2003) has concluded that The KOOS is a relatively new instrument that was originally released in 1998. The literature that is currently available supports its use in a variety of patient populations. However, continued usage of the tool will add to our knowledge and point out areas that need more research and development.[6]

Fernando Ribeiro et al., (2009) has concluded that Regular exercise has a good influence on knee joint position sensibility in both younger and older subjects and it can slow the decline in knee position sense that comes with getting older.[7]

Przemyslaw T Paradowski et al., (2006) has concluded that they discovered that pain, physical function, and quality of life associated with the knee varied with age and gender, suggesting the use of age- and gender-matched reference values for greater comprehension of the result by employing koos following therapies linked to knee injury and knee OA.[8]

Andrea E. Richter et al., (2001) has stated that Sports acceleration training regimens be used by many sportsmen to outperform their opponents. Increasing the balance and reaction time is one approach to obtain this advantage. These two elements are crucial for any athlete but are frequently disregarded. The athlete's skill level can be raised and injury risk decreased with the aid of balance and response time. Therefore, it is crucial to understand what kind of training can be employed to enhance them in order to help reduce the athlete's risk of injury and raise his or her degree of proficiency. This study examined whether plyometric and treadmill exercise enhanced balance and response time in high school players who took part in the Sports Acceleration program at the Altru Health Institute in the summer of 2000. The NBM was used to evaluate 19 patients utilizing the forward lunge and stability limit tests.

The outcomes showed that after plyometric and treadmill exercise, balance and response speed did dramatically improve. There were, however, a number of restrictions on this investigation. To help this area of analysis even further, it is advised that additional research combine the aforementioned suggestions.[9]

## Conclusion

According to this study, WEIGHT BEARING EXERCISE had better results when compared to the PLYOMETRIC TRAINING GROUP, weight bearing exercise is more effective in reducing the pain and improving the functional outcome among osteoarthritis knee subjects.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations- 03/033/2022/ISRB/SR/SCPT.

**Funding:** This study is a self-funded study.

**Conflict of Interest:** The authors state that there is no conflict of interest.

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Original Article

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# Comparative Study on Hatha Yoga Vs Conventional Physiotherapy Management in Pain and Functional Outcome in Osteoarthritis Knee Subjects

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**Abstract**

**Background**: Osteoarthritis is a degenerative condition of the joints that frequently impacts the knee. OA can cause discomfort, stiffness, swelling, instability of joint and decreased muscle strength which limits the movement and lowers the quality of life. Hence the study is to determine the effects of Hatha Yoga VS Conventional Physiotherapy Management in pain and functional outcome in Osteoarthritis Knee Subjects.

**Purpose:** The purpose of the study is to compare Hatha Yoga VS Conventional Physiotherapy Management in pain and functional outcome in osteoarthritis knee subjects.

**Materials and Methods**: About 196 subjects were selected from Vijay Physiotherapy Clinic by using KOOS based on inclusion and exclusion criteria. Experimental protocol and procedures were informed to all the subjects before giving their informed consent. Subjects were allocated into 2 groups. Hatha yoga group and Conventional group, each had 98 subjects. Hatha yoga group performed Hatha yoga and Conventional group performed Conventional Physiotherapy Management for a duration of 45 minutes, 4 days per week with IFT for 10 minutes. These interventions were given for 4 weeks. Study period : October 2022 to July 2023.

**Result**: The Pre-test and Post-test values were analyzed results suggest that Hatha Yoga group has significant improvement when compared with Conventional group with P value<0.0001.

**Conclusion**: According to this study, Hatha yoga group had better results than conventional group, Hatha yoga is more effective in reducing pain and improving functional outcome among osteoarthritis knee subjects.

**Keywords:** Osteoarthritis of knee, Hatha yoga, KOOS, Conventional Physiotherapy Management, IFT.

## Introduction

Osteoarthritis is a degenerative condition of the joints that frequently impacts the knee. OA can cause discomfort, stiffness, swollen unstable joints, and decreased muscle strength which can limit movement and lower the quality of life.[1] Osteoarthritis is a disorder marked by isolated areas of joint cartilage degradation within the synovial joints, together with bone enlargement and capsule becoming thicker.[2] Knee osteoarthritis symptoms are present in 10% men, 13% of women aged 60 years or more.[3] Globally the prevalence is about 9.8% among males and 18% among females above 65 years.[4]

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Elderly population, women, increased BMI, trauma to the knee, frequent usage of joints, the thickness of bones, and joint loosening can lead to the onset of osteoarthritis, especially in joints that bear weight.[3] A person's quality of life may be significantly impacted by pain and other OA symptoms on both physical and psychological level.5 Hatha yoga (ha) is the physical style of yoga that, in theory, helps to ease OA-related pain and stiffness by realigning the skeleton, strengthening the muscles that surround the joints, and loosening up constrictive joint structures.[6] Hatha yoga Performance includes asanas (postures), (pranayama), relaxation techniques. It features specialized body postures, such as relaxation poses, breath control, longer posture maintenance, and it also requires constant, judgment-free focus while practicing, which sets it apart from other forms of physical training.[7] Hatha Yoga can increase strength and flexibility.[8] The mindful prolonging of inhale, breath retention, and exhalation are the main focuses of Hatha yoga's breathing methods. Despite the emphasis on breathwork and meditation, Asanas stretch and strengthen various body parts while lubricating the joints, muscles, and ligaments, and massaging and providing new blood to the interior organs.[9] Exercises for strengthening the quadriceps, hamstrings, abductor muscles, active hamstring and quadriceps stretching are part of the Osteoarthritis management program.[4] The KOOS shows adequate content validity, test-retest reliability, construct validity, and responsiveness for age- and condition-relevant subscales.[10]

## Aim

Aim of the study is to compare Hatha Yoga VS Conventional Physiotherapy Management in pain and functional outcome in Osteoarthritis Knee Subjects

## Material and Method

Yoga mat, chair, IFT apparatus, Electrode pads, Electrode gel, cotton, Micropore. The study was conducted on 196 subjects with osteoarthritis among age groups of 40 years or more. Subjects were collected from Vijay Physiotherapy Clinic and convenient sample technique was used. Study period: October 2022 to July 2023.

**Inclusion Criteria:**

1. Subjects age 40 years or above
2. Subjects diagnosed with osteoarthritis knee grade I and II based on American College of Rheumatology Criteria
3. Chronic knee pain for more than 6 months.

**Exclusion Criteria:**

1. Knee replacement surgery
2. Congenital deformity of affected limb
3. Fracture in the lower limb

**Outcome Measures:**

Assessment was done before and after the end of 4 weeks of study.

1. Knee Injury and Osteoarthritis Outcome Score (KOOS) [10]

**Procedure**

Total of 196 subjects were selected by a convenient sampling technique based on selection criteria. This study includes both male and female, age groups from 40 and above years. Written informed consent was collected from all the subjects prior the commencement of the study. Experimental protocol and procedures were informed to all the subjects before giving their informed consent. These 196 participants were allocated into 2 groups. All the subjects underwent pre-test measurement with KOOS and the same repeated for post-test for a period of 4 weeks.

IFT was given for both the groups.

**IFT Protocol**: The patient was explained that a tingling sensation could be felt which should not be unpleasant.

**Patient Position** -Supine lying

**Frequency**- 4000 Hz

**Base**- 90 Hz

**Sweep**- 40 Hz

**Beat Frequency**- 90-130 Hz

Quadripolar/2 channel

**Duration:** 10 minutes

**In Hatha Yoga Group:** (n=98) subjects were selected and IFT was given for 10 minutes and Hatha yoga practice such as utkatasana (Chair pose), Janu sirsasana (head to knee Pose), Virabhadrasana I (warrior pose I), (Bridge pose) Setubandhasana, (Mountain pose) Tadasana, (Tree pose) Vrikshasana, Virabhadrasana II(Warrior II) were performed. Chairs were utilized during the class, poses might be changed according to the patient. Yoga was performed for 45 minutes for each session for 4 days per week. Each yoga pose was performed for 3 sets and 10 repetitions with a short period of rest in between.

**Hatha Yoga Group**:

**1. Vrikshasana:**

In standing pose the subjects were asked to exhale and bend left knee and place the foot against the inside of the right thigh with their heel abutting their groin. Ask the subjects to inhale and raise the arms overhead and keep palms together. Subjects were asked to repeat the asana on the other side.

**2. Tadasana:**

In standing pose subjects were asked to interlock their fingers and ask them to raise their arm overhead when raising their heel.

**3. Utkatasana:**

In standing pose subjects were instructed to inhale and lift their arms in front of their body up to shoulder level then ask them to exhale and bend their knees and lower trunk to the half squat pose without bending forward.

**4. Virabhadrasana I:**

The subjects were asked to stand with feet apart and then to exhale and turn to the right while turning their right foot. Then the subjects were asked to inhale, raise their arms overhead and bend back. Exhale and subjects were instructed to bend their right knee and lower their trunk. Subjects were asked to repeat asana on the other side.

**5. Virabhadrasana II:**

The subjects were asked to stand with feet apart and exhale and were instructed to turn their right foot, inhale and ask them to raise their arms sideways up to their shoulder level exhale and then ask the subject to bend the right knee and lower the trunk. Subject was asked to repeat asana on the other side.

**6. Setu Bandhasana:**

Subjects were told to lie in their back with their legs bent and foot flat on the floor with hip distance apart. The palms of the arms should be downward as they slide along the body. The fingertips have to be barely in contact with the heels. When rolling the spine off the ground ask them to raise their hips high while pressing the feet firmly into the ground and was asked to keep their knees hip distance apart by lightly squeezing them together. On raising chest ask them to apply downward pressure on shoulders and arms and raise the hip higher by contracting the legs. Ask them to hold their breath and then to release, instruct them to take a breath out and lower the spine to ground slowly.

**7. Janu Sirsasana:**

It was instructed for the subject to sit with their legs extended in front of them. Instruct the subject to relax their right knee by bending it and placing their right foot against their left inner thigh. Instruct them to lift their arms to either side of their head as they inhale, ask to bend their left feet to the outside and press the top of their thigh down and extend their spine. Subjects were asked to turn their upper body slightly to face their left leg and ask them to exhale and fold their hips forward. As they inhale, instruct the patient to flex their left foot, ask them to squeeze the top of their leg down and stretch their spine and raise both arms above their head. Instruct the patient to exhale while bending forward from the hips and rotating their upper body slightly to face their left leg.

**Conventional group:** (n= 98) participants were selected and IFT was given for 10 minutes, Conventional Physiotherapy Management was done for 45 minutes each session 4 days per week for 4 weeks. Program includes Quadriceps isometrics, ROM exercise for knee joint , Hamstring isometrics, Active ankle pump, Active quadriceps stretching, Straight leg raise each exercise performed for 3 sets and 10 repetitions.

**1. Quadriceps Isometrics:**

Subjects were instructed to lie supine. Underneath the affected knee, A small rolled towel / foam roller

was placed. Ask them to push the back of their knee into the rolled towel and encourage them to tense the quadriceps muscle on top of the leg. The subjects were told to contract for ten seconds, then relax gradually.

**2. Active Ankle Toe Pumps:**

Subjects were asked to lie down on their back and asked to pull their toes up toward their head and then point the toes down.

**3. Hamstring Isometrics:**

Subjects were instructed to lie on supine. On the affected side place a rolled towel or foam roller under the ankle. Ask them to push their ankle into the rolled towel or foam roller and encourage them to tense the hamstring muscle on the back of their thigh. The subjects were told to contract for ten seconds then relax gradually.

**4. Straight Leg Raise:**

The Subjects were asked to lie on their back, by straightening the leg that should be trained. The subjects were asked to bend the other leg. Subjects were told to tense the muscle at the top of their thighs and lift the leg keeping it straight and then slowly lower the leg.

**5. Quadriceps Stretching:**

Subjects were advised to lay on their left side and bend their right knee and pull the right leg back toward their buttocks by firmly grabbing the ankle but asked not to extend the heel of the right ankle all the way to the buttocks and instructed to push the hip forward at the same time.

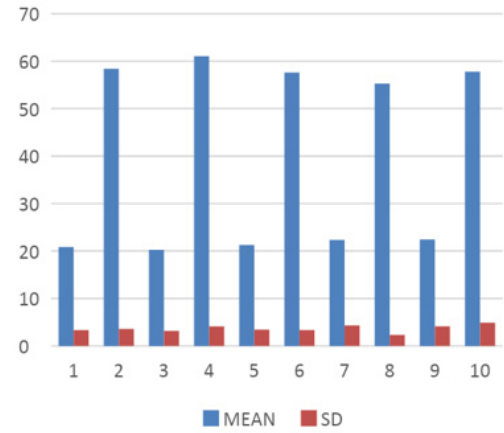
**6. Hamstring Stretching:**

Ask the subjects to sit with both the legs straight on the floor. Ask them to maintain the neutral position of the feet and then ask them to place the hands adjacent to their thighs on the ground. The head was lowered towards the leg as the waist was bent. Ask them to place their knees as close to the floor as possible. Ask them to slide their hands toward the feet while leaning forward.

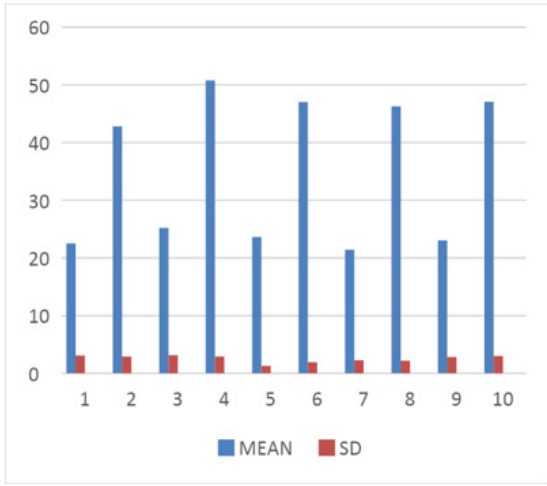
**7. ROM Exercise for Knee:**

Subjects were asked to lie on supine and asked to actively flex and extend the knee joint repeatedly for 10 times for 3 sets.

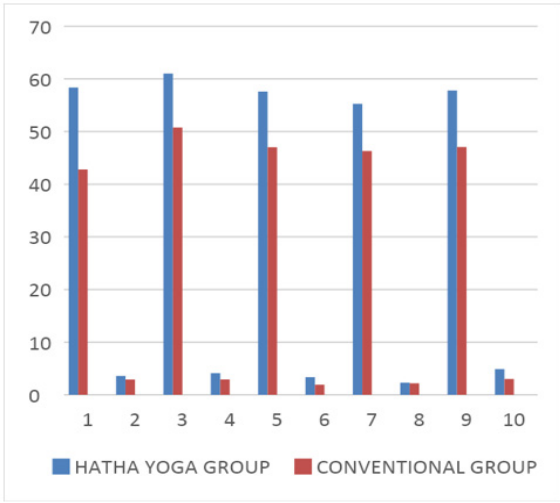
**Data Analysis**




**Graph-1: Comparison between Pre-test and Post-test values of Hatha Yoga Group**




**Graph-2: Comparison between Pre-test and Post-test values of Conventional Group**




**Graph-3: Comparison between Post-test values of Hatha Yoga group and Conventional group**

## Result

Graph 1: Pre-test and post-test values of Hatha YOGA group using KOOS scale are as follows. The value of pain mean and SD pre-test 20.87(±3.34), post-test 58.38(±3.59), symptoms mean and SD pre-test 20.24(±3.17), post-test 61.03 (±4.12), ADL mean and SD pre-test 21.28(±3.43), post-test 57.60(±3.35), Sports mean and SD pre-test 22.35(±4.32) and post-test 55.26(±2.31), QOL mean pre-test 22.43(±4.13), post-test 57.79(±4.89). As a result, the findings are considered statistically significant when the p-value is <0.0001.

Graph 2: Pre-test and post-test values Conventional group using KOOS scale. The value of pain mean and SD pre-test 22.54(±3.09), post-test 42.79(±2.90), symptoms mean and SD pre-test 25.23(±3.14), post-test 50.76(±2.29), ADL mean and SD pre-test 23.63(±1.28), post-test 47.03(±1.92), Sports mean and SD pre-test 21.43(±2.27) and post-test 46.28(±2.19), QOL mean pre-test 23.04(±2.83), post-test 47.06(±3.01). As a result, the findings are considered statistically significant when the p-value is <0.0001.

Graph 3: KOOS post-test mean values in Hatha Yoga group for pain was 58.38(±3.59), 42.79(±2.90), Symptom was 61.03(±4.12), 50.76(±2.92), ADL was 57.60(±3.35), 47.03(±1.92), SR was 55.26(±2.31), 46.28(±2.19), QOL was 57.79(±4.89), 47.06(±3.01).

Results suggest that findings are considered to be statistically significant with p-value<0.0001.This demonstrates that Hatha Yoga group received a higher score than Conventional Physiotherapy Management group. Thus Hatha Yoga group is considerably more effective than Conventional Physiotherapy Group among osteoarthritis knee subjects.

## Discussion

The purpose of the present study is to compare Hatha Yoga vs Conventional Physiotherapy Management in pain and functional outcome in Osteoarthritis knee subjects. The comparison is demonstrated with a duration of four weeks. The results were measured using KOOS before and after intervention.

Based on the Statistical analysis both groups showed improvement in KOOS beneficial effects were significantly greater in Hatha Yoga group than Conventional Group.

Ai -Min Liu et al., 2021 concluded that asana posture which include squatting and lunges leads to increase in strength of lower extremity. For people with symptomatic knee OA, the Chair yoga asana strengthens the quadriceps.[11] Nilima Bedekar et al., 2012 stated that antagonists are stretched and agonist undergo isometric contraction during Utkatasana and Virabhadrasana. When a slow stretch force is applied to a muscle during yoga, the golgi tendon organ activates and blocks muscle tension allowing the sarcomere to stay lengthened.[12] Bedekar Nilima et al., 2015 suggested that IFT can be used to reduce pain which is caused due to musculoskeletal conditions.[13]

Similarly in our study Hatha Yoga group is more beneficial than the Conventional Physiotherapy Group. It is more effective in reducing pain and improving functional outcome in osteoarthritis knee subjects.

## Conclusion

According to this study, Hatha yoga group had better results when compared to the Conventional group, Hatha Yoga is more effective in reducing the pain and improving the functional outcome among osteoarthritis knee subjects.

**Ethical Clearance**: Taken from Institutional Ethical Committee. ISRB number-03/034/2022/ISRB/SR/SCPT

**Funding**: Self Funding

**Conflict of Interest:** Nil

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Original Article

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# Comparison of Aerobic Strengthening Exercise Vs Conventional Exercise in Reducing Pain and Improving Balance in Osteoarthritis Knee Subject

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**Abstract**

**Background:** Osteoarthritis is a chronic knee disease that is caused due to wear and tear injury or inflammation in the joint causing pain and limiting ROM. The condition leads to joint stiffness which causes joint weakness and loss of stability and balance. The purpose of this study is to determine whether ASE or CE is effective in reducing pain and improving balance in an OA knee subject.

**Purpose:** To find out the effect of aerobic strengthening exercise and conventional exercise in reducing pain and improving balance in osteoarthritis knee.

**Materials and Methods:** 198 individuals aged from 55 to 70 of both genders suffering from pain and reduced balance in OA knee participated in the study taken from Dynamics physiotherapy and rehabilitation centre. The individuals were randomly assigned into two groups. Group A received ASE; Group B received CE for 4 weeks. The functional state of the subjects was evaluated pre and post using the NPRS and TUG test. The entire process was conducted from November 2022 to March 2023.

**Results:** Aerobic strengthening exercise was found to be effective compared to conventional exercise in improving balance and reducing pain in OA knee subjects.

**Conclusion:** Group A had better balance and seemed to have reduced pain in OA knee during ADL compared to Group B. It is concluded that ASE provides balance and reduces pain and is seen as an effective treatment in OA knee.

**Key Words:** Osteoarthritis, Range of Motion, Aerobic strengthening Exercise, Conventional Exercise, Numerical Pain Rating Scale, Time Up & Go, Activity of Daily Living

## Introduction

Osteoarthritis is of two types Primary and Secondary, this is the most commonly occurring arthritis[1,2,5]. Primary OA is idiopathic and has no exact cause. It can be caused due to wear and tear injury. The hyaline joint cartilage is the main cause of OA, the hyaline acts as a cushion between the bones it provides smooth gliding for the surface of the joint, when the cartilage breaks it allows the spurs to move around the joint causing pain and swelling and restricts movement of the joint, The inflammation leads to the process called cytokines and enzymes

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which leads to more wear and tear of the joint and damage of the joint [7,2,3,6].Joint osteoarthritis is the most common disease in adults and studies have shown that 6% of the adult population are diagnosed with knee OA, by the age of 60, 10% of men and 13% of women are diagnosed with symptomatic knee OA. The causes for the condition are ageing, obesity, repetitive use of knee, knee injury, muscle weakness, joint laxity and bone density. The process of the condition begins in the second decade of life but the degenerative changes and symptoms are not seen until middle age[8]. Osteoarthritis being a disease of the joint involves and affects lifestyle of a particular individual and also has an impact on anxiety, depression, difficulty in activity of daily living, socializing, feeling helpless and unable to fulfil occupational needs.[8] Aerobic exercise refers to cardio and conventional exercise refers to weight free exercise [1,7]. Aerobic exercise is mostly cardio, this exercise helps keep the cardiovascular and respiratory system healthy [17,18,19]. Aerobic exercise deals and targets more on the oxygen inspiration and expiration, during this activity or exercise raises the heart rate, blood pumps more and works the large muscle groups [15,16]. The benefits of this exercise are improved cardiovascular health, lowered blood pressure,regulated blood sugar, aided sleep, weight management and better mood. Engaging in aerobic strengthening for individuals with OA knee helps in enhancing and improving joint mobility, reduction of pain, and also aids in overall health. For individual with OA knee aged from 55 to 75 it is essential to choose activities that are low impact and don't stress the knee joint such as walking, slow cycling, water aerobics, elliptical training, rowing, low impact aerobics that are stepping, marching and side to side movement [13,14].

## Aim

To determine the effect of aerobic strengthening exercise vs conventional exercise in reducing pain and improving balance in OA knee subject.

## Materials and Method

It was a comparative study which included 198 subjects presenting with osteoarthritis knee aged 55 years and above. Convenient sampling with random allocation method was done in this study.

**Inclusion Criteria**

- Age – 55 or above
- Both male and female
- Subject should be diagnosed with OA knee grade I and II based on American college of Rheumatology
- Knee pain duration more than 3 months

**Exclusion Criteria**

- Age – 55 or above
- Both male and female
- Subject should be diagnosed with OA knee grade I and II based on American college of Rheumatology
- Knee pain duration more than 3 months

**Outcome Measures**

- Numerical Pain Rating Scale (NPRS)
- Time Up and Go Test (TUG),4,13

**Procedure**

A sample size of 198 participants was included in this study. Prior to their involvement, subjects provided written consent by signing a consent form. The participants in group A received Aerobic Strengthening Exercise every day for a four-week period.

On the other hand, the participants in group B engaged in conventional exercises every day for 4 weeks, the same as group A.

Additionally, both the groups were given IFT for pain before every session for 12 mins, the base was set at 90Hz and the spectrum at 50hz with a frequency of 80-100 Hz. The program was fixed at 20 and a trapezoidal pattern was used.

**Group A: Aerobic Strengthening Exercise**

1. Ball squats – stand on the resistance band with the feet shoulder – width apart, hold the end of the band at shoulder height, maintain tension in the band while performing squats. (3x10)
2. Dumbbell step up – hold a pair of dumbbells by your side. Step on a stair with one foot, then bring the other foot up. step back down in the same order. (3x10)

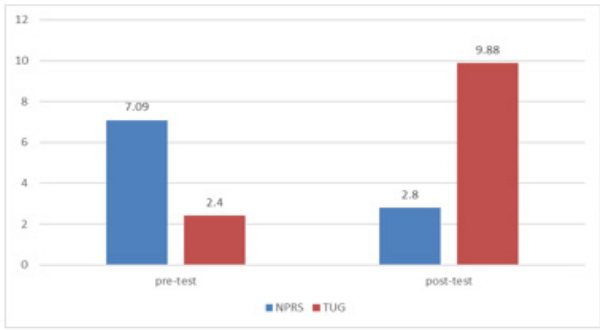
3. Russian twist assisted with stability ball – rest yourself faced forward on a stability ball with your feet planted flat and comfortably on the ground, lean back gently and move your torso side to side. (3x10)
4. Seated marching – sit straight on a chair and perform the marching action. (3x10)
5. Seated leg extension – sit straight on a chair and extend your legs one by one. (3x10)
6. Heel to toe walk – walk on a straight line, placing one foot directly in front of the toes of the other foot with each step. Use a wall or support to prevent falls. (3x10)
7. Calf raises – stand near a wall or support, rise up onto your toes, lifting your heel off the ground, then slowly lower back down. (3x10)
8. Tandem walk – walk in a straight line (1x10)
9. Walking 15 minutes

**Group B: Conventional Exercise**

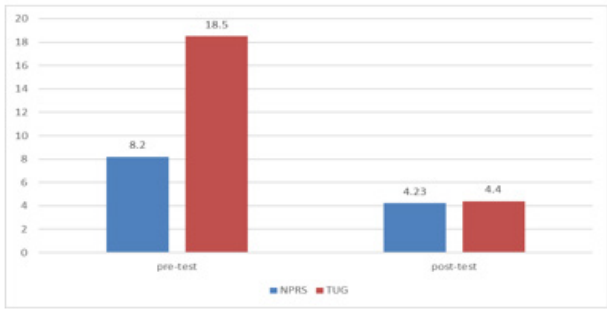
1. Quadricep isometrics – sit on a chair, place a rolled towel or small pillow under the knee and contract the quadricep muscle in front of the thigh by pressing the back of the knee down into the towel or pillow. (3x10)
2. Hamstring isometrics – sit on a chair with flat feet and knee at 90 degrees press the heel down into the floor, at the same time contract the hamstring muscle. (3x10)
3. SLR Straight leg raise – sit on a chair and extend the leg, lift the extended leg off the ground keeping the knee straight. (3x10)
4. Hamstring strengthening – stand behind a chair holding onto it for support. Flex the knee and bring your heel toward your hip region and gently lower your leg back down. (3x10)
5. Heel slide – lie on your back with both knee bent and feet flat on the floor. slowly slide one heel along the floor, straightening the knee as much as possible. (3x10)
6. Calf raises – stand near a wall or support. Rise up onto your toes, lifting your heel off the ground, then slowly lower back down. (3x10)

   Isometrics were applied with 6 second contraction and a rest period of 2 seconds.

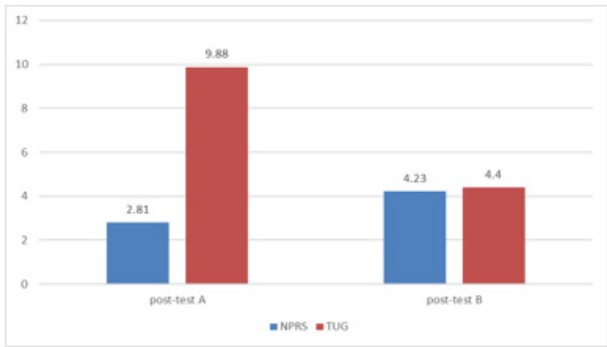
**Data Analysis**




**Graph No. 1: Comparison of pre-test and post-test values of group A (aerobic strengthening exercise) using NPRS and TUG test**




**Graph No. 2: Comparison Of pre-test and post-test values of group B (conventional exercise) using NPRS and TUG test**




**Graph No. 3: Comparison of post-test values of group A (aerobic strengthening exercise) and group B (conventional exercise)**

## Result

The statistical analysis of the data that was collected and evaluated revealed a statistically significant difference in the values between the group that received Aerobic Strengthening Exercise and the group that received Conventional Exercise.

**Graph 1**: The data obtained shows pre and post mean values of the group that received Aerobic Strengthening Exercise.

Mean values obtained for NPRS (cms) was 7.09 (SD 1.45) in pre and 2.81 (SD 0.09) in post. The t value was noted down to be 24.2551 with P value lesser to 0.0001.

Mean values obtained for the TUG test (secs) was 22.3 (SD 3.72) in pre and 9.288 (SD 0.05) in post. The t value was noted down to be 33.2167 with P value lesser to 0.0001.

**Graph 2:** The data obtained shows pre and post mean values of the group that received, Conventional Exercise.

Mean values obtained for NPRS (cms) was 8.20 (SD 1.62) in pre and 4.23 (SD 1.06) in post. The t value was noted down to be 20.4037 with P value lesser to 0.0001.

Mean values obtained for TUG test (secs) was 18.5 (SD 3.70) as pre and as 6.48 (SD 2.64) in post. The t value was noted down to be 26.3124 with P value lesser to 0.0001.

**Graph 3:** The data obtained shows post values of both Aerobic Strengthening Exercise and Conventional Exercise.

Mean values obtained for NPRS (cms) was 2.81 (SD 0.09) in post for group one and as 4.23 (SD 1.06) for the other group. The t value was noted down to be 9.7412 with P value lesser to 0.0001.

Mean values obtained for TUG test (secs) was 9.288 (SD 0.05) in post in group one and 6.48 (SD 2.64) for the other group. The t value was noted down to be 12.8119 with P value lesser to 0.0001.

The data obtained shows that Aerobic Strengthening Exercise has more effect than Conventional Exercise on the subjects with pain and decreased balance due to osteoarthritis.

## Discussion

The goal of the above conducted study is to find the efficacy for individuals with grade I and grade II Osteoarthritis by treating them with aerobic strengthening exercise and conventional exercise.

Osteoarthritis is a common and active condition that occurs in almost more than half of the population when they cross the age of 50, the population the experience osteoarthritic knee have various symptoms which comprises pain, joint instability, loss of range of motion, limitation of movement and loss of balance and coordination.[14]

Osteoarthritis occurs due to multifactorial reasons; studies show that any past medical history of knee trauma increases the risk of the knee OA 3.86 times. Mechanical forces that act on the knee are also a reason that leads to Osteoarthritis knee.

Osteoarthritis develops due to interactions between systematic and local factors. The progression of the condition may be due to risk factors, advancing age, genetics, trauma, knee malalignment, increased biomechanical loading due to obesity, bone density and imbalance in physiological processes.[18, 19]

Lucie Brosseau et al showed that aerobic strengthening exercise in general is more beneficial for OA patients and is equivalent to strengthening exercise further more Linda Mclean et al showed that a short-term aerobic exercise program with or without muscle strengthening exercise has been promising for reducing pain and improving physical functional and overall health in individuals with OA.

World J Orthop et al reported that aerobic exercise has the efficacy in reducing pain and improving physical and overall function in OA individuals. Sumaiyah Mat et al showed that aerobic exercise improved balance and fall risk in older individuals with knee OA.[17]

K La Mantia and R Marks et al showed that aerobic strengthening has been actively effective in reducing pain in OA individuals, further Ryo Tanaka concluded that showed in a study that both muscle and aerobic strengthening has been effective in reducing pain in OA knee individuals.[18]

Later Vahid Mazloum concluded the same as the previous authors that aerobic strengthening has been shown to be effective in reducing pain and improving balance in OA individuals, which was later confirmed by Nader Rahnama in a study that was conducted by her on OA individuals to show that aerobic exercise is effective in reducing pain and improving overall health in the individuals.

In the later years a study showed that aerobic strengthening in cooperation with other kinds of exercise has also been proven to show results in reducing pain and symptoms in OA individuals, Betsy Denisse Perez-Huerta confirmed this in practical research which was conducted by her and her team.[15]

Rufus A. Adedoyin et al (2005) conducted a randomized control trial on knee osteoarthritis to find out the effects of interferential current and transcutaneous electrical nerve stimulation. The subjects improved significantly over a period of 4 weeks, but there were no additional effects of interferential current or transcutaneous electrical nerve stimulation on pain and function.[18] With the consideration of the results, we made an attempt to combine the strengthening exercise with the interferential therapy to show improvement in the functional state and reduce pain in the subjects with knee osteoarthritis. [19]

## Conclusion

According to the research that was conducted on patients with I and II-degree OA knee for improving balance and reducing pain using Aerobic Strengthening Exercise and Conventional Exercise, it is analysed from the data obtained from the individuals after the period of intervention and concluded that Aerobic Strengthening Exercise has significant result in reducing pain and improving balance.

**Ethical clearance**: Taken from the institutional ethical committee. ISRB number- 03/035/2022/ISRB/SR/SCPT

**Funding:** Self

**Conflict of Interest**: NIL

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Original Article

DOI: https://doi.org/10.37506/78vcac66

# Effectiveness of Muscle Energy Technique and Strengthening Exercises by KOOS in Knee Osteoarthritis Strengthening Exercise in Reducing Pain to Improve Functional Activity Measured by KOOS in Knee Osteoarthritis

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**Abstract**

**Background:** According to 2012 data, the prevalence rate of OA in both rural and urban India was ranging from 33% to 46% of the older adult population where females were more affected than men. Participants with knee OA frequently need to perform strengthening exercises since they have weaker muscles due to decreased physical activity and pain tolerance.

**Purpose:** The Purpose of the study is to find out the efficacy of Muscle energy technique and strengthening exercise in pain management to improve ROM in knee osteoarthritis.

**Materials and methods:** This study included a sample of 196 between the age group of 45- 60 years were taken from Shri Shakthi's centre for pain relief and rehabilitation according to selection criteria for this experimental study which was divided into two groups, strengthening exercise group (n=98) and muscle energy technique group (n=98) . Interventions were given as 5 sessions a week and continued for 2 weeks.

**Study period:** March 2023 to July 2023.

**Result:** The Pre-test and post-test values were analysed, pain score was decreased and functional outcome was improved significantly in strengthening exercise groups when compared to muscle energy technique.

**Conclusion:** The study shows that strengthening exercise for osteoarthritis of the knee in older adults is more effective than muscle energy technique.

**Key Words:** Knee Osteoarthritis, Muscle energy technique, Strengthening exercises, Manual therapy.

## Introduction

The most prevalent type of chronic pathology of synovial joints is osteoarthritis, commonly known as osteoarthritis or degenerative joint disease.[1] After the age of 40, women are more prone than men to get OA, but the prevalence rises sharply with advancing years. According to the Global Burden of Disease in 2000, Years lived with disability (YLD) are most frequently caused by OA, which ranks fourth

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globally.[2] The primary clinical symptoms of OA are the slow degradation of articular cartilage and the formation of bone at the joint margin.[3] Weakness in the quadriceps muscle is the first sign of osteoarthritis in patients compared to healthy individuals.[4] Data from 2012 showed that OA affected between 33% and 46% of the population of older adults in both rural and urban India, with women being more afflicted than men.[5]

Manual therapy known as the Muscular Energy Technique (MET), involves the patient using their own muscles from a specific location, in a certain way, and in spite of the therapist applying a counter force.[6] The Mulligan Techniques recommend moving in a particular direction or within a range of motion that is pain-free in order to increase hip flexion and knee extension. Osteoarthritis of the knee patients experience significant physiological changes that impact their ability to do daily chores, such as weakness and diminished flexibility, in addition to discomfort.[7] There are numerous therapies available that 8th and 9th place a greater emphasis on pain.[8] Patients with knee osteoarthritis have not been studied to compare the two procedures. The purpose of this study was to compare the efficacy of Mulligan's bent leg raise (BLR) method with the muscular energy technique in treating knee OA.[9] The strength of your muscles, your ability to manage your muscles, your range of motion, the stability of your joints, and your fitness can all be enhanced by a good training regimen. Since their decreased physical activity and pain tolerance have left their muscles weaker, patients with knee OA frequently need to do strengthening activities.[10]

As a result, strengthening activities increase the strength of the quadriceps while also improving clinical outcomes such as pain, physical function, and quality of life. In order to better the quadriceps muscle and patellar tendon's capacity to efficiently unload the knee joint, it is believed that strengthening the quadriceps will increase their force when moving. In addition to exerting more force, the quadriceps would be able to absorb more energy (i.e., perform negative work), which might help to lessen the stress applied to the knee joint surface. This clarifies why it makes sense for the muscles' strength to serve as a shock absorber around the knee joint.[11] The knee joint is stabilized and has less varus-valgus laxity when the extensor and flexor muscles of the knee contract strongly together. Patients with stronger hamstrings and quadriceps walked faster and with less knee joint loading. The pathophysiology of osteoarthritis has been linked to increased articular cartilage loading and cartilage's capacity to withstand loading. Daily walking may put strain on the joints, which could alter how osteoarthritis manifests and advances. Walking places 70% of the strain on the medial compartment of the knee. It has been discovered that a high knee adduction moment is a potent indicator of the presence, severity, and rate of progression of knee osteoarthritis. Weight distribution between the compartments of the knee is changed by the knee's moment of adduction.[12]

It is common practice to diagnose and classify the severity of OA using radiographic evidence of abnormalities in the underlying subchondral bone and attrition of the articular cartilage.

The intra-articular changes have been the main focus of OA research, which has shed a lot of light on the pathophysiologic processes that take place within the articular environment. The periarticular skeletal muscles' alterations, in contrast, have received very little attention from researchers.[13] The neuromuscular skeletal system, which consists of the articulating bones, cartilage, ligaments, capsule, the muscles that control movement, and the nerves that regulate movement, should be seen as a whole, with the synovial joint acting as one of its functional components. However, because muscles are necessary for joint function, the synovial joint should be viewed as a functional component of the neuromuscular skeletal system. The efficient operation of each part of these units is necessary for precise, controlled movement. Joint dysfunction results from any malfunctioning component. A rising body of evidence suggests that muscle dysfunction may play a role in the pathophysiology of OA, despite the fact that very few research studies have been conducted in this field. This is because it is now known how the condition affects muscles.[14]

## Aim

To find out the effectiveness of Muscle energy technique and strengthening Exercise in pain management to improve ROM in knee osteoarthritis.

## Material and Method

- Couch
- Pillow
- Foot stool
- Bedsheet

The experimental study conducted on 196 subjects with knee osteoarthritis, age between 45-60 years was taken from Shri Shakthi's centre for pain relief and rehabilitation. Convenience sampling method was used in the study.

**Study period:** March 2023 to July 2023.

**Inclusion Criteria**

- The subjects diagnosed with OA knee subjects of age 45 to 60 years with ACR (American college of Rheumatology)
- Knee pain duration more than 3 months
- Both genders included

**Exclusion Criteria**

- History of past or recent surgery in lower limb
- Any deformity in the affected side lower limb
- Any neurological injury in affected lower limb
- Any malignancy in affected lower limb

**Outcome Measures**

- Knee Injury and Osteoarthritis Outcome Score (KOOS)

A self-report questionnaire known as the Knee Injury and Osteoarthritis Outcome Score

(KOOS) evaluates five outcomes: daily activities, sport and recreation function, pain, symptoms, and knee-related quality of life. The KOOS satisfies the requirements for a basic outcome measure and can be used to determine how well a knee injury has healed. It can be calculated in percentages, with 100 signifying no problems and 0 signifying severe problems.

**Procedure**

In the comparative study which carried 196 subjects with OA knee chosen in accordance with the inclusion and exclusion criteria from Saveetha medical college and hospital. The detailed procedure for performing the test will be explained to the subjects. The subjects are made to feel comfortable with the procedure after the explanation. 196 subjects are divided into 2 groups where one set of group A (n=98) will be given muscle energy technique which have 2 types, the post isometric relaxation with the sets of 3 and 10 repetitions and the reciprocal inhibition with the set of 3 and 10 repetitions/ per day, 5 days in a week and group B (n=98) will receive strengthening exercise with the following by quadriceps strengthening exercise, hamstring strengthening exercise and calf strengthening exercise with a sets of 3 and 15 repetitions/ per day, 5 days in week will be given respectively.

**1. Muscle Energy Technique**

This technique is divided into two types

A) Post Isometric Relaxation

B) Reciprocal Inhibition

**A) Post Isometric Relaxation (PIR)**

The subject will be supine with their hips 90 degrees flexed. The individual will be instructed to flex their knee with 20% more force. The quadriceps, the agonist muscle, will experience resistance for 5 seconds during the contraction. With a 5-second rest interval in between each set, there will be 3 sets of 10 repetitions each.

**B) Reciprocal Inhibition**

The subject will be positioned in the same 90-degree supine position. The individual will be instructed to flex their knee with 20% more force. While resistance is being given to the quadriceps, the contraction will be sustained for 5 seconds. With a 5-second rest interval in between each set, there will be 3 sets of 10 repetitions each.

**2. Strengthening Exercises**

**i) Quadriceps Strengthening Exercise**

The subject will perform this exercise while lying supine with the affected leg straightened and the unaffected leg bent. A towel will be put below the knee and pressure will be applied for 3 sets and 15 repetitions over the course of 5 days.

**ii) Hamstring Strengthening Exercise**

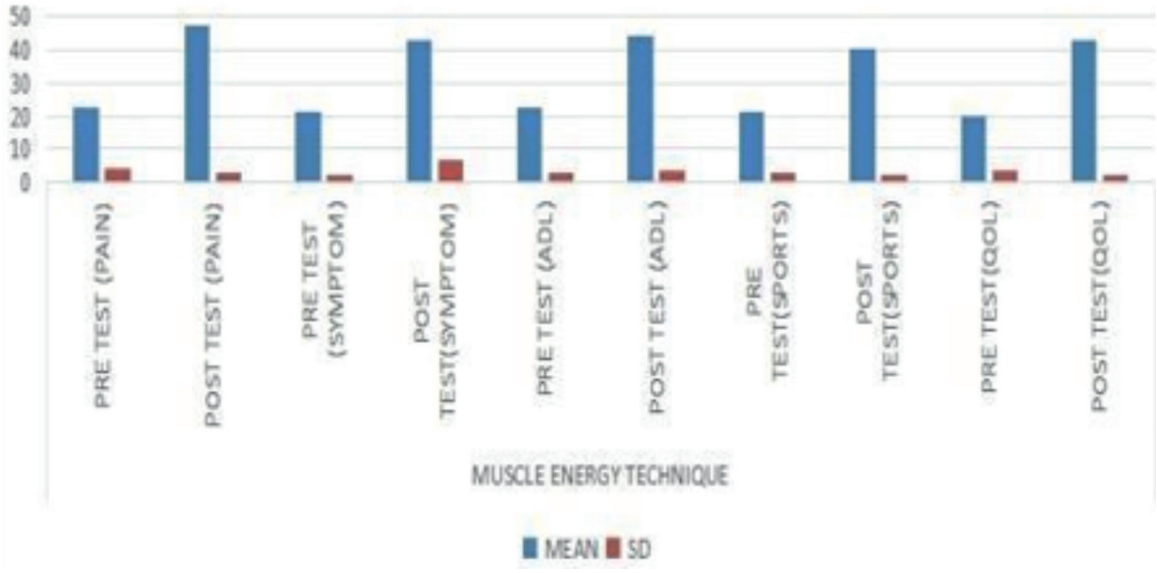
The subject will be in quadripod position, while the affected leg will be raised for 15 repetitions with 3 sets/ per day, 5 days in week will be given.

**iii) Calf Raises**

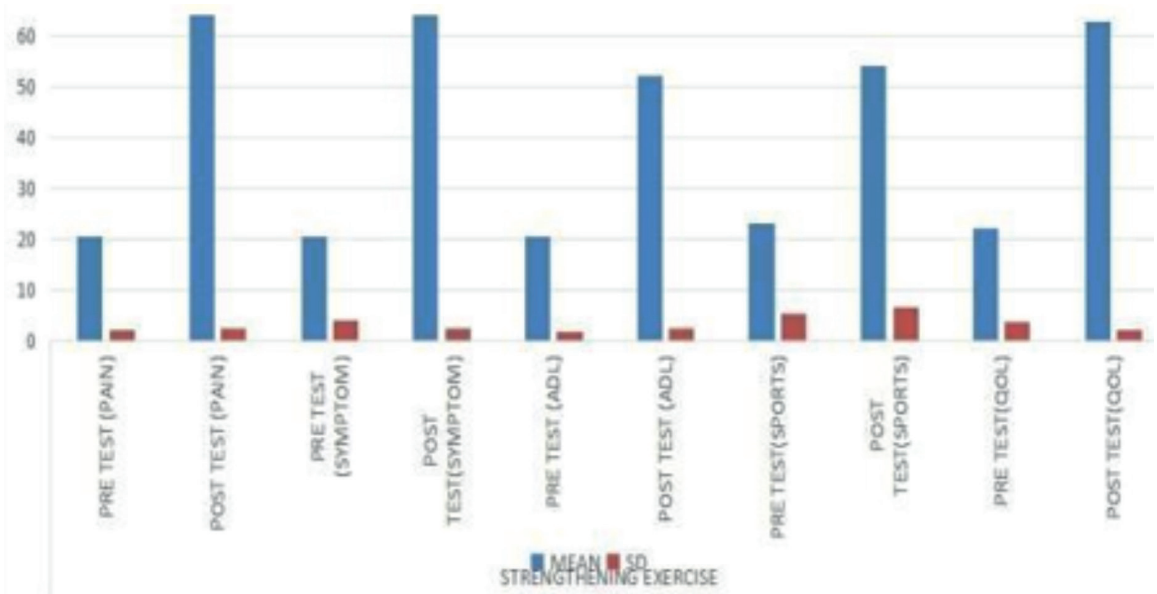
The subject will be instructed to stand on the foot stool or at the stairs and tell them to do calf raises for 3 sets and 15 repetitions per day, 5 days in week will be given.

**Data Analysis**

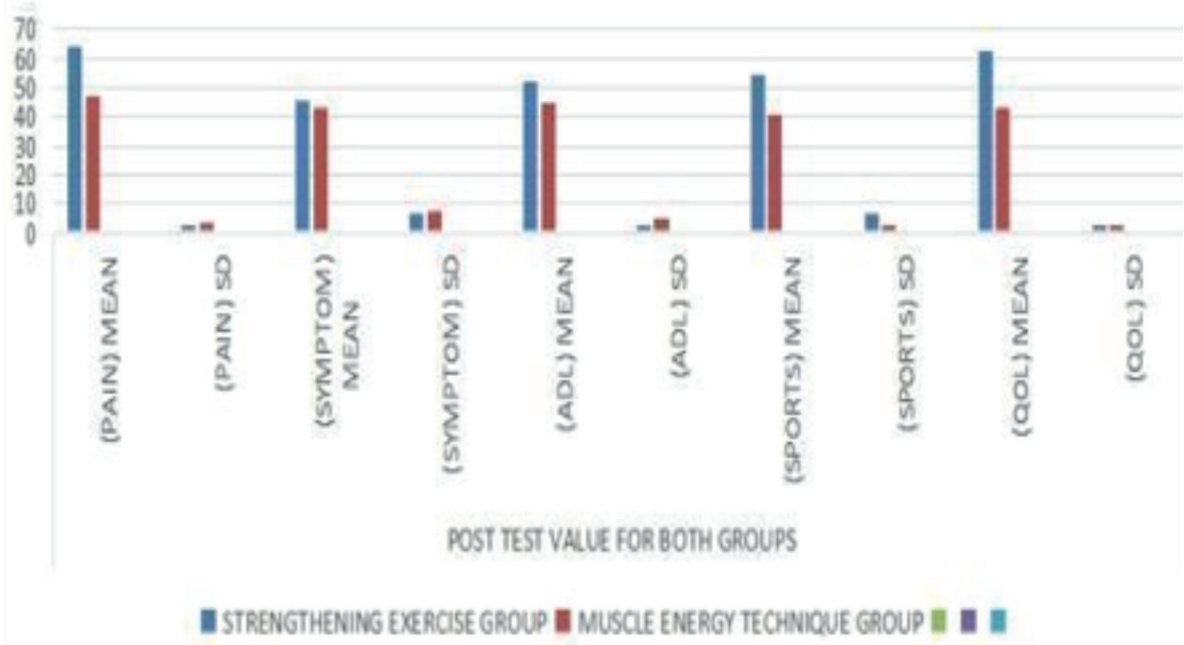
**The mean and standard deviation (SD) were applied to all parameters. The significant differences between pre-test and post-test measures of the same group were analysed using a paired t-test and the post-test values of both the group were analysed using the unpaired t-test to examine significant changes between two groups.**




**Graph- 1: Comparison of the Muscle Energy Technique Group's Pre- and Post-Test Values**




**Graph-2: Comparison of the Strengthening Exercise Group's Pre- and Post-Test Values**




**Graph-3: Comparison between Post-test values of Strengthening exercise group and muscle energy technique group**

## Result

Graph.1. Compare the pre-test and post-test values of muscle energy technique using KOOS scale. The mean value of muscle energy technique in the experimental group using the Koos scale, the value of pain pre-test (22.7) and post-test (47.12) and pain SD pre-test (4.13) and the post test (3.01), symptoms mean pre-test (21.14) and post-test (42.79) and symptom SD pre-test (2.49) and post-test (7.00), ADL mean pre-test (22.83) and post-test (43.97) and ADL SD pre-test (2.89) and post-test (3.50), SR mean pre-test (21.53) and post-test (54.08) and SR SD pre-test (2.73) and post-test (6.52), QOL mean pre-test (20.10) and post-test (43.02) and QOL SD pre-test (3.69) and post-test (2.39). As a result, the findings are considered statistically significant when the p-value is <0.0001.

Graph.2. Compare the pre-test and post-test values of strengthening exercise using KOOS scale. The mean value of strengthening exercise in the experimental group using the Koos scale, the value of pain pre-test (20.29) and post-test (63.96) and pain SD pre-test (1.93) and the post-test (2.48), symptoms mean pre-test (20.49) and post-test (63.96) and symptom SD pre-test (3.80) and post-test (2.46), ADL mean pre-test (20.49) and post-test (52.16) and ADL SD pre-test (1.71) and post-test (2.36), SR mean pre-test (22.86) and post-test (54.08) and SR SD pre-test (5.18) and post-test (6.52), QOL mean pre-test (21.88) and post-test (62.55) and QOL SD pre-test (3.68) and post-test (2.14). As a result, the findings are considered statistically significant when the p-value is <0.0001.

Graph.3. Compare the post-test values of strengthening exercise group and muscle energy technique group, revealing that strengthening exercise group mean of pain pre-test (63.96) and post-test (47.12) and pain SD pre-test (2.46) and post-test (3.01), mean of symptom pre-test (45.85) and post-test (42.79) and symptom SD pre-test value (6.80) and post-test (7.00), mean of ADL pre-test (52.16) and post-test (44.96) and symptom of ADL pre-test (2.36) and post-test (4.83), mean of SR pre-test (54.08) and post-test (40.66) and SR's SD value pre-test (6.52) and post-test (2.65), QOL mean pre-test (62.55) and post-test (43.02) and QOL's SD value pre-test (2.14) and post-test (2.39)

## Discussion

Based on the inclusion and exclusion criteria from Saveetha Medical College and Hospital, 196 patients with OA knee will be chosen for the comparative

study. The subjects will be given a thorough explanation of how the exam will be conducted. After the explanation, the individuals are guided through the procedure in a comfortable manner. 196 subjects are divided into two groups. Group A (n=98) will receive muscle energy technique, which consists of two types: post-isometric relaxation with sets of 3 and 10 repetitions and reciprocal inhibition with sets of 3 and 10 repetitions/per day, five days per week. Group B (n=98) will receive strengthening exercise, which includes quadriceps strengthening exercise, hamstring strengthening exercise, and calf strengthening exercise with a set of 3 and 10 repetitions/per day, five days.

In 2018 DeVita P concluded that, while improving symptomatic and functional outcomes, quadriceps strength training does not alter the biomechanics of the quadriceps or the knee joint when a person is walking. Strength training has been shown to enhance knee osteoarthritis patients' health, although the biomechanical mechanism underlying this improvement is yet understood. [11]

In 2011 Foroughi N concluded that, the knee or hip adduction moment did not increase following high intensity resistance training compared to controls. In contrast to expected increases in this parameter, hip adduction moment fell across the board for the whole cohort, regardless of group assignment. When compared to the resistance training group, the sham group's knee extension moment grew greater, while it was also associated with enhanced muscle strength. [12]

In 1997 Slemenda C concluded that, patients with osteoarthritis who do not experience knee discomfort or muscular atrophy may nonetheless have quadriceps weakness, which raises the possibility that the weakness is caused by a dysfunctional muscle. The information supports the hypothesis that quadriceps weakness plays a significant role in knee pain, disability, and the course of joint deterioration in individuals with osteoarthritis of the knee. [14]

## Conclusion

The study shows that strengthening exercise for osteoarthritis of the knee in older adults is more effective than muscle energy technique.

**Ethical Clearance:** Taken from institutional ethical committee. ISRB Number: 03/ 036/ 2022/ ISRB/ SCPT

**Funding:** Self funding

**Conflict of Interest:** Nil

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Original Article

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# Comparison Between Mckenzie Approach and Lumbar Core Stabilization Exercise in Improving Functional Activity and Reducing Pain for Lumbar Radiculopathy by Using Pain Rating Scale and Functional Scale as an Outcome Tool

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**Abstract**

**Background:** Lumbar radiculopathy, is a symptom of radiating pain in the lumbar nerve root distribution that may also include sensory and motor dysfunction. The most common causes of nerve root compression are intervertebral disc herniation and degenerative alterations

**Purpose:** To compare the effectiveness of McKenzie approach and core stabilization exercise in Lumbar radiculopathy by reducing pain and improving the functional activity

**Materials and Methods:** Total of 64 subjects will be selected by a convenient sampling method based on inclusion and exclusion criteria. The study was fully described to the participants, and their signed agreement was acquired. Numerical pain rating scale (NPRS), Roland-Morris Disability Questionnaire (RMDQ) was used to analyse the pain, and related disability.

**Results:** With a p value of 0.0001, the mean of the core stabilization at the post test was shown to be greater than the mean of McKenzie Exercise.

**Conclusion:** This study concluded that Neural mobilisation was found to be more effective than McKenzie in decreasing pain and functional ability for peoples with lumbar radiculopathy

**Key Words:** Lumbar radiculopathy, NPRS, RMDQ Scale

## Introduction

Radiculopathy is also known as nerve root pain which arises from disc herniation with nerve root compression. Nerve irritation caused by damage to the disc between the vertebrae damage to the disc occurs because of degeneration [wear and tear] of the outer ring of the disc traumatic injury or both a result the central softer portion of the disc can rupture (herniation) through the outer ring of the disc and about the spinal cords or its nerves as they exit the bony spinal Column. This rupture is what causes the commonly recognized pain of sciatica" that shoots down the leg. Lumbar radiculopathy is one of the most

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prevalent problems that a spine surgeon evaluates. It affects both men and women and is believed to impact 3%-5% of the population. Age is a major risk factor since it happens as a result of the degenerative process within the spinal column. Symptoms often appear in midlife, with males typically impacted in their 40s and women in their 50s and 60s. Females are at a higher risk in specific populations, such as those with physically demanding jobs such as military duty. Lumbar radiculopathy is caused mostly by degenerative spondyloarthropathies. Patients frequently present with back discomfort as a result of their radiculopathy. [1-2] The transverse abdominis, multifidus, pelvic floor muscles, and obliques are among the key core muscles that support and stabilize the spine. The lumbar spine may be subjected to excessive stress and strain when these muscles are weak or unbalanced, which can exacerbate the symptoms of lumbar radiculopathy.[3]

Strengthening and coordinating these muscles through core stabilisation exercises is intended to improve the spine's support and reduce pain. The strain on the damaged nerve roots can be relieved by strengthening the core muscles, which would lessen the lumbar radiculopathy-related pain and discomfort.[4-5]

The McKenzie technique, developed by physical therapist Robin McKenzie in 1981,is a categorization-based treatment for individuals with back pain. The McKenzie technique's purpose is to move the pain away from the spine or to integrate it. The McKenzie method is divided into three stages: assessment, treatment, and prevention .The McKenzie method has been widely used by physiotherapists as a treatment for back pain .

Numerical pain rating scale (NPRS) is an 11 point scale in which '0' indicates no pain and '10' indicates maximum pain.[6]

## Aim

To compare the effectiveness of McKenzie approach and core stabilization exercise in Lumbar radiculopathy by reducing pain and improving the functional activity for peoples with lumbar radiculopathy.

## Material and Method

It was an experimental study conducted on 64 subjects with lumbar radiculopathy aged between 30-45 years was taken from RTG Hospital. Convenient sampling with a random allocation method was used in the study.

**Inclusion criteria**

1. Both men and women
2. Age between 18-45 years
3. NPRS score between 5 to 10
4. Patients with lumbar radiculopathy

**Exclusion criteria**

1. Subjects with recent injury
2. Subjects with NPRS score less the 5
3. Subjects without cooperation
4. Recent surgery

**Outcome measures**

1. Numerical Pain Rating Scale[7]
2. Roland Morris Disability Questionnaire[8]

## Procedure

Total of 64 subjects will be selected by a convenient sampling method based on inclusion and exclusion criteria. The subjects were divided into two groups. McKenzie group (n:32) and core stabilization group(n:32). The study was fully described to the participants, and their signed agreement was acquired. Numerical pain rating scale (NPRS), and Roland-Morris Disability Questionnaire was used to analyse the pain and related disability before the treatment session. After Pre test analyses Mckenzie group received Mckenzie exercise and core stabilization received core stabilization exercise for 5 days per week for 4 days. After 4 weeks the post test values were collected and tabulated. ***Study period : November 2022 to april 2023***

**McKenzie Group**

**Lying face down:**

Subjects were asked to lie face down with arms at their side,then asked to turn their head to one side and instruct them to take deep breath and relax.

**Lying face down in extension:**

From this position, the subjects were asked to place the elbow under their shoulder to lean on forearm and instruct them to take deep breath and relax

**Extension in lying:**

Ask the subjects to Slowly straighten the elbow while pushing the upper body upward as far as discomfort will permit. After holding this position for 2-3 seconds ,ask them to return to starting position .If a patient feels uncomfortable, place the pillow to maintain the extension

**Extension in standing:**

Subjects were asked to place the feet slightly apart while standing straight and hands are placed behind the back, fingers pointing backward using hands as a fulcrum with knees straight,ask the subjects to bend their body backward at the waist as much as they can. After holding this position for 2-3 seconds ,ask them to return to their starting position.

**Core Stabilization Group**

**Side plank on knees:**

- Begin by sitting on one hip, leaning on your side, and stacking your legs next to you. Your forearm should be on the surface of the floor next to you when you bend your elbow. Exhale to push your forearm into the floor and lift your hips into the air.
- Inhale to lower your hips halfway.
- Exhale to lift your hips up again.
- Repeat 8–10 times, then inhale as you lower your hips all the way down with control.

**Bird dog:**

- Begin on all fours with your hands beneath your shoulders and your knees precisely beneath your hips.
- Aim for a neutral position in your spine.
- Exhale to draw the abdominals in and up. Without shifting your weight or arching your back, lift one leg behind you and lift your opposite arm in front.
- Breathe and hold the position for 3 slow counts.
- Inhale with control to return your leg and hand to the mat.
- Complete 6–8 reps and then repeat on the other side.

**Curl up:**

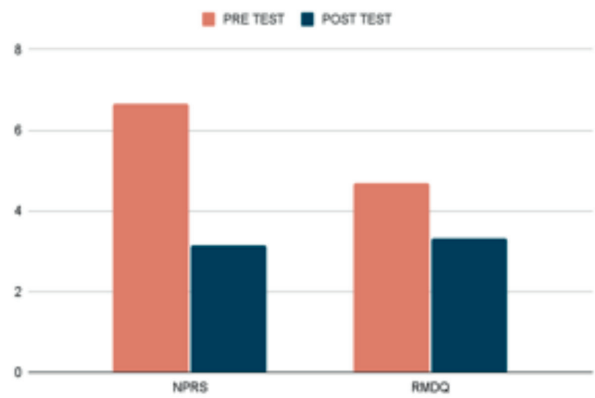
- In a relaxed arm-crossing
- While keeping their head in line with their shoulder, instruct the subject to contract their abdominal muscles and curl halfway up.
- 5 seconds of holding
- Roll out to lie down.
- Repetition of 3 sets of 5

**Glute bridge:**

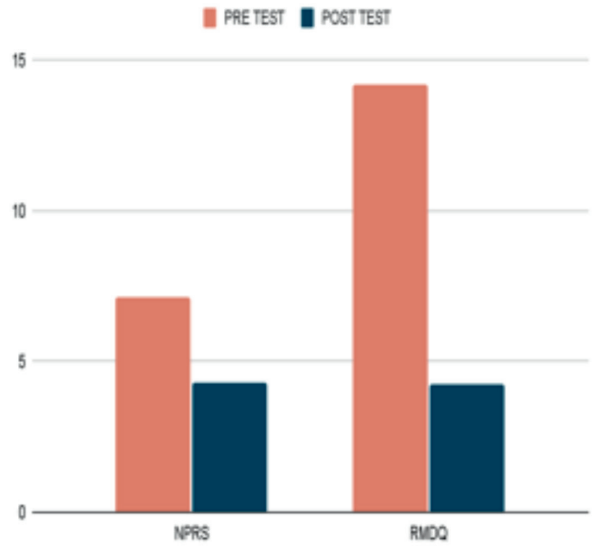
- Get the subject to lie on their back on a stable chair with their legs straight and their hands by their sides.
- Make the patient lift their hips off the surface while keeping their back straight, then pause for one second.
- Make them go back to the beginning position.
- Until the set is finished, repeat the movement.
- Repeat 3 sets of 4 holding per set

**Data Analysis**

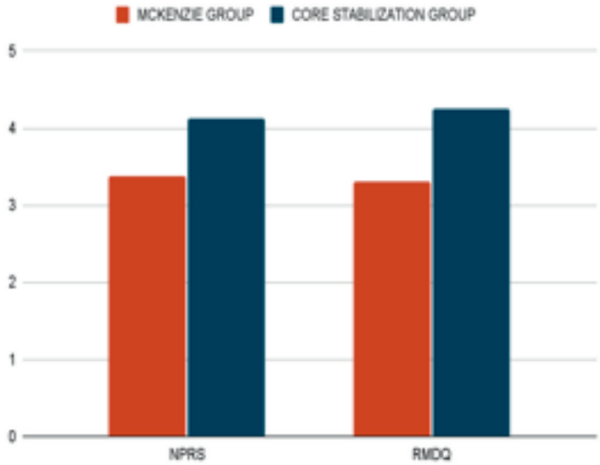
Using tabular and inferential statistics, the gathered data was evaluated. The statistically significant differences between pre-test and post-test measures were examined using a paired t-test. When utilizing the unpaired t-test to look at significant changes in the experimental group, the significance level of p 0.0001 was determined to be statistically significant.




**Graph No 1: Pre and Post Test Values of Mckenzie Group**




**Graph No 2: Pre and Post Test Values of Core Stabilization Group**




**Graph No 3: Post Test Values Mckenzie and Core Stabilization Group**

## Result

In Mckenzie Group,the pre test Mean value of NPRS is 6.66 and RMDQ is 14.69.The post test Mean value of NPRS is 3.14 and RMDQ is 3.31.

In Core Stabilization Group,the pre test Mean value of NPRS is 7.13 and RMDQ is 14.19.The post test Mean values of NPRS is 4.3 and RMDQ is 4.25. The statistical analysis of NPRS post teat Mean value of Mckenzie group is 3.38 and Core stabilization group is 4.13. The RMDQ post test Mean value of Mckenzie group is 3.31 and Core stabilization group is 4.25.

## Discussion

According to the findings of this study by Jay Indravadan Patel and Prem Kumar B N (2016a), both groups' VAS scores for pain showed a substantial decrease and their SLR, lumbar spine range of motion using MMST, and disability scores using MODI all showed improvements. The experimental group showed earlier control of all outcome measures than the control group at the conclusion of the sixth week, according to the statistical analysis[9]. According to research by Faria Aqil, Muhammad Affan Iqbal, Suhail Karim, Muhammad Umar Iqbal, Muhammad Junaid Akram, Zona Mehreen, Raeed Mufti 2021,Patients in both lumbar stabilisation and McKenzie groups showed significant improvement, however, the patients in lumbar stabilization group were superior than the patients in McKenzie group on the selected outcomes. In subjects with chronic low back pain (CLBP) with radiculopathy, who performed both the lumbar stabilisation and thoracic mobilisation exercise programmes in a coordinated manner, there was a statistically significant decrease in pain intensity values (VAS ls and leg), as well as the degree of functional disability (ODI), compared to initial values. According to Stefan Kostadinovic'a, Nenad Milovanovic'b, Jelena Jovanovic'b, and S Comparing respondents who performed a lumbar stabilisation programme in a closed and open kinetic chain, the patients who completed the lumbar stabilisation.

Thoracic mobilisation exercise programme in a closed kinetic chain had better functional recovery and a significantly greater reduction in pain intensity. Patients with a positive neuropathic pain component (Douleur Neuropathique en 4 Questions, DN4) were found to have higher initial and final values of pain intensity (VAS ls and leg) and functional disability (ODI) parameters than patients without the neuropathic pain component in both groups under study. Thoracic mobilisation exercises may enhance lumbar stabilisation and lead to a more potent decline in pain intensity and functional impairment[10].

## Conclusion

The collected data was statistically analyzed using an unpaired t-test. When Comparing the McKenzie group to the Core stabilization group,

the Mckenzie group indicates significant effects (p 0.0001)) in Improving the strength of the back and improving the functional activity. Mckenzie exercises are more effective in reducing pain and improving strength of back muscles.

**Ethical Clearance:** Taken from the institutional ethical committee. ISRB number- 03/037/2022/ ISRB/SR/SCPT

**Funding:** Self

**Conflict of Interest:** NIL

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Original Article

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# Effectiveness of Gluteus Maximus Activation in Correcting Pelvic Tilt for People with Mechanical Low Back Pain

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**Abstract**

**Background:** Low back pain (LBP) is one of the most common conditions in industrialized modern societies. Low back pain is usually nonspecific or mechanical. People with LBP have previously been found to have poor endurance and delayed Gluteus Maximus muscle firing. Anterior pelvic tilt was also believed to cause pelvic girdle discomfort and generalized LBP.

**Purpose:** To evaluate the effectiveness of Gluteus Maximus Activation in correcting anterior pelvic tilt, reducing pain and improving the Functional Outcome among Mechanical Low back pain subjects.

**Materials and Methods:** About 250 participants were selected from Thiraviam Orthopaedic Hospital by using Kinovea software based on inclusion and exclusion criteria. They were divided into 2 groups, Experimental Group (n=125), Control Group (n=125). Both groups were given stretching exercises then Experimental group was given Gluteus Maximus activation exercise with IFT and Control group was given spinal stabilization exercise with IFT. Interventions were given 5 times a week for 6 weeks. Study period : October 2022 to July 2023.

**Results:** Pre-test and post-test values were analyzed and the result suggests that GM Activation Group has significant improvement when compared with Spinal stabilization Group with $P<0.0001$.

**Conclusion:** According to this study, Gluteus Maximus activation exercises are more effective in correcting anterior pelvic tilt and reducing pain and improving functional outcome among Mechanical Low back pain subjects.

**Key words:** Mechanical Low Back Pain, Pelvic Tilt, Kinovea software, Roland Morris Disability Questionnaire, Spinal stabilization, Gluteus Maximus Activation.

## Introduction

Currently, one of the most prevalent disorders in industrialized, modern society is Low back pain.[1] Mechanical or nonspecific LBP is more common.[2] An important global public health issue is non-specific LBP. According to reports 23% of people will experience chronic LBP, leaving 11–12% of the population incapacitated.[3]

Anterior pelvic tilt was believed to be the cause of generalized LBP.[4] Excessive anterior tilting of pelvic is not an isolated disorder.[5] It was discovered that those with chronic LBP experience multifidus

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atrophy. Erector spinae, external oblique, rectus abdominis, and quadratus lumborum are important global muscles.6 Because many people spend a lot of time sitting down, GM frequently becomes weak.[7] People with LBP have previously been found to have poor endurance and delayed GM muscle firing.[6] Interferential current therapy is used for treating musculoskeletal pain.[8] In order to evaluate pain, people frequently utilize the Numeric Pain Rating Scale.[9] NPRS an 11-point scale, 0 represents no pain and 10 represents maximum discomfort.[10] Kinovea is used to study human motion using goniometry. Angles were measured utilizing Kinovea.[11] In order to evaluate physical disability brought on by LBP, Roland Morris Disability Questionnaire was developed for primary care research.[12]

## Aim

Aim of this study is to evaluate the effectiveness of Gluteus Maximus activation exercises in correcting anterior pelvic tilt, reducing pain and improving Functional Outcome among Mechanical Low back pain subjects.

## Materials and Method

1. Step Stool
2. Dumbbell
3. Dowel Bar
4. IFT Apparatus
5. Pad Electrode, Gel
6. Micropore
7. Cotton

It was an experimental study conducted on 250 subjects with mechanical LBP, aged between 20-40 years. The subjects were taken from Orthopaedic Hospital. Convenient sampling with a random allocation method was used in the study.

Study period: October 2022 to July 2023.

**Inclusion Criteria**

8. Subjects of both genders
9. Age group: 20 – 40 years
10. NPRS score more than 5
11. Subjects with Mechanical LBP along with Anterior pelvic tilt.

**Exclusion Criteria**

1. Radiculopathy
2. Disc derangement
3. Pacemaker , Metal implants , Cancer
4. Spinal stenosis
5. Skin ulcer, infection
6. With hereditary disorders
7. Neoplasm
8. TB spine, referred pain
9. History of recent fracture of lower limb
10. History of recent surgery of spine and lower limb

**Outcome Measure**

Assessment was done before and after 6 weeks of study.

1. Kinovea Software[11]
2. Numerical Pain Rating Scale[10]
3. Roland Morris Disability Questionnaire[12]

**Procedure**

About 250 participants with anterior pelvic tilt were screened by using Kinovea software based on inclusion and exclusion criteria. Written informed consent was collected and procedures were explained before commencement of the study. These 250 participants were allocated into 2 groups, GM Activation group (n = 125) and Spinal Stabilization group (n = 125). Both groups were given with Stretching exercise for 10 minutes, then Experimental group was given with Gluteus Maximus activation exercises and Control Group was given with Spinal stabilization exercises for 30 minutes. At the end of the session both groups were given IFT for 20 minutes. Intervention was given 5 times a week for a total duration of 6 weeks.

Kinovea Software, NPRS score and Roland Morris Disability Questionnaire were used to measure pelvic tilt, pain intensity and functional result. Pre-test results were evaluated prior to the start of the treatment, and they were reassessed 6 weeks later to determine post-test results.

**Pelvic Tilt Measurement**

ASIS and PSIS were palpated and marked then photo in lateral view was taken, using Kinovea

software, marks were connected with a straight line then a horizontal line was drawn through ASIS, the angle formed between the 2 lines was the degree of pelvic tilt. Normal range 0-23 degrees. Angles more than 23 were considered as anterior pelvic tilt, and were screened for this study.

**IFT Protocol**

IFT in 4 pole classic mode of carrier frequency of 4kHz, Base 90, Sweep 50 and Beat frequency 90-130 for 20 minutes duration was given to both the groups after each session. Intervention was given 5 times a week for a duration of 6 weeks.

**Stretching Exercise**

1. Double knee to chest
2. Single knee to chest
3. Hamstring muscle stretching
4. Piriformis muscle stretching
5. Tensor Fascia Lata stretching
6. Abdominal muscle stretching
7. Cat-Camel stretching
8. Quadratus Lumborum stretching
9. Quadriceps muscle stretching

Each of the above stretches were held for 15 seconds and performed for 15 reps and 1 set.

**Gluteus Maximus Activation Group**

Following exercises are given for the subjects of

Experimental group:

1. Band Hip Thrust
2. Step Up
3. Lateral Step Up
4. Cross Step Up
5. Inline Lunges
6. Traditional Lunges
7. Squats
8. Bulgarian Split Squats

**1. Band Hip Thrust**

Subjects were asked to take a resistance band, one end of resistance band was rapped on one foot and other end on other foot, band grabbed in U shape, asked to pull it down into the waist, knees at 90 degree, then by sitting in couch drop down hitting middle of back to the couch, feet should be underneath the knees, then thrust and straight up. (15 reps x 3 sets)

**2. Step Up**

Subjects were asked to stand in front of the step stool, one leg kept on stool; hip, knee and ankle placed at 90 degrees, trunk in neutral and then step up, stay for 1 second and then step down. Repeated for other leg. (15 reps x 3 sets)

**3. Lateral Step Up**

Subjects were asked to stand beside the step stool, leg next to stool was placed on the stool so that hip, knee and ankle were at 90 degrees, trunk in neutral position, then step up stay for 1 second, then step down. Repeated for other leg. (15 reps x 3 sets).

**4. Crossover Step Up**

Subjects were asked to stand beside the step stool, foot which is away from the stool is crossed over and placed on the stool, then asked to drag themselves up and land on the other side. Repeated for other leg (15 reps x 3 sets)

**5. Inline Lunges**

Subjects were asked to hold Dowel bar along the center of the spine at the back, it touches back of head, upper back and the middle of butt, upright posture was maintained then asked to stand on a straight line, one foot front and the other at the back with some distance, descent to the lunge position right knee touches the center of the line, return to starting position. Repeated for other leg. (15 reps x 3 sets)

**6. Traditional Lunges**

Subject's hands were placed on their waist or could have dumbbells on both hands then asked to step forward with one leg, bend both knees to 90 degrees, thigh placed parallel to ground, other thigh stretched back and knees behind the heel, trunk straight then come back to neutral position. Repeated for other leg. (15 reps x 3 sets)

**7. Squats**

Subjects were asked to stand with foot to their shoulder width apart, arms lifted in front and trunk

should be straight then asked to push their hips back like sitting in an imaginary chair, thigh parallel to ground and knee in line with toes, go down and come up. (15 reps x 3 sets)

**8. Bulgarian Split Squats**

Subjects were asked to stand before the low couch so that the couch should be behind the subject, front foot on ground, rear foot on couch, hands on waist, asked to bring themselves down like lunges, knee should not pass the toes and then come up. (15 reps x 3 sets).

**Spinal Stabilization Group**

Following exercises are given for the subjects of control group:

1. Crunches
2. Dead Bug
3. Side Plank
4. Prone Cobra
5. Bird Dog
6. Bridges
7. Planks

**1. Crunches**

Subjects in supine and knees bent, foot together and flat on the ground, hand lased and placed behind the head, abs engaged and head and the shoulder were lifted off the floor, hold the position for 2 counts then slowly loosen the back down to ground. (15 reps x 3 sets)

**2. Dead Bug**

Subjects in supine with hands extended towards ceiling perpendicular to ground. Hip, knee and ankle placed at 90 degree, then asked to lower one leg down to the ground and simultaneously lower opposite hand to ground. Repeated for other side. (15 reps x 3 sets)

**3. Side Plank**

Subjects in side lying, elbows placed under the shoulder elbow 90 degrees. Legs straight, then lift the hip away from ground, the hip should be straight, it should not be too high to low. Hold for 30 seconds, repeat for other side. This could also be done as side planks with leg raise. (3 reps)

**4. Prone Cobra**

Subjects in prone, arms at the side, face down on the floor. Simultaneously lift the head and chest upward and turn the hands outward and lift the leg hold for 10 seconds, then ask to relax. (5 reps x 3 sets)

**5. Bird Dog**

Subjects were in quadruped position, spine in neutral position. Simultaneously extend one leg outward parallel to ground and then reach the opposite arm forward parallel to ground. Repeated for other side. (15 reps x 3 sets)

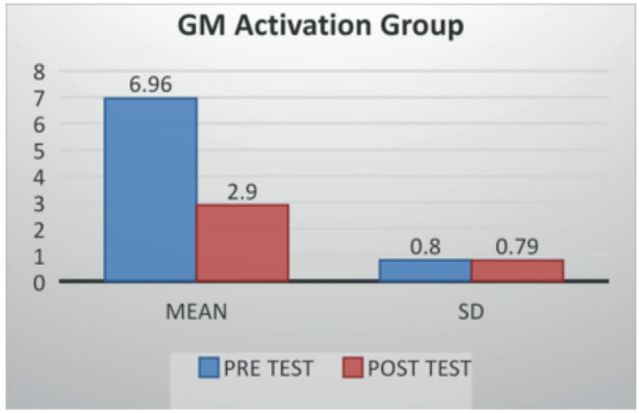
**6. Bridges**

Subjects in supine with knees bent, arms by the side, back lifted as they inhale and lower when exhaled. Also performed with single leg. (15 reps x 3 sets).

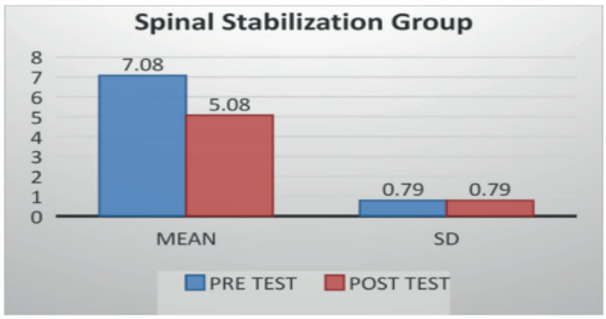
**7. Planks**

Subjects in prone, hands underneath the shoulders, curl the toes on the mat for grip then asked to press up to top of pushup, tighten glute and abdominals, then elbows bent drop to the forearm, then asked to keep the forearm parallel to each other and hold for 30 seconds. Could also be performed by lifting one leg. (3 reps )

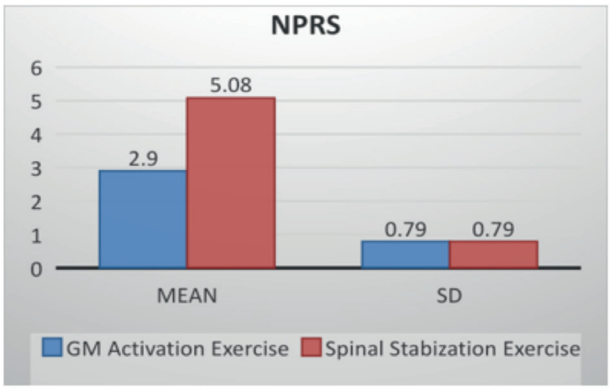
**Data Analysis**



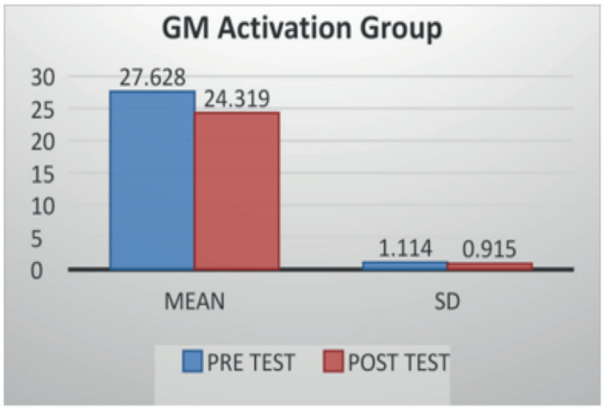

**Graph - 1: Comparison between Pre-test and Post-test values of GM Activation Group – NPRS.**



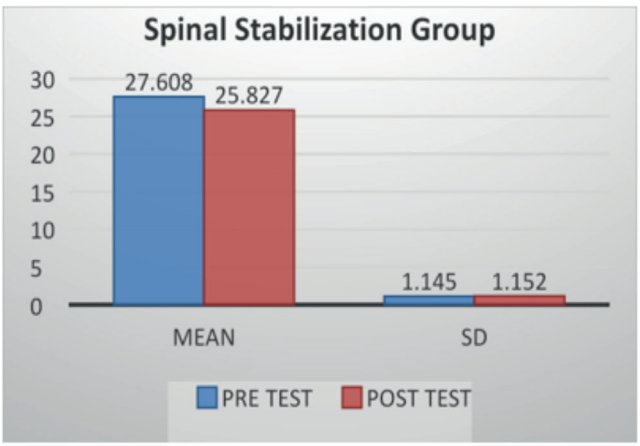

**Graph - 2: Comparison between Pre-test and Post-test values of Spinal Stabilization Group – NPRS**



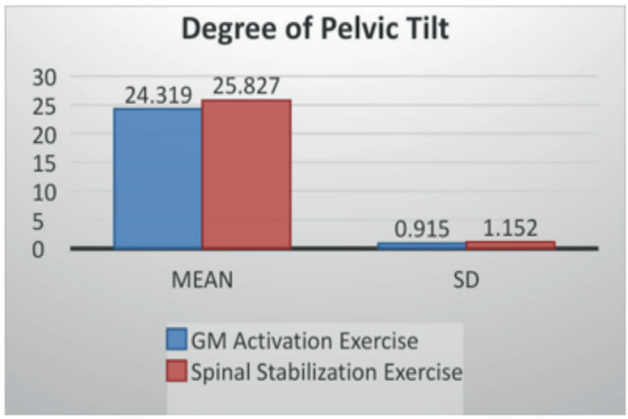

**Graph - 3: Comparison between Post-test values of GM Activation Group and Spinal Stabilization Group – NPRS.**



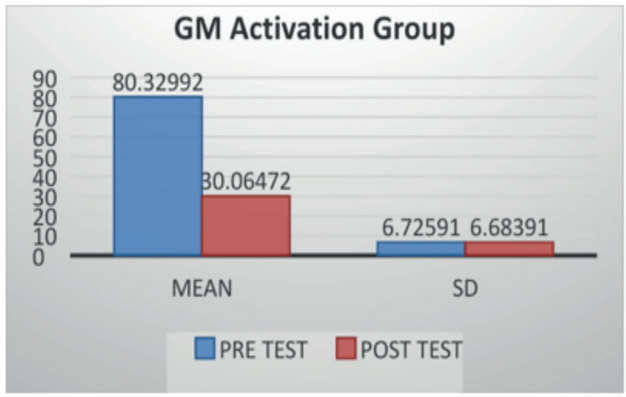

**Graph - 4: Comparison between Pre-test and Post-test values of GM Activation Group – Degree of pelvic tilt**



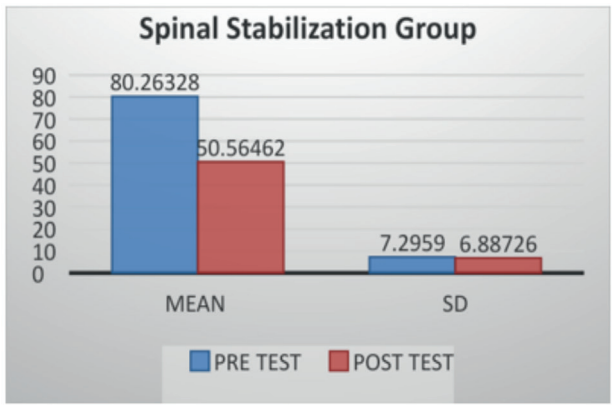

**Graph - 5: Comparison between Pre-test and Post-test values of Spinal Stabilization Group – Degree of Pelvic Tilt.**



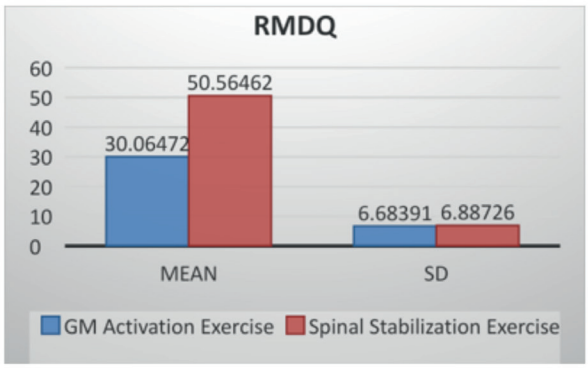

**Graph - 6: Comparison between Post-test values of GM Activation Group and Spinal Stabilization Group – Degree of Pelvic Tilt**




**Graph - 7: Comparison between Pre-test and Post-test values of GM Activation Group – RMDQ**




**Graph - 8: Comparison between Pre-test and Post-test values of Spinal Stabilization Group – RMDQ**




**Graph - 9: Comparison between Post-test values of GM Activation Group and Spinal Stabilization Group – RMDQ**

## Result

Statistical analysis of quantitative data showed statistically significant differences not only in the GM Activation group but also in the Spinal Stabilization group.

Graph - 1: In Experimental Group, NPRS Pre-test and Post-test mean values were 6.96(±0.80) and 2.90(±0.79), t=128.5647.

Graph - 2: In Control Group, NPRS Pre-test and Post-test mean values were 7.08(±0.79) and 5.08(±0.79), t =124.4990.

Graph - 3: In NPRS, Post-test mean values for Experimental and Control Group was 2.90 (±0.79) and 5.08 (±0.79), t =21.8508 and P <0.0001

Graph - 4: In Experimental Group, Degree of Pelvic Pre-test and Post-test mean values were 27.628(±1.114) and 24.319(±0.915), t = 29.7837.

Graph - 5: In Control Group, Degree of pelvic tilt Pre-test and Post-test mean values were 27.608(±1.145) and 25.827(±1.152), t = 12.4722.

Graph - 6: In Degree of Pelvic Tilt, Post-test mean values for Experimental and Control Group was 24.319 (±0.915) and 25.827 (±1.152), t = 11.4580 and P <0.0001.

Graph - 7: In Experimental Group, RMDQ Pre-test and Post-test mean values were 80.32992(±6.72591) and 30.06472(±6.68391), t = 324.1635.

Graph - 8: In Control Group, RMDQ Pre-test and Post-test mean values were 80.26328(±7.29590) and 50.56462(±6.88726), t = 237.7014.

Graph - 9: In RMDQ, Post-test mean values for Experimental and Control Group were 30.06472(±6.68391) and 50.56462(±6.88726), t = 23.8812 and P <0.0001.

Both the groups are similar at the baseline P>0.05. The results suggest that findings are considered to be statistically significant with P value <0.0001. Post-test mean values of NPRS, Degree of pelvic tilt and RMDQ in Experimental Group were less than Control Group thus GM Activation Group is considerably more effective than Spinal Stabilization Group among Mechanical Low back pain subjects.

## Discussion

Purpose of this present study is to evaluate effectiveness of GM activation in correcting anterior pelvic tilt, reducing pain and improving Functional Outcome among Mechanical Low back pain subjects.

Finding of this current study revealed that Gluteus Maximus activation exercises are very effective in correcting anterior pelvic tilt among mechanical LBP subjects. These results are in agreement with previous research done by Kevin McCurdy et al. in which both flexion bias exercise and GM activation exercise were employed in maintaining the normal angle of pelvis.[13] The trunk exercise contributes a lot to the recovery of mechanical low back pain[14]. In an early study conducted by Preece SJ, Willan P et al., in the year 2008 Apr to determine the variations in the morphology of pelvis, in which he included 30 cadaver pelvis and each of the specimen was positioned in the anatomical position and angle between ASIS-PSIS is drawn and measured bilaterally and found that the range of value for ASIS-PSIS is 0-30 degrees[15] and in our study the angle 0-30 degree was taken as normal range and the angle above this degree will be considered as anterior pelvic tilt.

## Conclusion

According to this study, Gluteus Maximus activation exercises are more effective in correcting the anterior pelvic tilt, reducing pain and improving the functional outcome among Mechanical Low back pain subjects.

**Ethical Clearance:** Taken from the institutional ethical committee. ISRB number- 03/038/2022/ ISRB/SR/SCPT.

**Funding:** Self funding.

**Conflict of Interest:** Nil.

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Original Article

DOI: https://doi.org/10.37506/g4p32g02

# Comparative Study on Tibialis Posterior Muscle Strengthening Exercise Vs Quadriceps Muscle Strengthening Exercise in Reducing Pain and Improving the Functional Status for Peoples with Anterior Knee Pain

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**Abstract**

**Background:** Flat foot is a condition in which the Medial longitudinal arch (MLA) has a more flattened curve when foot makes full contact with the ground. In medical terms, flat foot is associated with the pronated foot. For people ages 20 to 60, flat foot prevalence is 13.6%. People who have weak posterior tibial tendons are more likely to have flat feet and Flat foot is one of the contributing factors to development of anterior knee pain.

**Purpose:** To compare the effectiveness of Tibialis posterior strengthening exercise and Quadriceps strengthening exercise among people with anterior knee pain.

**Materials and Method:** The experimental study included 170 volunteers, both male and female, aged 20-60 years, who were drawn from Martin Physiotherapy Clinic by convenience sample method. informed consent was obtained before beginning the study. The participants were divided into two groups, the Tibialis posterior (n=85) group received Tibialis posterior strengthening exercise, whereas the Quadriceps (n=85) group received Quadriceps strengthening exercise. The intervention was administered five times over the course of six weeks.

**Study Period:** March 2023 to July 2023.

**Results:** The collected data was statistically analysed using paired and unpaired t-test, showed significant improvement in Tibialis posterior group than quadriceps group with $p<0.0001$.

**Conclusion:** The study concludes that Tibialis posterior strengthening was more effective in reducing pain and improving functional status among peoples with anterior knee pain.

**Key Words:** Anterior knee pain, AKPQ, Flat foot, Single limb heel rise test, Quadriceps, strengthening, Tibialis posterior strengthening.

## Introduction

Pain behind or around the patella (knee cap) when the knee is loaded in flexion or extension is referred to as anterior knee pain or patellofemoral pain. It is widely observed in physically active young people, and aged people. It is more prevalent in women than

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in men. They have trouble in getting into and out of the squat position, climbing and descending stairs, and sitting for an extended period of time with the knees bent [1].

Flat foot is a condition in which MLA flattens and the entire sole of the foot becomes flat when contact with the ground. The foot arches develop between the ages of two and six, and they reach structural maturity between the ages of 12 and 13. Flatfoot is classified into 2 types: rigid (symptomatic) and flexible (asymptomatic) flatfoot [2]. For people ages 20 to 60, the flat foot prevalence is 13.6%. In this study flatfoot is assessed using Clarke's angle by foot prints. The normal angle is 42-54 degree, < 30 degree is severe, 30-35 degree is moderate, 35-41 degree is mild and > 54 degree is high arched foot [3].

Tibialis posterior [TP] is the main stabilizer of MLA and responsible for 75% of MLA integrity and stiffness. The main contributing factor to flatfoot deformity in adulthood is tibialis posterior weakening and dysfunction [4]. Biomechanics: The subtalar joint's overpronation and excessive hindfoot eversion causes the tibia to twist excessively and alter the patellofemoral force's direction and decrease the patellofemoral joint's contact area, increasing the joint's stress during weight-bearing and results in patellofemoral pain. Excessive internal rotation of tibia and excessive foot pronation morphology may be linked via closed chain coupling [5].

Exercises to strengthen the tibialis posterior will improve dynamic balance and lessen pressure on the plantar medial column, improve foot functions, strengthen foot muscles, minimize excessive pronation and are helpful in reshaping the foot [6]. Exercises that strengthen the quadriceps can help patients with knee discomfort feel better, function better, reduce pain and make them more stable [7].

Clinical and functional results were assessed using the Kujala patellofemoral score (KPS) or the anterior knee pain questionnaire (AKPQ) and The single-limb heel rise test.

## Aim

The aim is to compare the effectiveness of Tibialis posterior strengthening exercise and Quadriceps strengthening exercise among peoples with anterior knee pain.

## Materials and Method

- Chair
- Towel
- Theraband
- Ball
- Yoga Mat

It was an experimental study conducted on 170 subjects with anterior knee pain, aged between 20-60 years. The Subjects were chosen from Martin Physiotherapy Clinic and Pain Management Centre. Convenience sampling method was used in the study.

Study Period: March 2023 to July 2023.

**Inclusion Criteria**

- Both Male and Female
- Age group: 20-60 years
- Subject with flat foot along with anterior knee pain
- Single limb heel rise test repetition between 0-3
- AKPQ score less than 100
- Clarke's angle less than or equal to 30 degree

**Exclusion Criteria**

- Subjects with previous knee injury
- Knee OA
- Subjects with recent history of surgery
- Recent fractures
- Neurological deficit of legs
- Open wounds

**Outcome Measure**

- Anterior Knee Pain Questionnaire:

The entire questionnaire consists of 13 items, asks about how the pain is in daily activity and also asks about symptoms. The lowest score is 0 (severe), and the maximum point is 100 (absence of symptoms) [8].

- Single Limb Heel Rise Test:

The tibialis posterior muscle weakness is assessed with this test.The patient balances himself against the wall using their arms throughout the test and attempts to raise the affected foot onto its toes by

elevating the opposite foot off the ground. Patients with weak muscles aren't able to perform a single repetition or more than three repetitions as normal people can perform 8-10 repetitions [9].

**Procedure**

The experimental study included 170 participants of age group 20-60 years, both male and female were recruited through Footprint analysis, Single limb heel rise or endurance test and AKPQ based on inclusion and exclusion criteria. All the participants were provided with an information sheet and informed consent were obtained before commencing the study. The Participants were allocated into 2 groups using a convenience sampling method. The Tibialis posterior group (n=85) received Tibialis posterior strengthening exercise whereas the Quadriceps group (n=85) received Quadriceps strengthening exercise. The intervention was given 5 times for a duration of 6 weeks.

- Tibialis Posterior Group

The subjects of Tibialis posterior group were given the following exercises and these exercises were performed in sitting or standing for 30 minutes, weekly 5 times for a duration of 6 weeks.

**1. Foot Adduction Resistance Exercise:**

Ask the subject to sit in a chair with their feet flat on the ground. Then one end of the TheraBand is fixed around the feet, and the other end of the band is held by me to maintain resistance, and the subject is advised to abduct the feet and hold for 5 sec. Ask to repeat the exercise. (10 reps x 3 sets)

**2. Foot Supination Resistance Exercise:**

Ask the subject to place his one leg at the end of the stair with the knee in a bent position. Then ask them to perform maximum foot supination and hold it for 5 seconds. Ask them to repeat the exercise. (10 reps x 3 sets)

**3. Heel Raise Exercise:**

Ask the subject to stand on a wall or chair, with both hands, hold onto for support. Then ask them to Lift their heels up from the floor until they feel tightness in the back of the leg and ask them to hold for 5 sec and return to the floor slowly. Keep their toes on the floor and their knees straight. Ask them to repeat the exercise. (10 reps x 3 sets)

**4. Calf Raise Exercise:**

Ask the subject to place both their feet flat on the ground as they stand sideways against a wall, keeping arches in a nice neutral posture. Then ask them to put their one hand against the wall to help them to stay balanced and ask them to place a ball in between their ankles just above medial malleoli. Then ask them to lift the heel to a maximum height and pause for 5 seconds. Then slowly ask them to return to the starting point and arches don't collapse inward as they put their feet back on the ground. Ask them to repeat the exercise. (10 reps x 3 sets)

**5. Single Leg Calf Raise:**

Ask the subject to raise up onto toes and hold this position for 5 seconds before lowering back down. Ask them to repeat the exercise (10 reps x 3 sets)

- Quadriceps Group

The subjects of Quadriceps group were given the following exercises and these exercises were performed in sitting, lying or standing for 30 minutes, weekly 5 times for a duration of 6 weeks.

**1. Knee Isometric:**

Ask the subjects to lie on their back and towels were used to prop up their knees. Then ask the subject First to contact the hamstring by digging heel into the bed and then tense the quad by pushing the back of the knee into a rolled towel, ask them to hold for 5 sec and repeat the exercise. (10 reps x 3 sets)

**2. Short Arc Quads:**

Ask the subjects to lie on their back and towels were used to prop up their knees. Then ask them first to contact the hamstring and slowly to straighten their bent knee until it is straight. Then ask them to lift their leg without bending and pause for 5 seconds then slowly lower their leg and ask to repeat the exercise. (10 reps x 3 sets)

**3. SLR:**

Ask the subject to lie on the floor and bend one leg and other leg in straight. Then ask them to raise

up the straightened leg off the floor. Then ask them to hold at the top for 5 seconds and then lower their legs down. Ask them to repeat this exercise. (10 reps x 3 sets)

**4. Seated Knee Extension:**

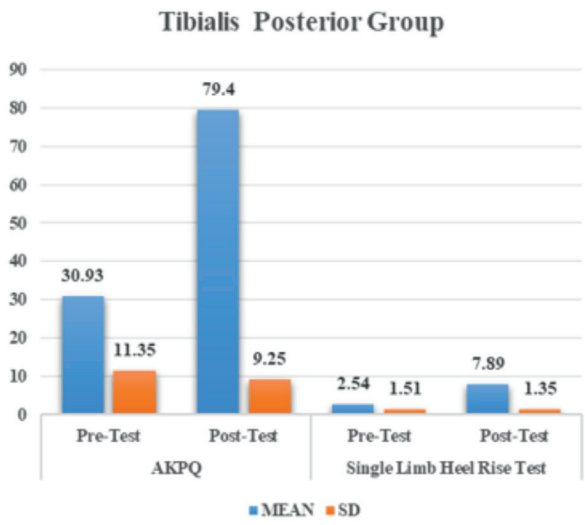
Ask the subject to sit up tall in a chair. Then ask them to lift the affected leg straight and tell them to hold for 5 seconds, then ask them to put the legs down and repeat the exercise. (10 reps x 3 sets)

**5. Wall Squat:**

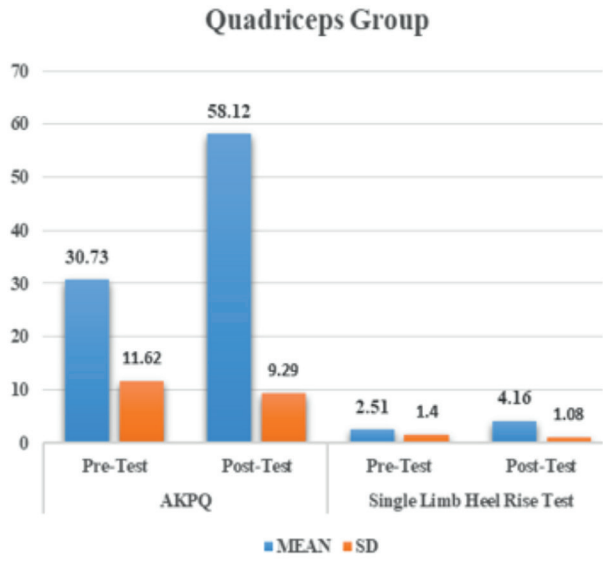
Ask the subject to stand straight, with their backs against walls and their feet shoulder-width apart. Ask them to bend their knees slowly to a 45-degree angle. Then ask them to slide back down the wall for a count of five and hold the position for 5 seconds. Then ask them to Slide up the wall and repeat the exercise. (10 reps x 3 sets)

**Data Analysis**

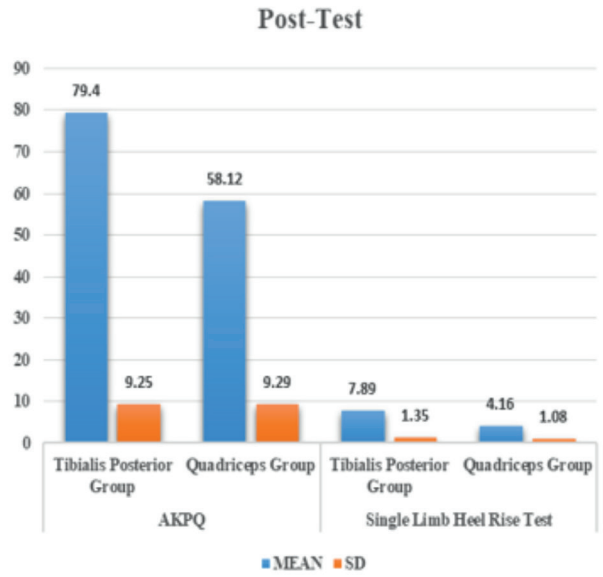
The mean and standard deviation (SD) were applied to all parameters. The significant differences between pre-test and post-test measures of the same group were analysed using a paired t-test and the post-test values of both the groups were analysed using the unpaired t-test to examine significant changes between two groups.




**Graph-1: Comparison of pre-test and post-test values of AKPQ and single limb heel rise test in tibialis posterior group**




**Graph-2: Comparison of pre-test and post-test values of AKPQ and single limb heel rise test in quadriceps group**




**Graph-3: Comparison of post- test values of AKPQ and single limb heel rise test in tibialis posterior group and quadriceps group**

## Result

This experimental study included 170 participants of age group 20-60 years, both male and female who had anterior knee pain. They were divided into two groups: the Tibialis posterior group (n=85) received treatment for posterior tibialis strengthening activities, and the Quadriceps group (n=85) received The Anterior Knee Pain Questionnaire (AKPQ) and

Single Limb Heel Rise Test scores were analysed before and after 2 weeks of therapy to provide pre-test and post-test values, respectively for a six-week period using t-test.

The AKPQ post-test mean value in Tibialis posterior group was 79.40 (+9.25), while it was 58.12 (+9.29) in the Quadriceps group. The Single limb heel rise test post-test mean value in Tibialis posterior group was 7.89 (+1.35), while it was 4.16 (+1.08) in the Quadriceps group. This indicates that the Tibialis posterior group is significantly higher than the Quadriceps group, with a P value of < 0.0001. (Graph -3).

Statistical analysis of the AKPQ and Single limb heel rise test post-test results revealed that Tibialis posterior group and Quadriceps group showed similar statistically significant differences. As a result, the Tibialis posterior group exceeds the Quadriceps group statistically.

## Discussion

The purpose of the study is to evaluate and compare the efficacy of tibialis posterior strengthening exercise and quadriceps strengthening exercises in decreasing pain and enhancing functional outcome in peoples with anterior knee pain.

The experimental study included 170 participants of age group 20-60 years, both male and female were recruited through Footprint analysis, Single limb heel rise and AKPQ based on inclusion and exclusion criteria. All the participants were provided with an information sheet and Informed consent was obtained before commencing the study. The participants were allocated into 2 groups. The Tibialis posterior group (n=85) received Tibialis posterior strengthening exercise whereas the Quadriceps group (n=85) received Quadriceps strengthening exercise. The intervention was given 5 times for a duration of 6 weeks. The outcome measures were AKPQ and Single limb heel rise test assessed before the initiation and after 6 weeks of treatment.

Tibialis posterior group and Quadriceps group showed similar statistically significant differences in the AKPQ and Single limb heel rise test post-test findings (Graph 3). This study discovered that tibialis posterior muscle strengthening exercise is particularly beneficial in lowering pain and improving functional status in those with anterior knee pain.

In 2021, Luoman Ali conducted a Quasi-experimental trial. The study involves 30 male and female participants ranging in age from 15 to 35 years. Group A (n=15) received exercises to strengthen hip muscle, while Group B received exercises to strengthen knee muscle. The study lasts 6 weeks, with 25 sessions per week. He concludes that hip muscle strengthening exercises are beneficial [10].

In 2019, Alexandar Hott, MD et.al conducted a randomized controlled trial. The study included 112 patients ranging from 16 to 40 years of age, with symptoms lasting more than 3 months, were separated into three groups. The first group (n=39) given education along with isolated hip exercise, the second group (n=37) given knee exercise, and the third group (n=36) given free physical activity for 6 weeks, concludes that these exercises are not effective in decreasing pain [11].

In 2021, Kisacik, Pinar et.al conducted a randomized control study. 30 subjects were separated into two groups. The control group received hip and knee stretching and strengthening activities, while the SFE group (n=15) received the same exercise with SFE. Both groups were given exercise intervention twice a week for six weeks and concluded that exercise programs that included additional SFE had a good effect. Increased hip extensor strength may potentially be associated with enhanced SFE stabilization [12].

## Conclusion

This study concludes that the two workouts employed in this study, Tibialis posterior strengthening exercise and Quadriceps strengthening exercise, are beneficial in reducing pain and impairment. In persons with anterior knee pain, Tibialis posterior strengthening exercise is more effective than quadriceps strengthening exercise in reducing pain and boosting functional status.

**Ethical Clearance:** Taken from Institutional ethical committee. ISRB number- 03/ 039/ 2022/ ISRB/ SR/ SCPT

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Efficacy of Proprioceptive Training and Conventional Training in Reducing Pain and Improving Functional Activity for people with Lateral Ligament Injury

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**Abstract**

**Background** : Most athletes who participate in sports experience lateral ligament injury. Lateral ligament damage is one of the most frequent ankle ailments. The study was developed to determine the efficacy of proprioceptive training and conventional training in reducing pain and improving functional activity with lateral ligament injury.

**Purpose:** To compare the efficacy of proprioceptive training and conventional training in reducing pain and improving functional activity with lateral ligament injury.

**Methods :** This study is an experimental study.A total of 40 subjects participated in the study based on inclusion and exclusion criteria were taken from prism health care. The subjects willing to participate were divided into two separate groups as Group A (20 subjects) received proprioceptive training and Group B (20 subject) received conventional training. All were assessed with Numerical pain rating scale and Foot and ankle ability measures. This exercise was given for 2 weeks, a period lasting for 45 to 60 minutes 10 reps, 3sets. Pre and post test values are calculated and tabulated. The entire process was conducted from November 2022 to March 2023.
**Result :** According to statistical analysis Proprioceptive training is effective in reducing pain with patients with lateral ligaments injury with p value of <0.0001.

**Conclusion** : This study finally concluded that proprioceptive training has a high impact in reducing pain with patients with lateral ligaments injury.

**Keywords** : Lateral ligaments injury, proprioceptive training, conventional training, Numerical pain rating scale, Foot and ankle ability measure.

## Introduction

Ankle ligaments injuries are common sports injuries. The ankle's lateral ligaments were injured in more than 90% of cases. The functional interaction of bone and ligamentous components as well as how they work as a protective shield against one another is perfectly illustrated by the ankle. The actual ankle motion consists of a combination of plantar and dorsiflexion, as well as a small amount of internal and external rotation and anterior/ posterior translation of The talus on the tibia. 20° dorsiflexion to 50° plantarflexion is the typical

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range.[1] Additionally, the lower leg can externally rotate relative to the ankle joint on Occasion. Because the ligament is tight in this posture, inversion injuries to the plantar-flexed Foot result in an injury to the ATFL. Reduced proprioceptive function and mechanical stability are to be blamed for this. Balance Board training significantly reduces the risk of recurring injuries to already wounded ankles.The completion of a monitored rehabilitation program of balance training activities should Therefore it can be recommended to athletes[2]. Among the most frequent orthopaedic ailments are ligament damage to the ankle joint. Sports-related ankle injuries range from 13 to 56% of all injuries, particularly those to the Lateral ligaments. Athletes who have "rolled over" on the outside of their ankle are the ones Who appear with lateral ankle ligament sprains most frequently[3]. The definition of proprioception is "the reception of stimuli produced within the organism,"

Whereas the definition of balance is "physical equilibrium" numerous balance exercises will Train proprioceptive pathways, thus it is crucial to comprehend the differences. Proprioception is a neurological process, whereas balance is the capacity to maintain Equilibrium. To develop an awareness of one's environment, this mechanism integrates the Central nervous system with peripheral nervous system receptors.[8] In order to fully engage the body's proprioceptive sense and proprioceptors for Body position evaluation, motor process perception, and motor unit activation, proprioceptive training is a phrase used to describe the comprehensive neuromuscular control of employing various training methods. Proprioceptive training is not a particular technique for training. As a component of the multisystem process of Balance and postural regulation, proprioception is the capacity to perceive joint position and movements. The nervous system receives information from sensory signals and Proprioceptors about body location, muscular activity, visual feedback, and other inputs. Essential for improved movement control and balance maintenance during regular activities and athletic performance.[12] Most ankle injuries, or 80% of them, are lateral ankle sprains, which are among the most Frequent musculoskeletal injuries. Conventional treatment is the initial preferred course of action for the majority of patients, consisting of early ankle mobilization and weight-bearing, unsupervised exercises, and occasionally the use of external support (a bandage, brace, or Tape)[9].

## Aim

To compare the efficacy of proprioceptive training and conventional training in reducing pain and improving the functional activity with lateral ligament injury.

## Material and Method

It was an experimental study conducted on 40 subjects with lateral ligament injury among athletes. Convenient sampling techniques are used.

**Study period: From November 2022 to March 2023.**

**Inclusion criteria**

- Age 20 – 35
- Both male and female are included**.**
- Subject with lateral ligament injury

**Exclusion criteria**

- Subject participating in other interventional studies.
- Subject with recent ankle fracture.
- Patients who refuse to sign consent forms or a lack of ability to adhere to study instructions.

**Outcome Measures**

Assessments were done at baseline (before the start of treatment) and two weeks into the study.

Numerical pain rating scale : This scale has been determined to be one of the most accurate pain outcome measures available. Patients were instructed to mark along a straight line on the evaluation sheet with a 0 at the beginning and a 10 at the end, with '0 denoting no pain and '10 denoting severe pain, depending on their perception of discomfort.[8]

**Foot and ankle ability measure scale:**

The Foot and Ankle Ability Measure (FAAM) was created in order to assess physical function in patients with foot and ankle-related disorders. This self-report outcome tool is also accessible in versions in Persian, English, German, and French. The Foot and Ankle Ability Measure, Sports Subscale and the

Foot and Ankle Ability Measure, Activities of Daily Living Subscale, are two subscales of the overall 29-item questionnaire. The more challenging tasks required for participating in sports are measured by the Sports subscale. It was made for athletes and is population-specific.[9]

**Procedure**

Taking into account the inclusion and exclusion criteria, participants were included. Participants were given a brief explanation of the process before being asked to sign the consent form. All of the invited subjects were evaluated in accordance with the assessment form. Participants were randomized into two groups, A and B, at random. Assessments were done at the start of the trial and two weeks later.

**Group A: Proprioceptive training** :

Proprioception is the neurological process that the body uses to receive sensory input from its environment and combine it with other information to produce a motor response. Examples of proprioceptive exercises for the ankle joint include standing on one leg while doing an activity like catching or throwing a ball, balancing on a wobble board or ankle disk, and standing on one leg Side Steps, Ankle Circle,Towel crunches,lateral crunches while doing these exercises.These workouts can improve the sensorimotor system's capacity to adjust to a changing environment, which will subsequently protect the body from harm[6]. Side step Procedure: The subject was instructed to stand with feet together with knees slightly bent and asked to take side step with the left foot followed by small steps and repeat the same to the other foot.No of sets: 3, No of repetition 10, hold for 10 sec and relax for 10 sec. Ankle circles : Procedure: The subject was instructed to sit in a long sitting and keep their arms inside and instructed to do little circles with the ankle and rotate left foot. No of sets : 3, No repetition 10 , hold for 10 sec and relax for 10 sec. Towel scrunches. Procedure:The subject was instructed to stand with flat foot placing on a towel and instructed to move the towel on their direction.No of sets :3, No repetition 10, hold for 10 sec and relax for 10 sec. Lateral lunges : Procedure: The subject was instructed to stand with feet hip width apart and take a broad side step with knee bent straight.No of sets :3, No repetition 10 , hold for 10 sec and relax for 10 sec.

**Group B: Conventional training:**

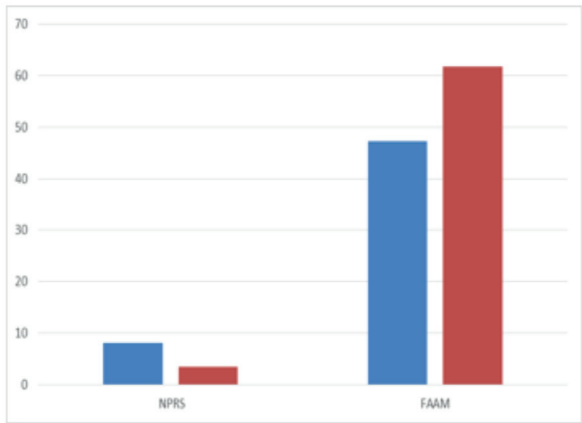
The main goals of conventional ankle joint treatment are to protect the wounded area to some extent and lessen the negative repercussions that the injury may have.After an ankle injury, muscular strength training has two purposes: to treat muscle dysfunction, such as atrophic muscle atrophy brought on by breaking and restricted mobility, and to treat articular muscle weakness. It is thought that one of the most effective ways to improve joint stability and reduce the risk of reinjury is to strengthen the associated muscle groups around the ankle through strength training.[13]

Bilateral heel raise Procedure:The subject was instructed to stand apart with maintaining straight knees then lift the heels from the ground and hold it for 10 secs.No of set 3 and no of repetitions 10 relax for 10 sec.

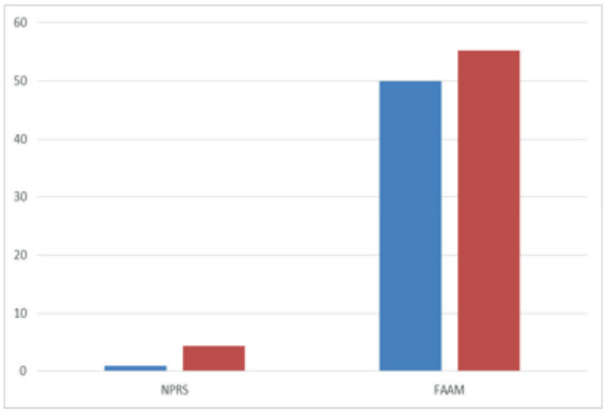
Forward lunges Procedure:The subject was instructed to stand with feet hip width apart and arms at their sides and bend any one of the knee forward with both legs bent 90 degree angle with weight bearing in front leg and repeat the same by switching legs.No of sets:3 , No of repetitions 10 , hold for 10 sec and relax for 10 sec.

Full squats Procedure:The subject was instructed to stand apart as they squat down with maintaining the chest up and shoulder back with parallel 90 degree knees.No of sets:3 , No repetition 10, hold for 10 sec and relax for 10 sec.

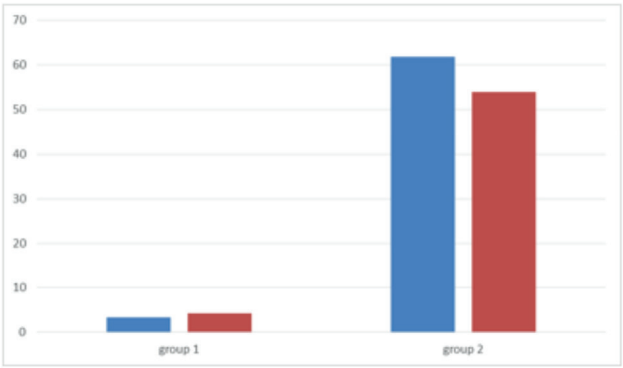
**Data analysis**




**Graph-1: Pre and post test value of proprioceptive training.**




**Graph-2: Pre and post test value of conventional training**




**Graph-3: Post test value of Proprioceptive training and conventional training.**

## Result

The statistical analysis of Group A with proprioceptive training using numerical pain ratings scale, pre test and post test mean value 8.10 ± 3.40; and standard deviation value of 0.72 ± 0.50; with SEM value of 0.16 ± 0.11; T value of 23.9730 and P value less than 0.0001 is considered to be extremely statistical significant. And with Foot and ankle ability measure scale, pre test and post test mean value 47.45 ± 61.75; and standard deviation value of 7.77 ± 6.54; with SEM value of 1.74 ± 1.46; T value of 6.2954 with P value less than 0.0001 is considered to be extremely statistical significant. The statistical analysis of Group B with conventional training using numerical pain ratings scale pre test and post test value of 8.05 ± 4.30 and standard deviation value of 0.69 ± 0.66; with SEM value of 0.15 ± 0.12; SEM value of 0.15 ± 0.15; and T value of 17.6519 and P value less than 0.0001 which is considered as extremely statistical significant. And with foot and ankle ability measure scale, pre test and post test value of 50.00 ± 55.26; and standard deviation value of 3.97 ± 3.14; SEM value of 0.89 ± 0.70 and T value of 4.5924 and P value less than 0.0001 which is considered to be extremely statistical significant. The difference between the two groups A and B by using Number pain ratings scale post test mean value of 3.40 ± 4.30; and standard deviation 0.50 ± 0.66; SEM value of 0.11 ± 0.15; with T value of 4.8659 with P less than 0.0001 which is considered to be extremely statistical significant. And foot and ankle ability measure scale posttest mean value of 61.75 ± 53.95; and standard deviation value of 6.54 ± 4.10 ; SEM value of 1.46 ± 0.92 with P value less than 0.0001 which is considered as extremely statistically significant.

Statistical analysis of numerical pain ratings scale and foot and ankle ability measure post test revealed that both groups show similar results but proprioceptive training exceeds the conventional training.

## Discussion

The goal of the present study was to compare the efficacy of proprioceptive training and conventional training in reducing pain and improving functional activity for people with lateral ligament injury. Athletes who have rolled their ankles outward on the outside most frequently show with lateral ankle ligament sprain.This frequently happens when an athlete missteps, lands on an opponent's foot, or lands on uneven terrain. Usually, these circumstances result in the foot being in plantar flexion at the time of the injury. Immediately following the injury, the patient typically feels a sharp, localized pain on the lateral side of the ankle. According to the statistical analysis, the difference between the pre-test and post-test score for both group A and B is significant.40 Individuals pre and post-test values are identified independently, and their respective mean values for both groups are determined. Using descriptive and inferential statistics, the collected data is tabulated and evaluated. The mean and standard deviation are applied to all parameters. Significant differences between pre and post treatments data were analyzed using a paired t-test. For both group A and B, the unpaired t-test was employed to examine significant

differences in post-test values between the two groups.

As per the findings of a study by Vivek kumar Arora in 2016 proprioceptive and technical training can be a successful treatment to stop ankle sprains from happening again in people who have previously experienced grade I or grade II ankle sprains.According to Ana Maria de Castro 2022, A proprioceptive training programme for athletes that lasts longer than three weeks with weekly protocols made up of dynamic exercises for people with ankle problems. According to Carlo Mamo in 2016,proprioceptive control enhancements in single stance may be a critical element in the effective prevention of ankle, knee, and low back discomfort. According to Tina Winter, when done five times a week for 15 minutes, proprioceptive training enhances functional ankle stability in speed skaters after 12 weeks but not after six. Elements of Proprioception are affected in several ways.The technical demands of speed skating only caused kinaesthesia to improve in the right feet for plantarflexion. While there was no improvement in the static one-legged stance, the intervention group significantly outperformed all test scores for dynamic balance. For speed skaters to improve their functional ankle stability, regular proprioceptive training is advised[7]

## Conclusion

According to the findings of this study Group A with proprioceptive training was found to be more beneficial than Group B with conventional training in reducing pain and improving functional activity for people with lateral ligament injury. As a result it is suggested that this procedure be used in clinical practice to improve functional activity and reduce pain with patients with lateral ligament injury.

**Ethical Clearance**: Taken from the institutional ethical committee. ISRB number- 03/041/2022/ ISRB/SR/SCPT

**Funding**: Self

**Conflict of Interest**: Nil

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Original Article

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# Efficacy of Therapeutic Ultrasound and Therapeutic Laser Along with Myofascial Release in Reducing Pain and Improving Hand Grip for People with Lateral Epicondylitis

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**Abstract**

**Background:** Lateral epicondylitis is a common overuse injury that affects the tendons on the outer side of the elbow. It results from repetitive gripping or wrist extension activities, leading to microtrauma and subsequent inflammation. The condition primarily manifests as pain and reduced grip strength, often affecting daily activities and occupational performance. However, limited research directly compares the effectiveness of these interventions for lateral epicondylitis.

**Purpose:** The aim of this study is to compare the effectiveness of therapeutic ultrasound and therapeutic laser, in conjunction with myofascial trigger release, in reducing pain and improving handgrip strength in individuals with lateral epicondylitis.

**Methods:** Patients willing to participate in the study were screened for inclusion and exclusion criteria taken from Get well soon physio rehabilitation centre. The total number of subjects (40) are divided into 20 subjects for the experimental group (Group A), they are given therapeutic ultrasound along with myofascial release . The control group (Group B) consisting of 20 subjects, are low level therapeutic laser along with myofascial release, NPRS and Handheld dynamometer are used as outcomes measure. The entire process was conducted from November 2022 to March 2023.

**Results:** The results revealed significant pain reduction and greater improvements in handgrip strength for the therapeutic laser group compared to the therapeutic ultrasound group. This study showed that the p value is statistically significant <0.0001.

**Conclusion:** This study concluded that therapeutic laser, when combined with myofascial trigger release, demonstrated superior effectiveness compared to therapeutic ultrasound in the management of lateral epicondylitis.

**Keywords**: Ultrasound therapy, Low level Therapeutic laser, myofascial trigger release, Handheld Dynamometer.

## Introduction

Tennis Elbow, also known as lateral epicondylitis, is a syndrome that affects the common extensor origin and produces discomfort and practical issues including weak hand grip strength.[1,2] The extensor muscle mass often radiates distally, lateral elbow pain is the most common patient complaint. Extending The

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wrist and fingers against resistance. The symptoms usually don't instantly connect to a particular painful experience and start up gradually. The time spent lifting something while hunching over or pronating the forearm.3 With a prevalence of 1.7% and a rising danger to the dominant arm between the ages of 30 and 60, tennis elbow is a prevalent ailment in those who work.[1,2]

Nonsteroidal Anti-inflammatory medicines (NSAIDs) are used in its treatment, as well as physiotherapy techniques like ultrasound, transcutaneous electrical nerve stimulation (TENS), low intensity Therapeutic laser, and extracorporeal shockwave.[6] Tennis elbow is treated with pulsed and continuous ultrasound, but there is disagreement over the technique's overall effectiveness in treating musculoskeletal diseases.[7] When receiving Therapeutic laser along with a proximal forearm strap for lateral epicondylitis, patients report decreased pain, more grip power, and an overall higher quality of life (QoL).[6] A non-invasive, painless procedure called low level Therapeutic laser (LLLT) can be used to lessen discomfort, improve blood flow to the limbs, and speed up the recovery of injured nerves.[8,9] Rather than having a thermal impact, LLLT has a photochemical one on tissue. Its ability to relieve musculoskeletal discomfort could improve quality.[10]

Low level Therapeutic laser (LLLT) is a painless, non-invasive, and simple to use technique for pain management, peripheral blood flow improvement, and nerve injury healing. Rather than having a thermal impact, LLLT has a photochemical one on tissue.[11] The ability to cure musculoskeletal discomfort through it may improve quality of life. Pain associated with musculoskeletal problems, tendon and muscle damage.[12] Myofascial Release Therapy (MFR) is one of the most common techniques used by physical therapists to treat symptoms of lateral epicondylitis. MFR is applied to the fascial complex to provide a low-impact, long-lasting stretch to restore optimal length, reduce pain, and improve function.[13] Although several treatments have shown beneficial effects in treating lateral epicondylitis, several studies have been conducted to investigate effects of MFR and its role on grip strength. Examining the effects of myofascial release therapy and vigorous stretching on pain and grip strength in lateral epicondylitis is the main goal of this study.

## Aim

The aim of this study is to compare the effectiveness of therapeutic ultrasound and therapeutic laser, in conjunction with myofascial trigger release, in reducing pain and improving handgrip strength in individuals with lateral epicondylitis.

## Material and Method

Patients willing to participate in the study were screened for inclusion and exclusion criteria. The total number of subjects (40) are divided into 20 subjects based on purposive sampling for the experimental group (Group A), they are given therapeutic ultrasound along with myofascial release. The control group (Group B) consisting of 20 subjects, are low level therapeutic laser along with myofascial release, NPRS and Handheld dynamometer are used as outcomes measure.

**Study period:** from November 2022 to March 2023.

**Inclusion criteria**

1. Subjects who have been diagnosed with Lateral Epicondylitis.
2. Both Male and Female.
3. Numerical Pain Rating Scale (NPRS) Above 6 will be included.
4. Aged Between 18-45 years

**Exclusion criteria**

1. Cardiovascular Disease
2. Fracture Dislocations
3. Infective Lesions
4. Neuromuscular Disease
5. Open Scar
6. Open Wound
7. Recent Surgery

**Outcome Measure**

Assessment was done at initial and at the end of the study using:

1. Numerical Pain Rating Scale[14]
2. Handheld dynamometer

**Procedure**

A total of 40 subjects were recruited for this study through the purposeful sampling method. All subjects were recruited based on the inclusion and exclusion criteria. Before commencing the study, an information sheet was provided to all the subjects regarding the study procedures, and informed consent was obtained. The recruited subjects were assigned to two groups (Experimental Group: 20 Subjects) and (Control Group: 20 Subjects) underwent pre-test analysis on the Hand Grip Strength Measurement using Handheld dynamometer and Numeric Rating Scale (NRS) to analyze the impact of the interventions on the overall quality of life for Lateral Epicondylitis Patients. After the pre-test analysis, Experimental Group received Therapeutic Ultrasound along with myofascial trigger release for 5 sessions per week for the period of 4 weeks, Whereas Control Group received Low Level Therapeutic laser along with myofascial trigger release for 5 sessions per week for the period of 4 weeks. After 4 weeks, the Post-test analysis was carried out, and the data were tabulated through SPSS.

**Experimental Group Therapeutic Ultrasound along with myofascial trigger release:**

Applying therapeutic ultrasound for lateral epicondylitis involves a specific technique to ensure optimal treatment delivery. Here is a step-by-step guide on how to apply therapeutic ultrasound for lateral epicondylitis patients:

Ensure that the therapeutic ultrasound machine is in proper working condition and calibrated appropriately. Applying 3 MHZ Frequency for the Lateral Epicondylitis patients. Instruct the patient to sit or lie down comfortably, exposing the affected forearm and elbow area. Support the patient's arm on a pillow or other soft surface to ensure relaxation and proper positioning throughout the treatment. Set the ultrasound parameters based on the patient's tolerance. This includes the intensity (intensity level should be within a comfortable range for the patient), treatment duration, and frequency. Place the ultrasound transducer directly over the gel-coated skin, ensuring good skin contact .Move the transducer in a slow, circular or linear motion while maintaining continuous contact with the skin.Administer therapeutic ultrasound for the recommended treatment duration, typically ranging from 5 to 10 minutes per session. Performing myofascial trigger release for lateral epicondylitis patients involves targeted manual techniques to release tension and address trigger points in the affected muscles and fascia. Here is a step-by-step guide on how to perform myofascial trigger release for lateral epicondylitis. Instruct the patient to sit or lie down comfortably, with the affected arm and elbow area exposed. Support the patient's arm on a pillow or other soft surface to ensure relaxation and proper positioning throughout the treatment. Identify the common trigger points associated with lateral epicondylitis, which are typically found in the extensor muscles of the forearm, including the extensor carpi radialis brevis and the extensor digitorum. Palpate the affected forearm muscles, feeling for areas of increased tenderness, tightness, or nodules. Using your fingers, thumb, or the pad of your hand, apply sustained pressure to the identified trigger points. Start with a moderate pressure and gradually increase it to a tolerable level, taking into account the patient's comfort. After applying sustained pressure, combine it with passive stretching of the affected muscle. Gently stretch the muscle by gradually elongating it, moving the patient's hand or wrist into a position that lengthens the muscle fibers.[10]

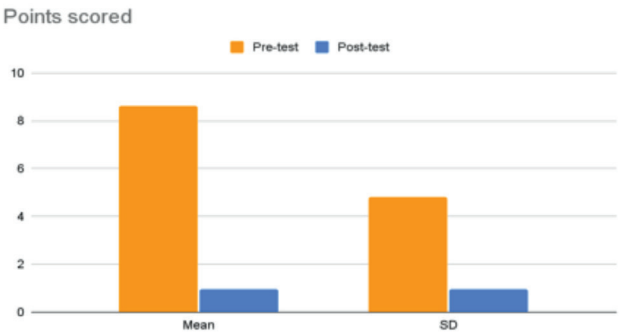
**Control Group low level Therapeutic laser along with myofascial trigger release:**

Applying Therapeutic laser for lateral epicondylitis involves utilizing low-level Therapeutic laser (LLLT) to stimulate healing and reduce pain in the affected area. Ensure that the Therapeutic laser device is in proper working condition and calibrated according to manufacturer guidelines. Instruct the patient to sit or lie down comfortably, with the affected forearm and elbow area exposed. Support the patient's arm on a pillow or other soft surface to ensure relaxation and proper positioning throughout the treatment. Ensure that both the patient and the therapist wear appropriate eye protection, such as Therapeutic laser safety glasses, to prevent potential damage from the Therapeutic laser light. Hold the Therapeutic laser device approximately 1 to 2 centimeters away from the skin surface. Position

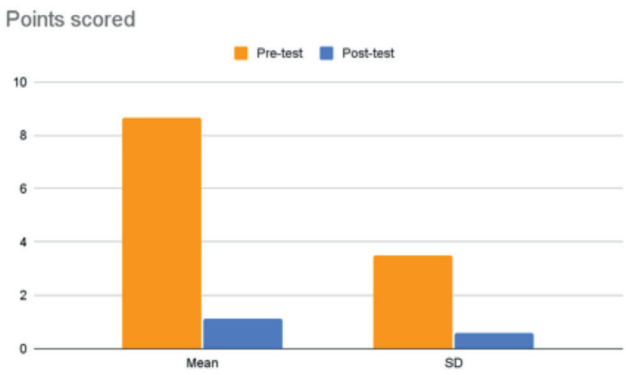
the Therapeutic laser probe perpendicular to the skin, targeting the lateral epicondyle region and the surrounding area. Move the Therapeutic laser probe in a slow, circular or linear motion, covering the entire treatment area. Maintain continuous contact with the skin surface. Administer Therapeutic laser for the recommended treatment duration, typically ranging from a few minutes to several minutes per session.

**Data Analysis**

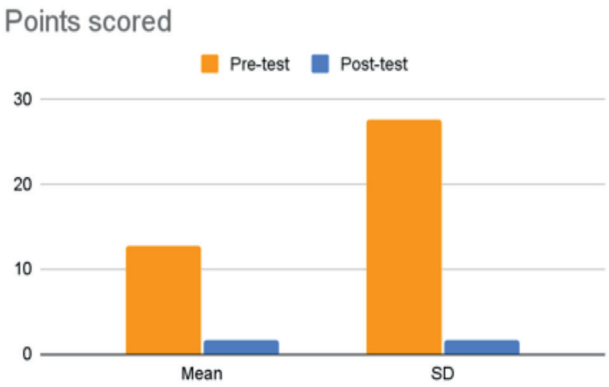
Using tabular and inferential statistics, the gathered data was evaluated. The mean and standard deviation were utilized for all parameters. The statistically significant differences between pre-test and post-test measures were examined using a paired t- test. When utilizing the unpaired t-test to look at significant changes in the experimental group, the significance level of p 0.0001 was determined to be statistically significant.



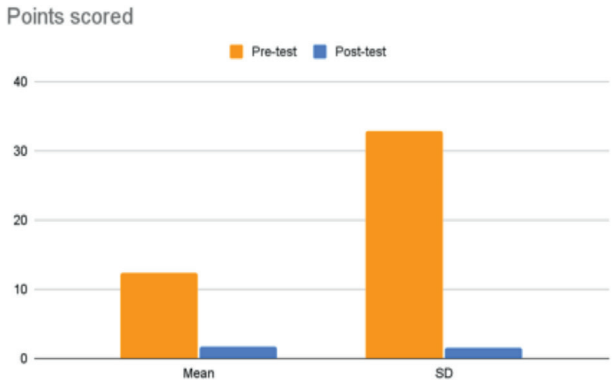

**Graph-1: Comparison between Pre-test and Post-test values of Numerical Pain RatingScale (NPRS)**



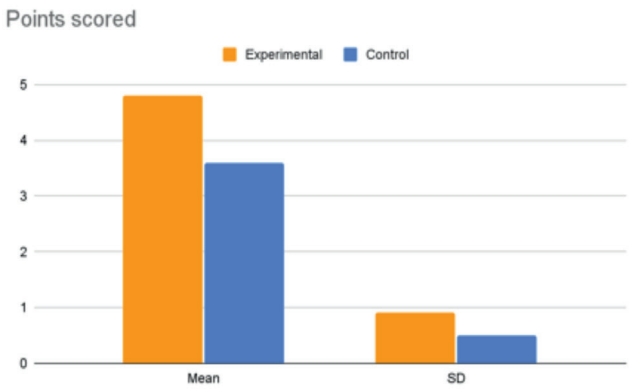

**Graph-2: Comparison between Pre-test and Post-test values of Numerical Pain Rating Scale(NPRS) Control Group Therapeutic laser along with Myofascial Trigger Release**



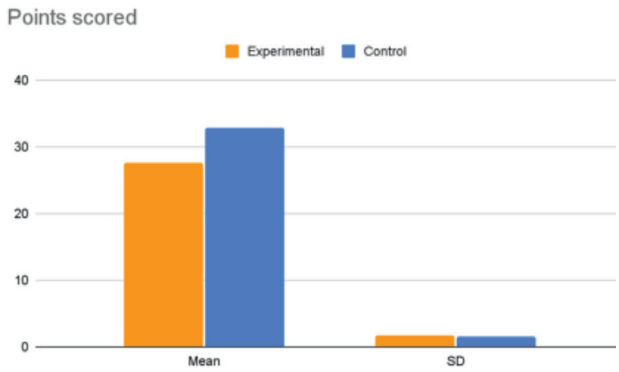

**Graph-3: Comparison between Pre-test and Post-test values of Handheld Dynamometer Experimental Group Ultrasound Therapy along with Myofascial Trigger Release**




**Graph-4: Comparison between Pre-test and Post-test values of Handheld Dynamometer Control Group Therapeutic laser along with Myofascial Trigger Release**




**Graph-5: Comparison between Post-test values of Experimental Group and Control Group for Numerical Pain Rating Scale (NPRS)**




**Graph-6: Comparison between Post-test values of Experimental Group and Control Group for Handheld Dynamometer**

## Results

The Pre-test means of Numerical Pain Rating Scale (NPRS) Experimental Group Ultrasound Therapy along with Myofascial Trigger Release showed 8.60, the standard deviation 0.94, whereas the Post-test mean value of Numerical Pain Rating Scale (NPRS) Experimental Group Ultrasound Therapy along with Myofascial Trigger Release showed 4.80, standard deviation 0.95.This showed Statistically significant-value of less than 0.0001.

The Pre-test mean of Numerical Pain Rating Scale (NPRS) Control Group Therapeutic laser along with Myofascial Trigger Release Showed 8.65, the standard deviation 1.14, whereas the Post- test mean value of Numerical Pain Rating Scale (NPRS) Control Group Therapeutic laser along with Myofascial Trigger Release Showed 3.50, the standard deviation 0.61.This Showed Statistically Significant-value of less than 0.0001.

The Pre-test mean of Handheld Dynamometer Experimental Group Ultrasound Therapy along with Myofascial Trigger Release showed 12.65, the standard deviation 1.60, whereas the Post-test mean of Handheld Dynamometer Experimental Group Ultrasound Therapy along with Myofascial Trigger Release showed 27.55, the standard deviation 1.70. This showed Statistically significant-value of less than 0.0001.

The Pre-test mean of Handheld Dynamometer Control Group Therapeutic laser along with Myofascial Trigger Release Showed 12.40, the standard deviation 1.70, whereas the Post-test mean value of the Handheld Dynamometer Control Group Therapeutic laser along with Myofascial Trigger Release Showed 32.85, the standard deviation 1.53. This Showed Statistically Significant in p-value of less than 0.0001.

Post intervention of Numerical Pain Rating Scale (NPRS), control group of the participants those who received therapeutic Laser for 4weeks Mean (3.60), the standard deviation (0.50) showed better result when comparing with participants those of experimental group who underwent Ultrasound Therapy for 4 weeks Mean (4.80), the standard deviation (0.95). This showed a statistically significant p-value of less than 0.0001.

Post intervention of Handheld Dynamometer, control group of the participants those who received therapeutic Laser for 4 weeks Mean (32.85), the standard deviation (1.53) showed better result when comparing with participants those of experimental group who underwent Ultrasound Therapy for 4 weeks Mean (27.55), the standard deviation (1.70). This showed statistically significant in p-value of less than 0.0001

## Discussion

The present study aimed to compare the therapeutic outcomes of therapeutic ultrasound, Therapeutic laser, and myofascial trigger release in the management of lateral epicondylitis. The results demonstrated that all three interventions were effective in reducing pain and improving handgrip strength to varying degrees.

Therapeutic ultrasound has long been utilized in the management of lateral epicondylitis, and its effectiveness has been supported by previous research. In this study, therapeutic ultrasound demonstrated significant pain reduction and improvements in handgrip strength compared to baseline measurements. These results align with the existing literature and further strengthen the evidence supporting the use of therapeutic ultrasound as a valuable treatment modality for lateral epicondylitis.

Therapeutic laser, although less extensively studied in the context of lateral epicondylitis, also showed promising results. The application of Therapeutic laser led to significant pain reduction and improvements in handgrip strength. These findings suggest that Therapeutic laser may be a viable treatment option for individuals with lateral epicondylitis, warranting further investigation and consideration in clinical practice.

Myofascial trigger release, a manual technique targeting trigger points and muscle tension, also demonstrated positive outcomes in this study. The application of myofascial trigger release resulted in pain reduction and improvements in handgrip strength, indicating its potential as an effective treatment approach for lateral epicondylitis.

The comparison between the three interventions revealed interesting findings. While all three approaches showed effectiveness, there were some differences in their outcomes. It is important to acknowledge certain limitations of this study. First, the sample size was relatively small, which may limit the generalizability of the findings. Additionally, the study duration was relatively short, and the long-term effects of the interventions were not assessed.

The findings of this study suggest that Therapeutic laser, when combined with myofascial trigger release, demonstrated superior effectiveness compared to therapeutic ultrasound in the management of lateral epicondylitis. The results revealed significant pain reduction and greater improvements in handgrip strength for the Therapeutic laser group compared to the therapeutic ultrasound group.

## Conclusion

This Study Concluded that Therapeutic laser, when combined with myofascial trigger release, demonstrated superior effectiveness compared to therapeutic ultrasound in the management of lateral epicondylitis. The results revealed significant pain reduction and greater improvements in handgrip strength for the Therapeutic laser group compared to the therapeutic ultrasound group.

**Ethical clearance;** Taken from the institutional ethical committee.

ISRB number-03/060/2022/ISRB/SR/SCPT

**Funding:**Self

**Conflict of Interest:**No conflict of interest during this research.

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Original Article

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# Efficacy of Cervical Thoracic Spine Correction Exercise in Reducing Pain and Improving Neck Posture in People with Cervical Spondylitis

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**Abstract**

**Background:** The development of osteophytes and the involvement of adjacent soft tissue structures are the initial indications of degenerative changes in the intervertebral discs in cervical spondylitis. Forward head posture also has an effect on the muscles at the head and shoulders, which aggravates postural deformity.

**Purpose:** The purpose is to determine Efficacy of cervical thoracic spine correction exercises in reducing pain and improving neck posture in people with cervical spondylitis.

**Methods:** This experimental study has been conducted from December 2022 to April 2023. Patients willing to participate in the study were screened for inclusion and exclusion criteria. The total number of subjects (30) were taken from Sai charan physio clinic and they are divided into 15 subjects for the experimental group, they are given cervical thoracic spine correction exercises with ultrasound. The control group consisting of 15 subjects, are isometric exercises with ultrasound. NPRS and Neck disability index are used as outcome measures. The treatments were given for 5 days per week and continued for 2 weeks.

**Results:** From statistical analysis made with the quantitative data revealed statistically significant differences between the Group A and Group B, with the P value of <0.0001. Thus, the experimental group has higher statistical differences than the conventional group.

**Conclusion:** According to the findings of this study, Cervical thoracic spine correction exercises in the experimental group were found to be more beneficial than isometric exercises in conventional groups in lowering pain and leading to faster recovery in participants with forward neck posture.

**Keywords:** Cervical Spondylitis, Posture Correction, Isometric Exercise, NPRS, NDI .

## Introduction

The development of osteophytes and the participation of nearby soft tissue regions are the initial indications of discs between the vertebrae that experienced deterioration in cervical spondylitis.[1] However, it can be challenging to distinguish between healthy aging and disease because many patients indicate equivalent aberrations on simple cervical vertebral column radiographs.[2]

Early spondylitis has been correlated with

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degenerative disc changes that can lead to dehydration of the disc, thereby decreasing the disc's capacity to deal with or tolerate increased axial loads along the cervical spine.[3,4]

A forward-facing posture is one of the wrong postures that can lead to neck pain. It is most frequently office workers were noticed and is distinguished by excessive upper cervical spine extension, excessively lower vertebrae in the flexing, increased thoracic the condition known as and increased strain on the cervical spine muscles and joints as a consequence of the restricted movement of the cervical and thoracic spine. [5,6] Prevalence- In middle age, predominance is greatest. In an adult general practice survey, 20% of men and 25% of women reported having recent neck pain.Forward Head Posture also affects the trapezius, sternocleidomastoid, suboccipital, and temporal muscles in the area of the head and shoulders, aggravating postural deformity. As a result of these modifications, the muscles, fascia, and nerves in the neck and shoulders are continuously and abnormally compressed.[8]Of these, back extensor strengthening exercises are the most frequently used intervention. The thoracic kyphosis is significantly reduced, and muscle strength and endurance are increased with progressive back strengthening exercise among other benefits.[9]

To determine the level of pain, the NPRS was used (Numeral Pain Rating Scale), Based on the level of neck pain, the neck disability index questionnaire was utilized to determine the neck impairment's severity.[10]

### Aim

The aim is to determine Efficacy of cervical thoracic spine correction exercises in reducing pain and improving neck posture in people with cervical spondylitis.

### Material and Method

Patients willing to participate in the study were screened for inclusion and exclusion criteria. The total number of subjects (30) are divided into 15 subjects for the experimental group; they are given cervical thoracic spine correction exercises. The control group consisting of 15 subjects, are isometric exercises. NPRS and Neck disability index are used as outcome measures. Convenient sampling with a random allocation method was used in the study.

**Study period:** From December 2022 to April 2023.

**Inclusion Criteria**

- Subjects of both genders,
- Pain and reduced movements were mainly diagnosed for cervical spondylitis,
- Subject with a numerical pain rating scale of more than five to seven points,
- Subject with moderate disability in Neck disability index.

**Exclusion Criteria**

- Previous surgery or trauma scars.
- Speech or hearing problems.
- Present of any metal implants.
- A cardiac pacemaker or cancer.

**Outcome Measures**

- Numeric Pain Rating Scale (NPRS)
- Neck Disability Index (NDI)

## Procedure:

For inclusion and exclusion criteria, patients who were willing to participate in the study were assessed. The total number of subjects (30) are divided into 15 subjects for the experimental group (Group A), they are given cervical thoracic spine correction exercises with ultrasound. The control group (Group B) consisting of 15 subjects, were given isometric exercises with ultrasound. NPRS and NDI are used as outcome measures. Both the groups were treated with ultrasound therapy.

**Experimental Group (Group A)**

The experimental group was given Cervical thoracic spine correction exercises for 3 sets each per session and each set consists of 15 repetitions with ultrasound given. This treatment strategy is applied for five days of the week and performed for 2 successive weeks. Patient is given rest after each session. After 2 weeks post-test values for NPRS and Neck disability index are taken, tabulated, and then statistically evaluated for results.

**Cervical Thoracic Spine Corrections Exercises:**

**1. Thoracic Roll Stretching Exercises**

- Kneel up while reclining on a flat surface like the floor.
- Position the Pettibone thoracic roll under the nape of the neck.
- Roll the back over the foam while pushing with your feet, stretching your thoracic muscles until you notice a noticeable increase in mobility.
- Until the spine is flexible, add lateral flexion or rotation of the upper body while causing it to travel over the roll.

**2. Shoulder Bracing (Shoulder Retraction)**:

- Place your feet shoulder-width apart while standing.
- Extend the elbows slightly and abduct the shoulders.
- Perform three sets of 20 repetitions.

**3. Superman Pose:**

- Lie on your stomach with your arms straight out in front of you.
- Then lift your arms, legs, and chest off the ground, as high as you can.
- Holding the position for 10 seconds before lowering yourself back down.
- Do it for 3 sets.

**4. Chin Tuck (Cervical Retraction)**

- Place one foot flat on the ground and either stand up or sit down on a chair. Drop your shoulders.
- Direct your gaze forward. Set your chin up straight and lean back. It barely moves at all. Do not tilt your face up or down or bend your neck forward.
- Hold for five seconds, then release.
- Repetition five times.
- Try not to hunch your shoulders or arch your back.

**Control Group (Group B)**

Generalized isometric workouts with ultrasonography alone were administered to the control group. The therapy plan was offered five days a week and executed for two straight weeks. Post-test results for the Neck Disability Index and NPRS are measured at the conclusion of the treatment plan and recorded for tabulation and statistical analysis.

**Isometric Exercises:**

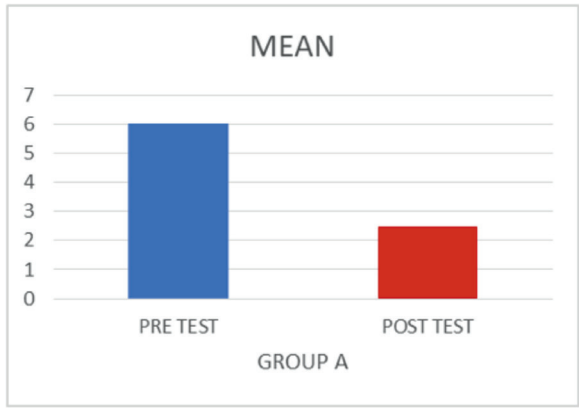
- Put your hand to your forehead and press. Use your neck muscles to fight back. Ten seconds of holding and relaxing with 5 Repetitions.
- Repeat the exercise while applying pressure on your side of the head with 5 Repetition and change sides.
- Repeat the technique while applying pressure on your back of head with 5 Repetition.

**Data Analysis**

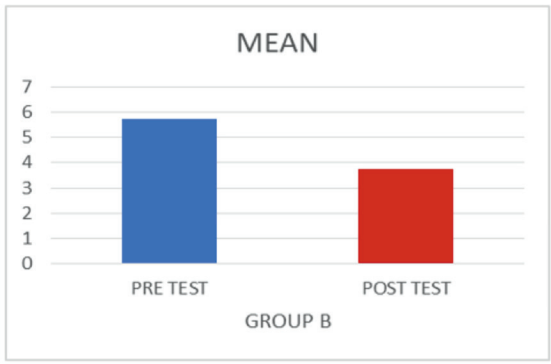
Using tabular and inferential statistics, the gathered data was evaluated. The mean and standard deviation were utilized for all parameters.

The statistically significant differences between pre-test and post-test measures were examined using a paired t-test.

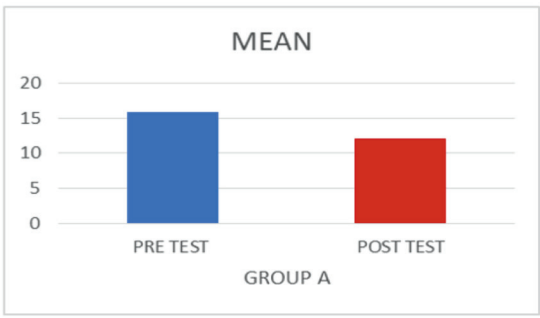
When utilizing the unpaired t-test to look at significant changes in the experimental group, the significance level of p 0.0001 was determined to be statistically significant.



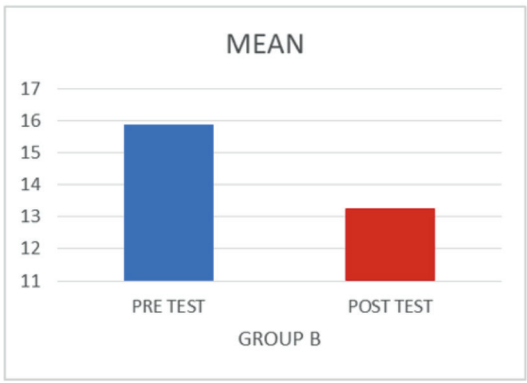

**Graph-1 Group A comparison of pre and post-test for NPRS**



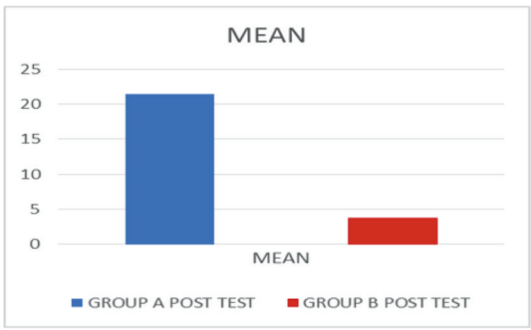

**Graph-2 Group B comparison of pre and post-test for NPRS**



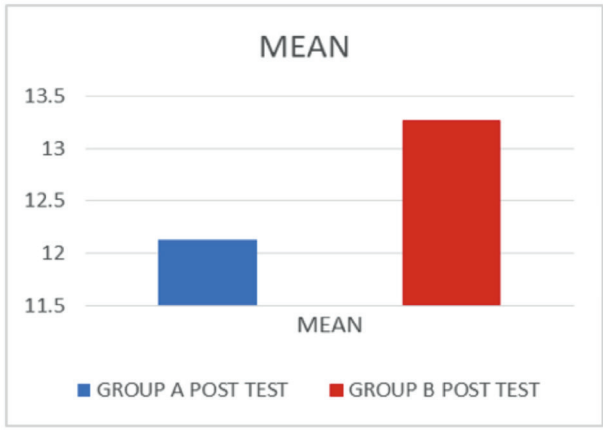

**Graph-3 Group A comparison of pre and post-test for NDI**




**Graph-4 Group B comparison of pre and post-test for NDI**




**Graph-5 Group A and B comparison post-test values for NPRS**




**Graph-6 Group A and B comparison post-test values for NDI**

## Results

Statistics used to analyze quantitative data revealed a statistically significant difference between group A and group B's values.

The pre-test and post-test values for groups A and B are contrasted in Table 1.

For Group A, the NPRS pre-test value was 6.00, whereas the post-test value was 2.47.

For Group B, the NPRS pre-test value was 5.73, but the post-test value was 3.74. With a p-value of 0.0001, the results are therefore regarded as statistically significant.

Table 2 compares the pre-test and post-test values for groups A and B. The NDI pre- test value for Group A was 15.87, and the post-test value was 12.13.

The NDI pre-test value for Group B was 15.87, and the post-test value was 13.27.

As a result, the findings are considered statistically significant with a p-value of 0.0001. The pre-test and post-test values for groups A and B are contrasted in Table 2.

For Group A, the NDI pre-test value was 15.87, whereas the post-test value was 12.13.

For Group B, the NDI pre-test value was 15.87, whereas the post-test value was 13.27. As a result, the findings are considered statistically significant with a p-value of 0.0001.

## Discussion

The study's aim is to identify the Efficacy of the cervical thoracic spine correction exercises and the isometric exercises with ultrasound. The comparison is recorded over the course of a week. Both NPRS and Neck Disability Index were used to measure the outcomes. The effects were significantly greater in the cervical thoracic spine exercises than the isometric exercises with the ultrasound. The main findings of the study are treatment of cervical thoracic spine correction exercises to a group showed a higher rate of reduction of patients with cervical spondylitis than the treatment of isometric exercises to the other group. Both the groups showed the improved movements and significant reduction of pain.

Early spondylitis is linked to degenerative disc alterations where desiccation of the disc takes place, leading to total fall of disc height and a decrease in the disc's ability to sustain or bear increased axial loads throughout the cervical spine.[3-4] Cervical spondylitis can occasionally cause the spinal canal within the spine's bones, or vertebrae, to become more constrained. The susceptibility of the neck's bones and protective cartilage to wear and tear might lead to cervical spondylitis. Some occupations or hobbies (such as construction require heavy lifting or repetitive motions. This may increase spinal pressure and cause early wear and tear. Cervical spondylitis is a frequent aging-related condition. Neck injuries - It seems that previous neck injuries raise the possibility of cervical spondylitis. Forward head posture, which occurs the most typical postural aberration is when the head seems to be in front of the body and outwardly extends from the sagittal plane. Back extensor strengthening exercises, abdominal exercises, and postural education have all been included in prior studies. Of these, back extensor strengthening exercises are the most frequently used intervention.[9] According to the statistics analysis, the difference between the pre-test and post rest score for both group A and B is significant. 30 individuals' pre and post -test values are identified independently and their respective mean values for both groups are determined. Using the results, the collected data is tabulated and evaluated. The mean and standard deviation are applied to all parameters. Significant differences between pre and post treatments data were analyzed using a paired t- test for both group A and B, the unpaired t-test was employed to examine significant differences in post -test values between the two groups. Jong-Hyuck Weon et al (2010 oct) conducted study on Scapular upward rotators' response to forward head position during maximal shoulder flexion and suggested that in comparison to FHP during loaded shoulder flexion, maintaining NHP is favorable in lowering sustained upper and lower trapezius activity and increasing serratus anterior activity.[6] To determine the level of pain, the NPRS was used (Numeral Pain Rating Scale), Based on the level of neck pain, the neck disability index questionnaire was utilized to determine the neck impairment's severity.[10]

The goal is to find the Efficacy of cervical thoracic spine correction exercises in reducing pain and improving neck posture in people with cervical spondylitis. Both groups experienced considerable modifications. According to statistical analysis, group A with cervical thoracic spine correction exercises was more effective at reducing neck pain than group B with isometric exercises. The study concludes that cervical thoracic spine correction exercises bring about a significant reduction of pain in patients with cervical spondylitis.

## Conclusion

According to the findings of this study, Group A with cervical thoracic spine correction exercises in the experimental group was found to be more beneficial than Group B with isometric exercises in the control group in reducing pain for cervical spondylitis. As a result, cervical thoracic spine exercise is suggested for the people with forward head posture on cervical spondylitis to reduce the pain.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/043/2022/ISRB/SR/ SCPT).

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Comparison between Neural Mobilization and Mckenzie Approach in Reducing Pain, Improving Mobility and Functional Ability in Peoples with Lumbar Radiculopathy

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**Abstract**

**Background:** Lumbar radiculopathy is the compression of lumbar nerve root. The most common causes of nerve root compression are intervertebral disc herniation and degenerative alterations. About 3% of cases, disc disease causes lumbar radiculopathy. Pain is the major symptom.

**Purpose:** The study is to compare the effectiveness of neural mobilisation and McKenzie approach in reducing pain, improving mobility and functional ability for peoples with lumbar radiculopathy.

**Materials and Methods:** A Experimental study which consists of 64 subjects who were selected based on inclusion and exclusion criteria from A.K.B physiotherapy during the period of November 2022 to April 2023. They were split into two groups , the Neural mobilisation group(n=32) and McKenzie group(n=32).The intervention was given for 5 days a week for 4 weeks . The pre and post test values were measured using (NPRS), Modified Schober's method and (MODI).

**Results:** With a p value of 0.0001, the mean of the Neural Mobilization at the post test was shown to be greater than the mean of McKenzie Exercise.

**Conclusion:** This study concluded that Neural mobilisation was found to be more effective than McKenzie in decreasing pain , improving mobility and functional ability for peoples with lumbar radiculopathy.

**Key Words:** Lumbar radiculopathy, NPRS, Modified schober's method and MODI

## Introduction

Lumbar radiculopathy is a radiating pain in the lumbar nerve root distribution that may also include sensory and motor dysfunction. The most common causes of nerve root compression are intervertebral disc herniation and degenerative alterations, whereas less often occurring causes include infection, inflammation, tumor, vascular disease, and congenital anomalies [1, 2]

The primary manifestation occurs as a result of degenerative changes (osteophyte formation) or a prolapsed disc, lumbar radiculopathy is the compression of peripheral nerves that exit the intervertebral foramina, causing pain either alone

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or with significant neurological symptoms [3,4] While osteoarthritic changes associated with ageing in the spine are the primary cause of radiculopathy in people over the age of fifty, prolapsed discs are the most common cause in patients under fifty[5,6].

About 3% of cases, disc disease causes lumbar radiculopathy. With 11.10% occurrence among working people and 13% due to lumbar radiculopathy, they are more susceptible to low back ache[7]

Pain is frequently the main symptom of lumbar radiculopathy patients. The radiating pain may be described as being sharp, dull, penetrating, throbbing, or scorching[8]

Activities that place an excessively high level of repetitive stress on the spine are risk factors for radiculopathy. In comparison to people who lead more sedentary lifestyles, those who engage in hard labour or contact sports are at a higher risk of developing radiculopathy[9].

Secondary risk factors for acute lumbar radiculopathy (peak 40-60 years) include smoking, mental stress, extended physical activity (frequent lifting), and driving (whole-body shaking)[10].

Neurodynamic mobilisation is a manual treatment approach that could be used to treat patients with lumbar radiculopathy. Both slider and tensioner manoeuvres are a part of neural mobilisation. A nerve slider intervention aims to cause the nerve trunk to glide relative to its surrounding tissues. The nerve slider technique involves moving the joint proximally while releasing it distally, then combining the movements in reverse. The goal of a nerve tensioner intervention, on the other hand, is to create tension in a nerve trunk relative to its surrounding tissues. The targeted structure is moved proximally and distally at the same time and in the same direction with joint movements using the nerve tensioner technique to increase nerve tension [11].

Theoretically, irritation of the lumbar nerve root may result in neural edema, ischemia, and fibrosis, which would worsen the system's damage, result in discomfort, and reduce function [12,13].

The McKenzie method is divided into three stages:assessment, treatment, and Prevention. Postural, dysfunctional, and derangement syndromes are the three mechanical syndromes that McKenzie lists. When a derangement is reduced, centralization takes place. When derangement has completely subsided, pain has been eliminated, and full range, pain-free movement has been returned.

## Aim

The purpose of the study is to compare the effectiveness of neural mobilisation and McKenzie approach in reducing pain, improving mobility and functional ability for peoples with lumbar radiculopathy.

## Material and Method

It was an experimental study conducted on 64 subjects with lumbar radiculopathy, age between 30-45 yrs was taken from A.K.B Physiotherapy . Convenient sampling with a random allocation method was used in the study. Study period : November 2022 to April 2023.

**Inclusion Criteria**

- Subjects who have diagnosed with lumbar radiculopathy
- Age between 30 – 45 years
- Both males and female
- Patients with SLR positive

**Exclusion Criteria**

- Patients with a history of vertebral fracture.
- History of spinal surgery.
- Cardiovascular disorder
- Neurological deficits
- Uncooperative patient

## Outcome Measures

- Numerical pain rating scale (NPRS) [17]
- Modified oswestry disability index (MODI) [19,20]
- Modified schober's method [21]

## Procedure

A Total 64 Participants were recruited on the basis of inclusion and exclusion criteria. Information sheet was provided regarding the procedure and Informed consent was obtained from participants. Assessment

was done before the treatment. Participants were assigned into two groups. Neural mobilization group and Mckenzie group. All subjects underwent pre test measurement using NPRS, MODI and modified schober's method and same repeated for post test after the treatment session

**Neural Mobilization Group**

- Neural Mobilisation was performed 3 sessions a day and five days per week.
- Duration per session: 20 minutes

**Passive Exercise:**

**Straight Leg Raise:**

- Ask the patient to lie in supine
- Stand next to the patients affected side
- Place one hand at the ankle joint and the other at the knee joint.
- Raise the affected side leg perpendicular to the bed until back discomfort is felt.
- Then lower the limb few degrees from symptomatic point
- Dorsiflex the ankle
- Ankle plantar flexion, inversion, Hip adduction and medial rotation to tense the sciatic nerve more.

**Active Exercise:**

**Straight Leg Raise:**

- Lay flat on back with legs extended.
- Flex one knee and place both hands behind it.
- Next, extend the knee. Flex and extend ankle once your knee is straight.
- A small stretch below the knee and calf should be felt
- Slowly lower your leg back down to the bent knee position.
- Repeat 5 to 10 times.

**Slump Technique**

- Sit upright on a couch.
- Slump the back and head.
- Extend the affected knee
- Slowly dorsiflex your ankle

**Mckenzie Group**

- There are 4 levels in this exercise program .
- Mckenzie exercise was performed 3 sessions a day and five days per week.
- Duration per session: 20 minutes

**Lying Face Down:**

- Lie face down with arms at side
- Turn head to one side
- Breathe deeply and relax.

**Lying Face Down In Extension**

- From this position, place the elbow under shoulder to lean on forearm
- Take a deep breath and relax.

**Extension In Lying:**

- Slowly straighten the elbow while pushing the upper body upward as far as discomfort will permit.
- Maintain this position for 2-3 seconds
- Come back to the starting position
- Breath in at bottom and come up then breath out
- If a patient feels uncomfortable, place the pillow to maintain the extension.

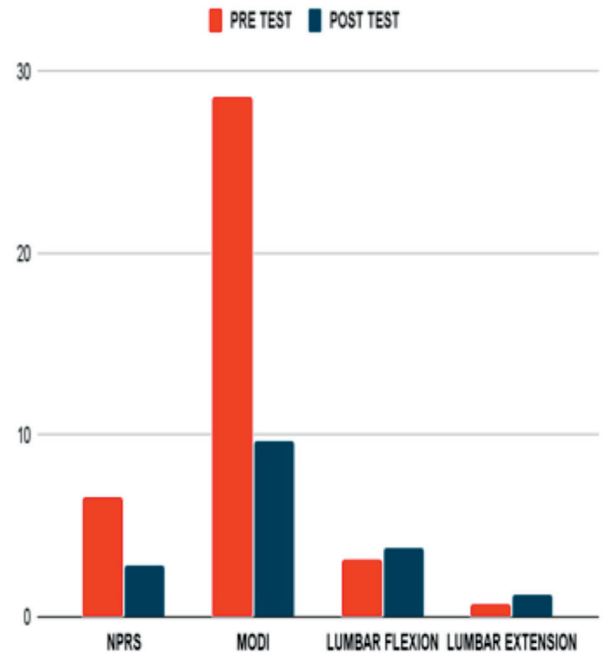
**Extension in standing:**

- Put feet slightly apart while standing straight.
- Position the hands behind, fingers pointing backward using hands as a fulcrum with knees straight, bend the body backward at the waist as much as possible.
- For 2-3 seconds this position should be maintained.
- Then come back to the standing position.
- Try to bend backward a little further while doing this movement each time.

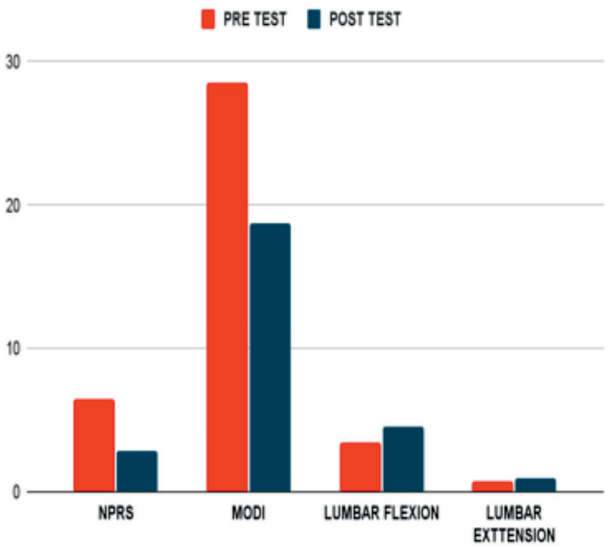
**Data Analysis**

Using tabular and inferential statistics, the gathered data was evaluated. The mean and standard deviation were utilized for all parameters. The statistically significant differences between pre-test and post-test measures were examined using a paired t-test. When utilizing the unpaired t-test to

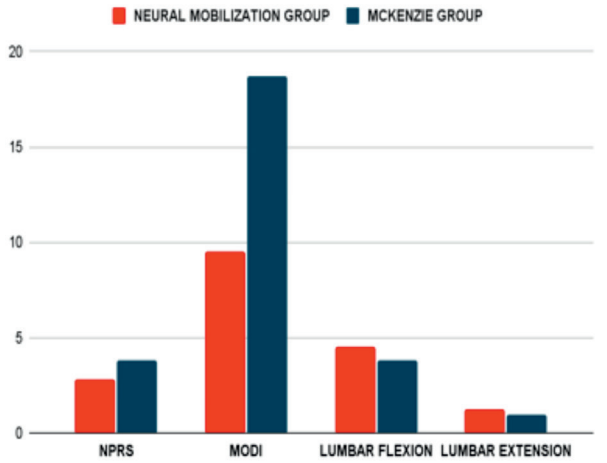
look at significant changes in the experimental group, the significance level of p 0.0001 was determined to be statistically significant.




**Graph - 1: Pre and Post test values of Neural mobilization group**




**Graph- 2: Pre and Post test values of Mckenzie group**




**Graph - 3: Post test values of Neural Mobilization group and Mckenzie group**

## Result

A statistical comparison of quantitative data between the McKenzie group and the Neural mobilisation group, as well as within the group showed a statistically significant difference.

The statically analysis of neural mobilization group pre test mean value of NPRS was 6.56 , while Post mean value was 2.78 .The MODI pre test mean value was 28.58 while Post test mean value was 9.63. Lumbar Flexion pre test mean value was 3.175 while Post mean value was 3.781. Pre test Mean value of lumbar extension was 0.691 and, while Post mean value was 1.244. This showed statistically significant in p-value of less than 0.0001

The statistical analysis of McKenzie group pre test mean value of NPRS was 6.47 while Post mean value was 2.81.The MODI pre test mean value was 28.56,While Post mean value was 18.72. Lumbar flexion pre test mean value was 3.469, while Post mean value was 4.503. Pre test Mean value of lumbar extension was 0.687 ,while Post mean value was 0.941.This showed statistically significant in p-value of less than 0.0001

The statistical analysis of NPRS Post test mean value of Neural mobilization group was 2.78,while Post test mean value of McKenzie group was 3.81.The MODI post test mean value of Neural mobilization group was 9.48 while post test mean value of McKenzie group was 18.72.The lumbar Flexion Post

test mean value of Neural mobilization group was 4.503 , while Post mean value of McKenzie group was 3.781.The lumbar extension post test mean value of Neural mobilization group was 1.244, while post test mean value of McKenzie group was 0.941.This showed statistically significant in p value of less than 0.001

## Discussion

This study compares the efficacy of neural mobilization and McKenzie and also assesses the effectiveness in terms of reducing pain and improving Mobility and functional ability. This comparison is recorded with a duration of 4 weeks. The pre and post test values were measured by NPRS scale, Schobers method and MODI before and after treatment. The main finding of the study is that the group which received neural mobilization showed a higher rate of decreasing pain and improving functional ability for the patients with Lumbar Radiculopathy than the group that received McKenzie exercise.

The effects of the McKenzie method and Mulligan mobilization in Lumbar disc prolapse with unilateral Lumbar radiculopathy were examined in Trupti Warude's (2012) study, which concludes that the given data shows the effectiveness of both manual therapy modalities, namely the McKenzie approach and Mulligan's mobilization (SNAGS) approach, in treating PIVD patients with unilateral radiculopathy in reducing pain improving lumbar spine mobility and functional ability.

Therefore, this study's data imply that Mulligan's Mobilization SNAGS is efficient when combined with baseline therapy[20].

It was believed that the neural mobilization therapies caused the nerve bed, or the tract made up of the components surrounding the nerve, to stretch, which resulted in nerve movement. Numerous studies support the hypothesis that extension of the nerve bed during neurodynamic tests is related to nerve gliding. Coppieters et al. (2009) claim that expanding of the nerve bed may also lead to the nerve elongating, resulting in an increase in tension and intraneural pressure.

According to the neural mobilization theory, changes in the nervous system's mechanics or physiology could lead to issues in other systems or with the musculoskeletal structures it innervates. By using the neural mobilization approach, the flexibility and range of motion of the nervous system[21].

While lumbar manipulation and neural mobilization both had an effect in reducing compression on the sciatic nerve root, whereas lumbar manipulation had superior outcomes . This may be the result of modification having a significant impact on disc bulge size, even if only slightly. It has been verified by (Bulbulian et al., 2002), who observed that despite substantial advancements in our understanding of the treatment of LBP, the precise mechanisms for LBP symptom reduction produced by spinal manipulation remain unknown. In a previous study where patient experienced significant pain relief and disc bulging was decreased to 14%, a series of clinical findings described additional potential pathways connected to successful treatment outcomes for LBP [22].

Straight leg raise (SLR) combined with lumbar spine mobilization and exercise was helpful in lowering temporary impairment according to Sahar M. Adel's investigation into the impact of lumbar spine mobilization and neural mobilization technique on sciatic pain and the degree of nerve root compression for chronic low back dysfunction (LBD) [23].

The result of the study, who performs neural mobilization shows reduction in pain, improving mobility and functional ability when it is compared to those who are all performing McKenzie approach.

## Conclusion

I According to the findings of this study, neural mobilization was found to be more beneficial than McKenzie technique in decreasing pain, increasing lumbar spine mobility and functional ability for peoples with lumbar radiculopathy. As a result, neural mobilization is suggested for the people with Lumbar radiculopathy in reducing pain and improving functional ability.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number:

03/044/2022/ISRB/SR/SCPT).

**Funding:** This study is a self-funded study

**Conflict of Interest:** Nil

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Original Article

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# Comparison of Joint Mobilization and Energy Conservation Technique in Rheumatoid Arthritis Patients in Hand Joints

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**Abstract**

**Background:** Rheumatoid arthritis is an auto-immune inflammatory condition that affects the hand, wrist,and knee joints.Joint mobilization is frequently used in RA patients. This study was to find the effectiveness of Joint mobilization and Energy conservation technique using range of motion measurement and Sollerman hand function test in hand joints.

**Purpose:** This study is to find the effect of Joint mobilization and Energy conservation technique which is a non-invasive procedure on Rheumatoid arthritis patients.

**Materials and Methods:** A group of 60 Rheumatoid arthritis patients were selected according to inclusion and exclusion criteria from Saveetha medical college and hospital and SAGA Rehabilitation centre.they were divided into Joint mobilization group: (n=30) the subjects were treated with Joint mobilization and taught exercises to gain strength and mobility for 3 days a week for 4 weeks for 15-30 minutes and Energy conservation group: (n=30) the subjects are taught pacing the activities, prescribing assistive devices, foam-covered handles, wide grip handles using large joints to lift objects, teaching Proper body mechanics and Ergonomic considerations to be followed for 4 weeks.Study period: November 2022 to April 2023.

**Result:** A statistically significant difference between Joint Mobilization and Energy conservation technique groups reveals that Joint mobilization has significant effects in lowering stiffness and pain and improving ROM of hand joints.

**Conclusion:** Joint mobilization worked more effectively than energy conservation techniques in RA patients.

**Keywords:** Rheumatoid Arthritis, Joint Mobilization, Energy conservation technique, ROM, Hand joints, Sollerman hand function test**.**

## Introduction

In Rheumatoid arthritis (RA), our immune system wrongly harms healthy cells in our bodies, leading to swelling in the areas of the body that are impacted. The joints of the knee, hand and wrist are frequently impacted by RA[1]. This tissue damage can lead to prolonged or persistent discomfort, shakiness, and

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deformity. Rheumatoid arthritis can also affect various tissues throughout the body, including those in the eyes, heart, lungs, and other organs. The most typical signs of Rheumatoid arthritis include pain, stiffness, tenderness and swelling in multiple joints, a warm feeling, fatigue, weight loss, deformities contractures, nodules, cysts, decreased energy, lack of appetite, and weakness. People who are aged over 60, and people who are born with Human leukocyte antigen (HLA) class II genotype can make it worse. Most women who had never given birth, smokers, and obese people are more likely to catch arthritis. It's safer to consult and diagnose rheumatoid arthritis earlier than 6 months. We can get diagnosed by physical assessment tests, X-ray, and lab tests by diagnosing HLA gene tests1. Drugs like methotrexate, leflunomide, hydroxychloroquine, and sulfasalazine are given as pharmacological interventions. Nonpharmacological interventions seem to be more effective and valuable these days, such treatments like psychological treatments like relaxation techniques and physiotherapy treatments such as hydrotherapy, splint therapy, hot pack, cryotherapy, massage therapy, acupuncture, yoga, and deep breathing can relieve pain in the joint area1. Joint mobilization instruction places a lot of emphasis on teaching students how to accomplish tasks like picking up goods with two hands, and distributing the weight of objects across the palm while avoiding rotating motions that press the fingers in an ulnar position. The balance between activity and relaxation is the basic way of energy saving. plan and organize the area, halt all activities or a portion of them, and cut back on the weight you put on your joints1. The efficacy of exercise programs for Rheumatoid arthritis for the whole body came to the conclusion that dynamic exercise improved muscular strength and endurance without having a negative impact on the disease's activity or discomfort[2]. Joint mobilization may properly reflect changes in the participant's ability to perform the strengthening exercises when their symptoms worsen[3]. A home strengthening exercise program was created using just hand weights and elastic bands to ensure accessibility for people with Rheumatoid arthritis and was proven to be clinically useful and cost-effective[4]. The management of Rheumatoid arthritis symptoms and deformities benefits from joint mobilization technique such as rest and splinting, employing compressive gloves, assistive technology, and adaptive equipment[5]. Manual therapy technique are frequently employed to regain mobility and lessen discomfort in the treatment of musculoskeletal diseases like rheumatoid arthritis[6]. Small intensity motions with traction are used in the three levels of mobilisation to release and counteract any compressive pressures on the joint[7]. Grade II soft joint mobilisation with oscillations avoids clenching of the muscle fibres surrounding the joint[8]. Moderate exercise causes noticeable changes in the blood levels of various indicators of joint metabolism following a night of rest[9]. The results of the Sollerman hand function exam, which evaluates practical skills in performing daily tasks and the quality of seven key hand grips, show a strong correlation with disabilities[10]. It is accurate and repeatable to use the test. Physiotherapists can utilize the test, which is straightforward and takes around 20 minutes to complete, to assess hand function[11]. If Maitland Mobilization manual oscillations might suppress nociceptive and/or sympathetic activity, we would anticipate a rise in PT after these types of manual oscillations[12].

## Aim

To compare the effectiveness of joint mobilization and Energy conservation technique using a range of motion measurement in hand joints.

## Materials and Methods

This was an experimental study conducted on Rheumatoid arthritis patients age between 30 to 75. The patients were selected using a convenient sampling technique with computer generated random methods, according to the inclusion and exclusion criteria from Saveetha Medical College and Hospital and SAGA rehabilitation center. The entire study procedure was conducted from November 2022 to April 2023.

**Inclusion Criteria:**

- Age: 30 to 75 yrs
- Subjects with grade I, II Rheumatoid Arthritis
- Morning Stiffness
- Swelling in soft tissues and Metacarpophalangeal joints and Interphalangeal joints

**Exclusion Criteria:**

- Subjects with grade III, IV Rheumatoid arthritis
- OA, Ankylosis Spondylolysis, Chronic kidney disease, Congenital-heart disease.
- Muscle diseases, malignancies, Unstable heart conditions, Diabetes Mellitus
- Recent fractures and injuries within 6 months
- Surgeries in Upper Limb.

**Outcome Measures**

Subjects were assessed using:

**ROM Measurement:**

A joint's range of motion is the total amount of movement it is capable of making in all directions. It's a frequent method of evaluation that is utilized to gauge the body's joint flexibility and mobility. It gives us accurate information about how much movement there is in a certain area of our body. It is measured in degrees. It is utilized for a variety of things, including functional evaluation, treatment planning, progress tracking, and baseline establishment.

**Sollerman Hand Function Test:**

The Sollerman hand function test is a technique for assessing the upper extremity and hand functional limitations. It is frequently used to evaluate hand function in patients with a range of illnesses, including neurological disorders, hand injuries, or musculoskeletal disorders. The Sollerman hand function test consists of a number of uniform activities that are intended to assess 5 main hand functions Grip and pinch strength, Gross motor coordination, Dexterity, Sensory function, and Fine motor function. It consists of 20 subtests to assess the hand function grading from 0 to 4. Each subtest is graded from 0 to 4. The total score for the test is 80. Normal scores for a hand function are 77 to 79[11].

**Procedure**

A group of 60 patients diagnosed with Rheumatoid arthritis were selected conveniently according to inclusion and exclusion criteria before the study began. The subjects were given a thorough explanation, and an informed consent form was obtained from them. The pre and post-test values were measured using range of motion (ROM) measurement and the Sollerman hand function test. The subjects were divided into the Joint mobilization group and the Energy conservation technique group, with 30 samples each.

**Joint mobilization group:**

The 30 subjects are taught joint mobilization and exercises for 3 days a week and it was continued for 4 weeks. For each session, the duration ranges from 15 to 30 minutes, Techniques such as gliding or sliding, traction, and oscillatory mobilization are given to the patients. Grade – I and II Maitland mobilization are used here. With mobilization, exercises are given to the patients.

- **Active ROM Exercises** - Flexion, Extension, Abduction, Adduction of fingers, and Circling of wrist.
- **Strengthening Exercises** - Grip strength can be increased by training with rubber bands, a hand grip exerciser, and a sponge ball.
- **Dexterity Exercises** - Stretching, Drawing, Writing, Buttoning, and Unbuttoning the Shirt Buttons.

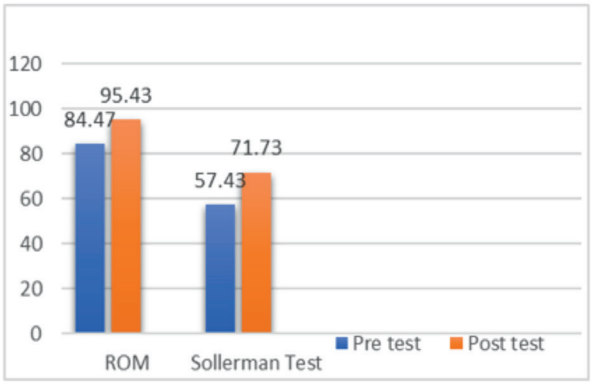
**Energy conservation group:**

The 30 subjects were taught energy conservation techniques to reduce fatigue and overexertion of joints. These lifestyle modifications intend to optimize daily functioning followed for 4 weeks. The energy conservation technique are mentioned below:

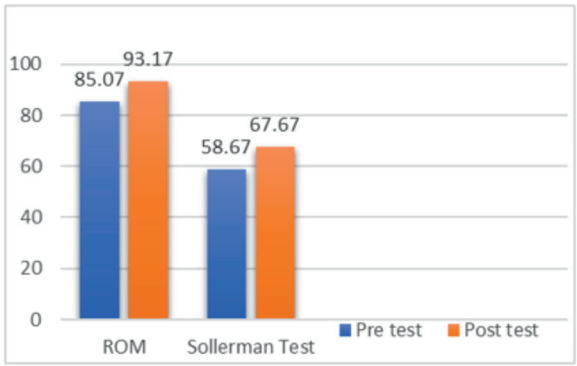
- **Prioritizing and Planning:** Planning your daily activities by making schedules and larger tasks into smaller tasks.
- **Time Management:** Pacing ourselves by taking regular breaks to prevent fatigue at your joints.
- **Joint Protection:** Using proper body mechanics. e.g.: using large joints to lift weights instead of your hands.
- **Assistive devices:** Usage of assistive devices reduces energy expenditure. e.g.: Foam Handlers, Jar Openers, Long-handled tools, and Reachers.
- **Task Modifications:** Avoiding repetitive activities and giving breaks between tasks.
- **Energy Saving Technique:** Using Gravity has an advantage while doing an activity.

- **Ergonomic Modifications:**Environmental and ergonomic changes are a must in energy conservation in RA patients. e.g.: desktop modifications, mouse devices, adjustable chairs, shelves, and doors should be set up with long handles.

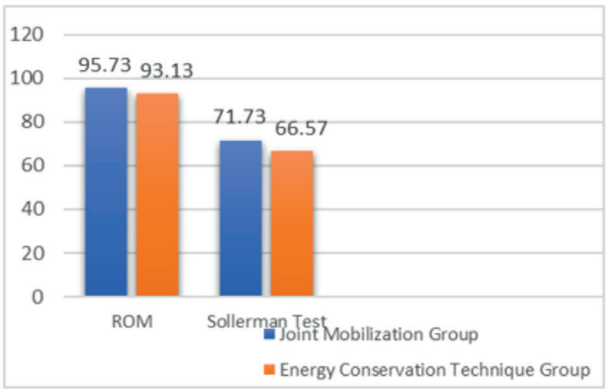
**Data Analysis**




**Graph-1 Pre-test and Post-test values of the Joint Mobilization group**




**Graph-2 Pre-test and Post-test values of Energy conservation technique group**




**Graph-3: Post-test values of Joint mobilization and Energy conservation technique group**

## Results

- Statistical analysis of quantitative data showed statistically significant differences between Joint mobilization and Energy conservation technique groups.
- The Joint mobilization group mean values for ROM measurement and the Sollerman test were 95.43(2.58) and 71.73(3.94) whereas for the Energy conservation technique 93.17(2.88) and 67.67(3.83)
- The significance level of $p<0.0001$ was judged statistically using the unpaired t-test.
- This suggests that Joint mobilization in Rheumatoid arthritis patients with stiffness and reduced ROM was more effective than the Energy conservation technique.

## Discussion

The prevalence rate of rheumatoid arthritis, which affects persons of working age and has no known cure, is 01/81. Increases with age, reaching a maximum of 5% after the age of 55. In 80–90% of Rheumatoid arthritis patients, the hands and wrists are thought to be impacted. The articular ligaments may be damaged, cartilage and subchondral bone may erode, and pannus may invade the joint as a result of the synovitis associated with Rheumatoid arthritis. It is mostly due to the molecules from the HA-rich synovial fluid cavities entering the circulation.[9] While there is emerging evidence that manual mobilization is effective for treating musculoskeletal disorders such as shoulder and elbow discomfort, research on hand and wrist mobilization is still in its infancy.

This study compares the efficacy of joint mobilization and energy conservation techniques in people with rheumatoid arthritis and evaluates the efficiency of the suggested therapies in promoting mobility and reducing stiffness. ROM is taken as an Outcome measure which is measured using a goniometer. The Beneficial effect of the treatment was significantly greater in Joint mobilization than in the Energy conservation technique. In the Joint mobilization group pre-intervention mean of ROM was 84.47(3.22) and the Sollerman test was 57.43(4.96). After treating the subject with Joint Mobilization and exercises, the mean value increased to 95.43(2.58)

and the Sollerman test was 71.73(3.94) which shows a statistically significant difference between the tests. In the Energy Conservation Technique group, the pre-intervention mean of ROM Measurement was 85.07(3.15) and the Sollerman test was 58.67(5.36). After treating the subject with Energy Conservation Technique, the mean value of ROM Measurement was 93.17(2.88) and the Sollerman test was 67.67(3.83) which shows a statistically significant difference between the groups. This indicates that the Joint Mobilization group ROM Measurement and the Sollerman test were significantly higher than the Energy conservation technique group, with a P value of < 0.0001. As a result, the Joint Mobilization Group exceeds the Energy conservation technique group statistically.

Based on the Statistical Analysis both Groups showed improvement in ROM Measurement and Sollerman test. However, the group who have received Joint Mobilization showed better results in ROM Measurement and Sollerman test than the Joint Conservation Technique Group. An early study by Daniel-Henri Manicourt, Pascal Poilvache, et al., stated that after a night of rest, this study offers compelling evidence that moderate physical exercise causes noticeable changes in the serum levels of various indicators of joint metabolism. Measurement of these variations offers information about altered joint metabolism that is obviously significantly different from information received by monitoring the levels of the changes at a single time point [9].

An early study by Adrian Levitsky, PhD, a,b Yogan Kisten, MTech, a,b, et al., concluded that Most RA comparison patients had sustained, significant decreases in fatigue. This study shows that patients with rheumatoid arthritis have significant pain reduction in the MCP joint over a period of 2 months which concluded that statistical analysis of the significant difference in p-value is < 0.050[8].

An early study by A. V. O'Brien, P. Jones, et.al, concluded that hand strengthening exercises may be helpful in the treatment of RA. The hand function of the RA patient is of the highest importance, and this study adds to the body of knowledge to help the therapist in management regimens. This study analysed the unpaired-t test which statistically shows a significant difference in upper limb function between the strengthening and stretching groups and the energy conservation group, p value = 0.0002[10].

## Conclusion

Nowadays there are Advanced technologies, new generation DMARDS, and new manual techniques to treat Rheumatoid Arthritis. The experimental study which is done on Rheumatoid Arthritis Patients gives Evidence that Joint mobilization with exercises works effectively on Rheumatoid arthritis patients.

**Ethical Clearance:** Taken from the institutional ethical committee. ISRB number-03/060/2022/ ISRB/SR/SCPT

**Funding:** Self.

**Conflict of Interest:** Nil.

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Original Article

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# Comparison of Effectiveness of Maitland Mobilization and Muscle Energy Technique in Patients with Periarthritis Shoulder Using SPADI and NPRS

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**Abstract**

**Background:** Periarthritis shoulder is a shoulder ailment with no recognised cause. It gradually causes the shoulder's range of motion to be restricted. Between 2% and 3% of the general population suffer from adhesive shoulder capsulitis, which most frequently develops between the ages of 40-65 years. The region gradually thickens, leading to shoulder stiffness and increase in pain.

**Purpose:** To compare the effectiveness of Maitland mobilization and Muscle energy technique in patients with periarthritis shoulder using SPADI and NPRS.

**Materials and Methods:** Subjects were randomly allocated into two groups. Maitland mobilization group (n = 33) and Muscle Energy Technique group (n = 33). The subjects were assessed using SPADI and NPRS for pre and post-test values. The one group treated with Maitland mobilization (grade 1 and 2) were given to the patients along with some exercises. The other group were treated with muscle energy technique along with some exercises. These interventions were given for 4 weeks.The entire process was conducted from November 2022 to April 2023.

**Result:** There was a significant improvement from pre-treatment levels in pain and ROM in Maitland mobilization group compared to muscle energy group.

**Conclusion:** Hence the study concludes that there is a more significant increase in ROM and SPADI score, and a significant decrease in pain on NPRS by Maitland mobilization as compared with Muscle energy technique.

**Key Words:** Periarthritis shoulder, Maitland mobilization, Muscle energy technique, SPADI, NPRS

## Introduction

The shoulder is a multi-planar anatomical joint that allows for complicated movement. Exactly what drives this complex's dynamic force and stability is regulated muscle movement.[1] Periarthritis shoulder is a shoulder ailment with no recognised cause. The sneaky, excruciating illness known as "frozen shoulder" is adhesive capsulitis that gradually causes the shoulder's range of motion to be restricted. This results in impairment.[2] Frozen shoulder, pericapsulitis, scapulo-humeral periarthritis, humeroscapular fibrositis, and adhesive capsulitis are a few synonyms for periarthritis shoulder, along with

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stiff and painful shoulders. Between 2% and 3% of the general population suffer from adhesive shoulder capsulitis, which most frequently develops between the ages of 40-65 years.[3] Diabetes, thyroid issues, previous shoulder injuries, cervical radiculopathy, postoperative immobility, and other conditions are risk factors for frozen shoulder operation. Research indicates that the method began with an irritation of the joint's inside lining. This region gradually thickens, leading to the shoulder stiffness and pain increasing.[4-5] This causes the onset of severe shoulder discomfort that prevents successful activity, substantial restrictions of movements, significant night pain, and of everyday living to a loss of 50% or more and less than 100% uncomfortable end range of motion.[6] The traditional methods of treating adhesive capsulitis are exercises, electrotherapy, and massage are just a few of the various modalities that can be used concurrently to treat capsulitis through physical therapy.[7-11]

Types:

Stage 1: Primary adhesive capsulitis, also known as idiopathic adhesive capsulitis, is an inflammatory condition with no known cause.

Stage 2: Traumatic injuries that cause secondary adhesive capsulitis capsulitis or if another health issue is both present.

Stage 3: Also known as the thawing stage, starts when ROM starts to improve, is characterized by a gradual restoration of shoulder mobility with minimal pain.[12]

A self-administered questionnaire called the Shoulder Pain and Disability Index (SPADI) has two dimensions: one measures pain and the other measures functional ability and activities. There are five questions in the pain dimension about the degree of a person's agony. Eight questions are used in the functional activity assessment to gauge how difficult a person finds certain functional activities. Various daily tasks involving the use of the upper extremities. For a test, the SPADI takes 5 to 10 minutes. The only trustworthy and valid method that takes time to complete the shoulder measurement for the region.[13] NPRS (Numerical Pain Rating Scale) which can be used in questionnaires. An NPRS is defined as an 11-point scale with scores ranging from 0 to 10, with 0 denoting no pain and 10 denoting the worst possible pain.[14]

The Maitland concept is a method for examining, diagnosing, and treating neuromusculoskeletal disorders with manipulative physical therapy.[15] The cyclical alterations will be made in the joint's modest spinning, gliding, and other supplementary motions between joints, such as rolling or distracting movements. In order to move around normally, surfaces are necessary.[16] In contrast to grade 3 and 4, grade 1 and 2 of Maitland mobilization techniques are generally utilized to treat joints that are painfully constrained stretching technique.[17] The MET are a subset of soft-tissue or joint mobilizations that were developed to treat the malfunctioning of the muscles and bones. The benefit of MET is that it uses the patient's energy (in the sort of physical exertion) to produce a therapeutic result.[18]

One of this technique's primary applications is to restore normal joint range, not expand methods are adaptable and may be used to any disability in any range of motion in joints (ROM) identified through the passive evaluation. There are two basic MET impacts that can be explained in different physiological functions: Post Isometric, Reciprocal inhibition (PRI) and relaxation (RI).[19] According to reports, the cases with chronic adhesive capsulitis react effectively to therapeutic massage using the (MET), resulting in pain reductions and improvements in range of motion.[20] Therefore, efficient therapy that reduces the length of symptoms and incapacity may be of great benefit in terms of decreased morbidity and costs.[21]

This study's primary objective is to assess the effects of Maitland mobilisation and muscular energy method (MET) in patients with periarthritis shoulder, notably in terms of pain relief and range of motion (ROM) improvement.

## Aim

To evaluate the effectiveness of Maitland mobilisation and muscle energy approach in patients with periarthritis shoulders utilising SPADI and NPRS.

## Material and Method

The Sri Dhanalakshmi Physiotherapy and Rehabilitation Centre provided a total of 66 subjects

with shoulder periarthritis, aged 35 to 65. In this investigation, convenient sampling with random assignment was used. The entire study process was conducted from November 2022 to April 2023.

**Inclusion Criteria**

- Subjects within the age group of 35-65 years.
- Both genders were included.
- Subjects having stiff painful shoulders for at least 2 months duration.
- Patients who show restriction of movements.
- Patients with diabetes mellitus.
- Diagnosis of stage I and II periarthritis shoulder or frozen shoulder.

**Exclusion Criteria**

- Post fracture complications.
- Presence of any neurological disorders or deficits.
- Uncontrolled diabetes.
- Thoracic outlet syndrome.
- Peripheral nerve injury.
- Concurrent cervical signs and symptoms.
- History of any trauma or surgery.
- Patients with steroid therapy or under the history of multiple steroid injections ( > 2 injections).

**Outcome Measures**

- Assessment was performed before starting and after the treatment.
- Shoulder Pain and Disability Index (SPADI).
- Numerical Pain Rating Scale (NPRS).

**Procedure**

Inclusion and exclusion criteria were used to choose the participants. Patients received thorough explanations of the treatment process, and each gave their agreement after being given all the information necessary. According to the assessment form, evaluations of all the included patients were conducted. The patients were split into the "Maitland mobilisation group" and the "Muscle Energy Technique group" at random. Prior to and four weeks following the start of the treatment, assessments were done.

**Maitland Mobilization Group:**

**Treatment Given:**

- Moist pack for 15 minutes.
- Ultrasound – 5 minutes.
- Maitland mobilization : Patients were given Maitland mobilization grade 1 and 2.
- Dose: 2 to 3 glides, 2 sets of 5 repetitions, 3 sessions per week for 4 weeks.
- The patient's position was in supine lying.

**Flexion Range:**

Procedure: The humerus was glided posteriorly.

**Abduction Range:**

Procedure: The web space of the hand was grasped and the humerus was glided inferiorly.

**External Rotation:**

Procedure: The humerus was glided anteriorly.

**Home Exercise:**

- Active shoulder movements.
- Stretching exercises.
- Codman's pendular exercise.
- Finger ladder.

**Muscle Energy Technique (MET) group:**

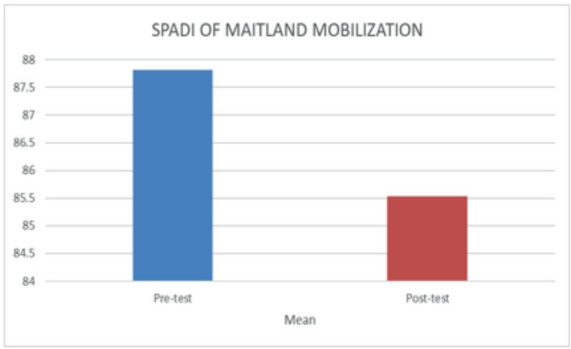
**Treatment Given:**

- Moist pack - 15 minutes.
- Ultrasound – 5 minutes.
- Muscle energy technique (MET): Exercises for Muscle Energy [Post Isometric Relaxation (PIR)] the individual is instructed to attempt a vigorous contraction against resistance at the limit of the range of motion where there will be no joint movement. The individual is then instructed to release the muscle (PIR). 3-4 contraction with 5-7 seconds hold of each contraction for 3 repetitions.
- Dose: 2 sets of 3 repetitions, 3 sessions per week for 4 weeks and with the duration of 8- 10 minutes.

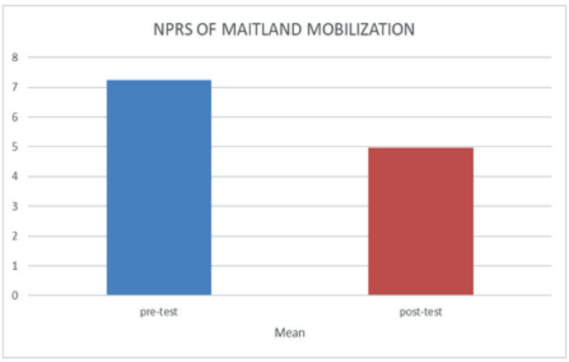
**Home Exercises:**

- Active shoulder movements.
- Codman's pendular exercise.
- Finger ladder.
- Towel exercises.

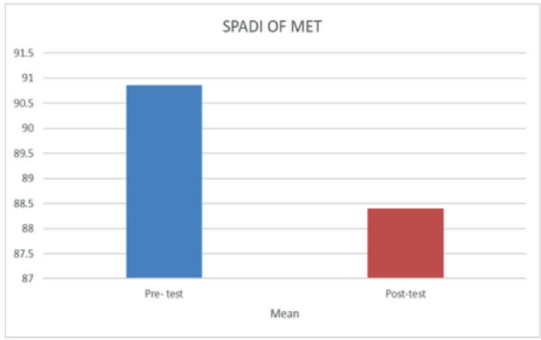
## Data Analysis



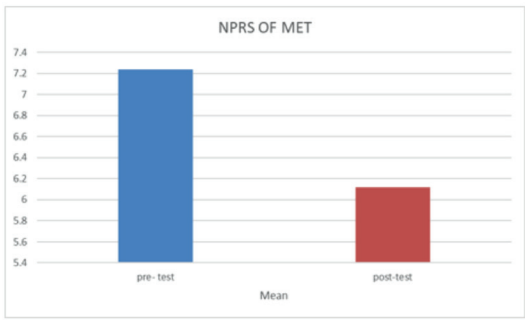

**Graph- 1: Pre and Post-test values of SPADI of Maitland Mobilization Group**



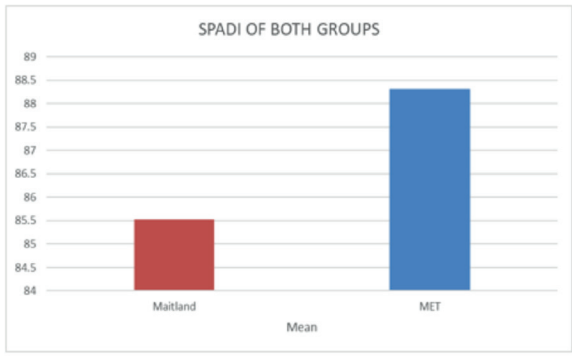

**Graph- 2: Pre and Post-test values of NPRS of Maitland Mobilization Group**



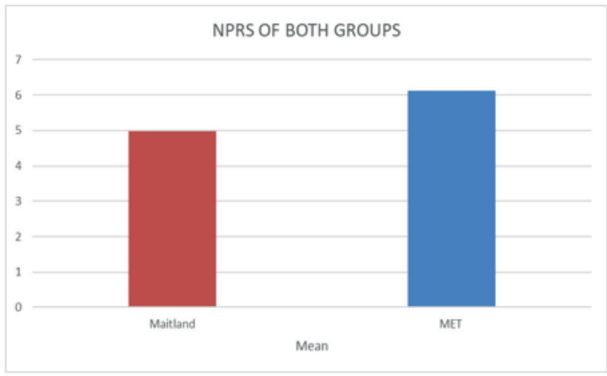

**Graph- 3: Pre and Post-test values of SPADI of Muscle Energy Group**




**Graph- 4: Pre and Post-test values of NPRS of Muscle Energy Technique Group**




**Graph- 5: Post-test values of SPADI of both the Groups**




**Graph-6: Post test values of NPRS of both the Groups**

## Result

The statistical examination of quantitative data revealed a statistically significant difference between the MET group and the Maitland mobilization group as well as within the group.

Using SPADI, the Maitland mobilization post-test mean was 85.524, whereas the muscle energy group post-test mean was 88.315, with a P value < 0.0001.

Using NPRS, the Maitland mobilization group post-test mean was 4.97, whereas the muscle energy group post-test mean was 6.12, with a P value < 0.0001.

This demonstrates that the Maitland mobilization group received a higher score than the muscle energy technique group. And this study suggests that the Maitland mobilization is considerably more effective than the MET in patients with periarthritis shoulder.

## Discussion

This study examined the effects of Maitland mobilization and Muscle energy technique in patients with periarthritis shoulder using SPADI and NPRS. The intervention lasted for four weeks, and the 66 subjects with periarthritis shoulder were divided into two groups (n=33). I have given these techniques along with ultrasound and combined with exercises. There was a greater effect in the Maitland mobilization group than the muscle energy technique group. The P value for both the groups were less than 0.0001, which leads to the conclusion that the Maitland mobilization technique is more effective in reducing pain and increasing the range of motion (ROM) than MET.

An early study by Shikha Tiwari et al., stated that 50 subjects with the age group of 35-70 years, were included in that study. One group received the muscle energy technique whereas the other group received Maitland mobilization. SPADI and ROM were taken as the outcome measure. The study was conducted for 4 weeks. According to the analysis the (p= 0.00), this shows that there is a significant improvement in the Muscle energy technique group than the Maitland mobilization group.[1] Abhay Kumar et al. reported in a previous study that Maitland techniques were beneficial in treating idiopathic shoulder adhesive capsulitis. There were 40 people with idiopathic shoulder adhesive capsulitis, ranging in age from 40 to 60. Exercises under supervision and Maitland's mobilisation methods were used to treat the one group. The other group received standard therapeutic exercises under supervision. The P value was (p=0.005), indicating that mobilisation in conjunction with a programme of supervised exercise is helpful in lowering pain and enhancing ROM and function.[6] A total of 30 volunteers were chosen and split into two groups of 15 each, according to a previous study by Samiksha Sathe et al. The 15-day study was carried out. The outcome measures used were VAS, NPRS, and ROM. The P value is less than 0.0001 according to the statistical analysis. According to this study, Maitland mobilisation treatment combined with conventional therapy, as opposed to conventional therapy alone, significantly improves ROM and SPADI and decreases pain on the NPRS.[22] A total of 40 subjects, 20 in each group were used in an early investigation by Abdullah Al Shehri et al. One group had Maitland mobilisation coupled with exercises, and another group received ultrasonography along with exercises for a period of four weeks. As a result, the VAS score for the Maitland mobilisation group improved more (4.21 points) than it did for the Ultrasound group (2.5 points). The findings indicate that the Maitland group outperformed the ultrasound group in terms of performance.[23]

Overall, this was an experimental study assessing the effects of Maitland mobilization and MET among periarthritis shoulder patients

## Conclusion

This study concludes that Maitland mobilization and Muscle energy technique both are effective in the treatment of periarthritis shoulder. But Maitland mobilization is more effective in improving range of motion (ROM) than the MET. Therefore, MET's therapeutic use of the antagonists can help when acute or chronic pain makes it difficult to control the contraction of the affected muscles. Maitland mobilization can be used to increase range of motion (ROM) as well as to reduce pain.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number-03/ 046/ 2022/ ISRB/ SR/ SCPT).

**Funding:** Self.

**Conflict of Interest:** Nil.

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Original Article

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# Effect of Kapalabhati, Sithali, Seethakari Pranayama and Yogic Postures On Polycystic Ovarian Syndrome

**Mythri Jain[1], Senthilkumar. S [2], S. R. Karthika[3], Prathap Suganthirababu[4], Jagatheesan Alagesan[5]**

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**Abstract**

**Background:** Polycystic ovarian syndrome is an endocrine disorder distinguished by hormonal imbalances, ovarian dysfunction, and metabolic disturbances. The incidence of PCOS varies greatly in India, from 2.2% to 26%.[14]

**Purpose:** To find out the effect of Kapalabhati, Sithali, seethakari pranayama and yogic postures inPoly- cystic Ovarian Syndrome

**Materials and Methods:** A total number 50 were selected from Jain Hospitals and labs based on inclusion criteria and were divided. Yoga group: Kapalabhati pranayama – 3 rounds with 5 forceful expirations Sithali pranayama – 5 breaths Seethakari pranayama - 5 breaths, Suryanamaskar – 6 rounds Bhujangasana, supta baddha konasana, dhanurasana, badhakonasana, and Nauvasana all hold for 15 – 30 s and dietary changes low fat food, less carbohydrates and high protein and meditation for 10 minutes. Conventional group: Conservative management including exercise including treadmill, steps climbing and cycling. Total session flows for an hour. Both groups were compared with the pre- and post-test measurements

**Results:** The study shows a significant effect on Polycystic Ovarian syndrome using yoga intervention

**Conclusion:** Yoga intervention can be used effectively on Polycystic ovarian syndrome for long term benefits

**Keywords:** Yoga, Polycystic ovarian syndrome, Kapalabhati pranayama

## Introduction

Hormonal abnormalities, irregular menstrual periods, and the appearance of tiny cysts in the ovaries are its defining characteristics. Infertility, hirsutism (excessive hair growth), acne, and metabolic abnormalities like insulin resistance and obesity are just a few of the signs and complications that can result from PCOS.[1] The objective of PCOS management is to encourage general health and quality of living while reducing symptoms and re-establishing hormonal balance. The recent advances and industrializations have brought a great impact on the lifestyle changes of the human population[2]. These changes have shown a greater distress and impact on the health spectrum of the individuals. In this drastic revolution

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and pollution the health of the women have been highly affected causing various physical, mental and reproductive problems. The recent changes have certainly changed the natural rhythm of the human reproduction system especially the women's health as they are facing the broad spectrum of the health conditions like the metabolic disorders, reproductive issues, such as irregular menstruation and ovarian growth, miscarriage, fertility issues, cysts, irritation, amenorrhea and poly cystic ovaries.[1 - 4]

The American Society for Reproductive Medicine (ASRM) and the European Society of Human Reproduction and Embryology (ESHRE) have reached a new understanding regarding the definition of polycystic ovarian syndrome. The current definition of PCOS is "The clinical presence of any of the three criteria that includes i) polycystic ovaries ii) Oligo-/anovulation iii) evidence of hyperandrogenism. This adapted definition helps in the diagnosis and clinical assessment of the condition.[2,3] While traditional PCOS treatments including hormonal contraception and drugs to control menstrual cycles and manage symptoms are frequently employed, interest in alternative and complementary therapy is rising. Yoga has drawn interest as a possible therapeutic intervention for PCOS because it combines physical postures, breath control, and meditation. Numerous yoga techniques, such as Kapalabhati, Sithali, Seethakari Pranayama, and particular yogic postures, have been theorised to have positive impacts on hormone control, stress reduction, and general wellbeing.[5-7]

The potential advantages of yoga in addressing some of the underlying causes of PCOS served as the foundation for this study's justification. According to studies, yoga can help you manage your stress better, encourage relaxation, and improve your overall physical and mental health. Chronic stress and psychological issues can worsen symptoms and hormonal abnormalities, and they have been linked to the pathophysiology of PCOS8. Yoga practises may therefore offer a holistic approach to PCOS care that addresses both the physical and psychological elements of the disorder.[9] Additionally, it has been proposed that yoga practices are beneficial for metabolic parameters including insulin sensitivity and weight control, which are frequently impacted by PCOS. Yoga may support lifestyle changes that are crucial in the management of PCOS by encouraging physical exercise, enhancing body awareness, and developing mindfulness. Yoga has been suggested as a viable supplementary therapy for PCOS, with the potential to reduce symptoms, regain hormonal balance, and enhance general health and quality of life.[10]

## Aim

To find out the effect of Kapalabhati, Sithali, seethakari pranayama and yogic postures in Polycystic Ovarian Syndrome.

## Material and Method

Subjects: Polycystic ovarian syndrome patients aged between 18 to 25 Sampling technique: convenient sampling Sample size: 50 samples Study period: October 2022 to June 2023.

**Inclusion criteria**

- Female population between the age of 18- 25
- PCOS condition diagnosed on the basis of Rotterdam criteria. (Oligo-anovulation, hyperandrogenism, and polycystic ovaries (at least one ovary with at least 12 follicles measuring 2 to 9 mm in diameter and/or an ovarian volume more than 10 mL). Females with post-delivery PCOS complications were also included
- Female who have attained the menarche for more than a year were included

**Exclusion criteria**

- Females with thyroid, pelvic floor dysfunction. Uterine fibroids, pelvic inflammatory disease were excluded, i.e differential diagnosis of PCOS
- Subjects with h/o heart and lung diseases and surgery were excluded
- Subjects with any h/o chronic disorders like osteoarthritis and rheumatoid arthritis were excluded.
- Post pregnancy females and females who are planning family were excluded

**Outcome Measures**

Ultrasound imaging of uterus

## Procedure

The study took place in a private hospital, Madurai and the study was explained to the female population and the interested candidates were given a questionnaire to be filled for identifying the population with the condition of PCOS and scrutinized the candidates as per the inclusion and exclusion criteria. The suitable and interested candidates were scrutinized and the consent form for the study was sent. Once the consent is finalised, the individuals were split into two groups, each of which included.

**1. Yoga group**:

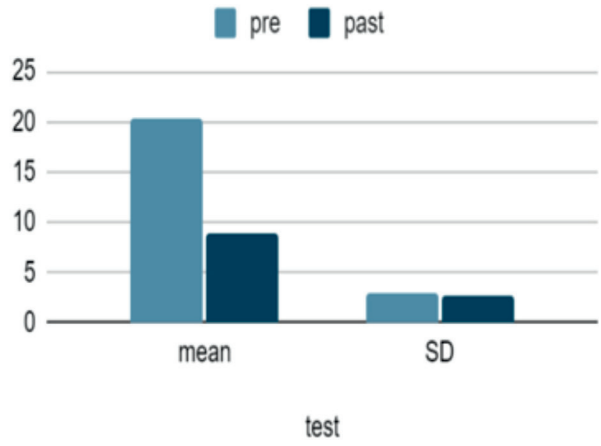
Kapalabhati pranayama – 3 rounds with 5 forceful expirations Sithali pranayama – 5 breaths (Inspiration with mouth with folded tongue, hold – 2s and expiration 8 s with nose) Seethakari pranayama - 5 breaths (Inspiration with clenched teeth, hold – 2s and expiration 8 s with nose) Suryanamaskar – 6 rounds Bhujangasana, supta baddha konasana, dhanurasana, badhakonasana, and Nauvasana all hold for 15 – 30 s and dietary changes low fat food, less carbohydrates and high protein and meditation for 10 minutes. Total session flows for an hour.

**2. Conventional group:**

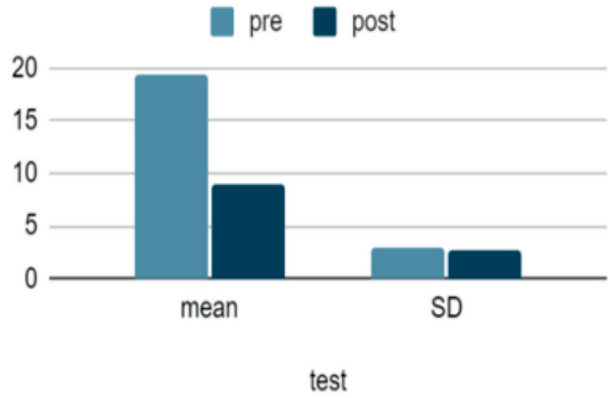
Conservative management includes a diet with low fat food, less carbohydrates and high protein and exercise including treadmill, steps climbing and cycling. Total session flows for an hour.

Both groups were compared with the pre-test and post-test measurements that were taken before and after the intervention. The intervention was given for three months and then the post- test values were taken. The outcome measurements were calculated.

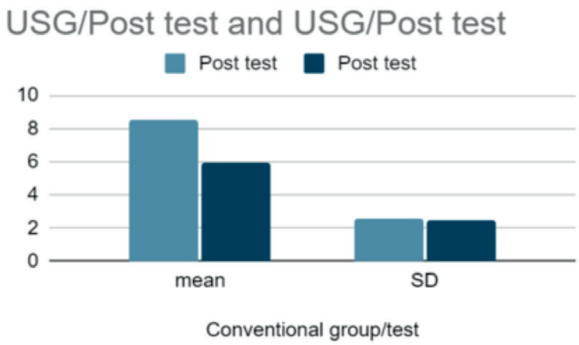
**Data Analysis**




**Graph-1: pre test and post test values of yoga group**




**Graph-2: pre test and post test values of conventional group.**




**Graph-3: post -test values of both group.**

## Result

A total of 92 female population were filled out the google form in this study. The participants age from 18 to 25 years, approximately 12(11.04%) of the population were 18 to 19 and 50 (46%) were between the ages of 20 to 22 and 30 (27.6%) between 23 to 29. Over half of the participants 12 (11.04 %) have normal BMI, while 22(20.24%), 44 (40.48%) were underweight and overweight respectively, additionally 14 members of 12.88% were obese. So, statistical analysis of the quantitative data indicated statistically significant differences in both groups by measuring the diameter of the ovarian follicles. The experimental group's pre-test and post-test results demonstrate that the pre-test value 20.2 of were decreased 8.88 to in post-test with a p value of 0.0001 (graph1). (graph2) shows that the pre and post-test value for conventional group, the pre-test value of 19.6 is reduced into 8.88 with a p value of 0.0001. compare the conventional and experimental group of post-tests,(graph 3) showing the value is 8.96 reduced into 5.86 and As the result, said that they are statistically significant with a p value of 0.0001

## Discussion

Ragini shrivastava et al (2022): suggests that yoga and lifestyle modification must be the first line interventions for the PCOS as these are the interventions without side effects. It also concludes that there are various advantages of combining yoga with various therapies in the management of PCOS. It also suggest the integrated approach towards lifestyle modifications helps in aiding the condition of PCOS. [11] Maryam mohseni et al in 2021 stated that yoga exercises are recommended to control PCOS incorporated with the symptom of infertility caused in the women.[12]

Kalpana sharma et al in 2020 concluded that early lifestyle modifications reduce the risks of PCOS and its symptoms. It talks about the possible advantages of yoga as a management technique for PCOS[13]. Deepshikha Thakur et al in 2021 in her study concluded that yoga is very beneficial and effective management for PCOS.[1]

The study here compares the effectiveness of the yoga therapy and conservative management. The result of this study proves that the lifestyle modifications helps to improve the PCOS symptoms. The results of Yoga group have proved that yoga can be taken as a therapy for improved benefits and better option for lifestyle modification.

## Conclusion

The research on the effects of Kapalabhati, Sithali, Seethakari Pranayama, and Yogic Postures on Polycystic Ovarian Syndrome (PCOS) provides valuable insights into the potential benefits of yoga practices as alternative or adjunctive therapies for PCOS management. Yoga practices and conservative treatments commonly used in PCOS management provide insight into the potential benefits of incorporating yoga as a complementary therapy.

**Ethical Clearance:** Taken from the institutional ethical committee. ISRB number - 03/047/2022/ ISRB/SR/SCPT

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**Conflict of Interest:** Nil

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Original Article

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# Comparison of Effectiveness of Interferential Therapy and Transcutaneous Electrical Nerve Stimulation in Construction Workers having Cervical Spondylosis Using McGill Pain Questionnaire

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**Abstract**

**Background:** Degeneration can occur as a result of moisture loss and decreased flexibility in the neck's spinal discs over time. Cervical spondylosis can also be brought in addition to recurrent neck motions, prior neck injuries, bad posture, and genetic factors and by poor posture.

**Purpose:** The study objective was comparison of the efficiency of interferential therapy and transcutaneous electrical nerve stimulation in construction workers having cervical spondylosis using the short form of the MC Gill pain questionnaire.

**Methodology:** 50 subjects participated in the study from Mars India Builds and selected based on the inclusion and exclusion criteria. Subjects assigned into interferential therapy group (n=25) and transcutaneous electrical nerve stimulation group (n=25). Along with this, static neck exercises were given to both groups. The treatment period was given for 40 mins and 6 days per week and continued for 2 weeks. The entire study process is conducted from November 2022 to April 2023.

**Result:** From the finding of this study interferential therapy group post-test mean was 8.88 and whereas the transcutaneous electrical nerve stimulation group was 11.72. This strongly suggests that interferential therapy in construction workers having cervical spondylosis along with static neck exercises is more effective than transcutaneous electrical nerve stimulation.

**Conclusion:** In this study interferential therapy with static neck exercises among construction workers was found to be more effective than transcutaneous electrical nerve stimulation.

**Keywords:** Cervical spondylosis, construction worker, IFT, TENS, static neck exercise.

## Introduction

Degenerative disc leads to cervical spondylosis, which frequently results in random neck pain. Activities should be changed, the neck should be immobilized, modalities can be given should typically help this pain. Rarely, patients who have congenital spinal stenosis will experience neurologic symptoms. Consultation with a neurologist is indicated to rule out

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other neurologic illnesses because of the involvement of neurologic structures. Surgery is typically not recommended for spondylotic radiculopathy until the pain persists or there is a growing neurologic deficit because the results of conservative treatment are typically so good[1-2].

The movements of the neck muscles were strongly impacted by the weight being elevated as well as the posture of the neck. The neck muscles were much more engaged when the weight was heavier[3-4].

In cervical spondylosis, it is a major symptom. In some cases, certain body positions may be linked to the vertigo. Such as changing positions from a seated to a standing position, from a supine to a left or right lateral, or from a sitting position to an upright one. It is also occasionally noticed while moving the head or neck to any side[5].

Spondylosis usually impacts people with no symptoms. Neck discomfort, cervical radiculopathy, and/or cervical myelopathy are the three symptoms most frequently experienced by patients who are symptomatic and are typically older than 40 years old. A clear precipitating event is frequently absent, and the neck pain might be short-term or chronic[6-7].

Lifting big objects is necessary for many construction work tasks. Traditional mortar or grout mixing includes lifting massive cement bags. 80–100 pounds are the approximate weight of full cement bags. Concrete blocks must be raised to shoulder level or higher during routine masonry works. The weight of 0.2 x 0.2 x 0.4 m standard-weight concrete blocks is around 16.3 kg. The lifting, holding, and carrying of large structures is a necessity for these and many other construction-related tasks[8].

Since lifting weights and maintaining awkward positions require maintaining muscle force for a prolonged amount of time, these are the two risk factors for WMSDs that are most essential to consider. Worker pain and muscle ache are obviously brought on by extended, repetitive lifting jobs, which also inevitably raises the risk of WMSDs.

Although appropriate lifting positions (such as stooping and squatting) have been widely suggested by prior studies, it is still unknown how these postures affect the biomechanics of the spine. Major factors affecting a construction worker's capacity to perform their job and contributing to an elevated proportion of occupational impairment are musculoskeletal conditions and external causes[9-10].

When two medium-frequency currents [1–10 kHz] interfere, it combines to produce a low frequency [1 kHz], which is the essence of interferential therapy. Utilizing either a bipolar or quadripolar application, interference therapy is delivered transcutaneously using electrode pads[11].

Transcutaneous electrical nerve stimulation seems to lessen the duration and intensity of cervical pain, both acute and chronic, particularly within the near future[12].

Exercises that strengthen weak muscles by isometric contractions (static exercises) are more agreeable to patients since they don't irritate joints, ligaments, tendons, or other pain-sensitive tissues. They can also be performed anywhere without any equipment because of their elegance and effectiveness. Patients can commit to the program well because isometric neck exercises are simple, simple to do, and convenient[13-14].

The short form of the McGill Pain Questionnaire (SF-MPQ) has a condensed form. The SF-MPQ's major component is made up of 15 descriptors, 11 of which are sensory and 4 of which are affective, and which on a scale of 0 to 3 depending on their seriousness. Three pain scores are generated by adding the intensity rank scores of the terms selected to reflect the sensory, affective, and overall descriptions. A visual analog scale (VAS) is included in the SF-MPQ in addition to the Present Pain Intensity (PPI) index from the conventional MPQ[15].

## Aim

To find the effectiveness of interferential therapy and transcutaneous electrical nerve stimulation in construction workers having cervical spondylosis.

## Material and Method

Subjects who have been working on construction sites were taken according to inclusion and exclusion criteria. The research utilized a Convenient sampling technique. The sample size was 50. Each group 25. The entire study procedure was conducted from November 2022 to April 2023.

**Inclusion Criteria**

- Adults aging from 30 to 60.
- Both male and female.
- Pain diagnosed with cervical spondylosis.
- Person who works in a construction site.
- People who lift above 5kg.

**Exclusion Criteria**

- Under 18.
- person with vertigo.
- person undergone any Previous trauma – cervical spine injury, spine surgery, cervical fusion.

**Outcome Measure**

Before and after the study's first two weeks, assessments were done.

Short Form of the McGill Pain Questionnaire

**Procedure**

Following the inclusion and exclusion criteria, participants were chosen. The subject was given a description of the procedure before being requested to sign the consent form. Before the treatment, an evaluation was conducted. Participants were allocated into two groups at random, including interferential therapy group and transcutaneous electrical nerve stimulation group. Assessment was taken after 2 weeks of study.

**Intervention protocol for interferential therapy group**

Subject position: sitting or prone lying. region Electrode placement: the four pads were placed on the painful area of the cervical. Frequency - 100Hz, duration - 15Minutes, Intensity - as per patient tolerance. The intensity of the interferential therapy was increased gradually until the patient reported a comfortable tingling sensation and it was given for 15 mins to the subjects. After finishing interferential therapy, static neck exercises were given. Session: 6 days per week and continued for 2 weeks.

**Intervention protocol for transcutaneous electrical nerve stimulation group**

Subject position: sitting or prone lying. Electrode placement: the four pads were placed on the painful area of the cervical region. Type - continuous, duration - 15 Minutes, Intensity - as per patient tolerance. The intensity of the interferential therapy was increased gradually until the patient reported a comfortable tingling sensation and it was given for 15 mins to the subjects. After finishing transcutaneous electrical nerve stimulation, static neck exercises were given. Session: 6 days per week and continued for 2 weeks.

**Intervention protocol for static neck exercise**

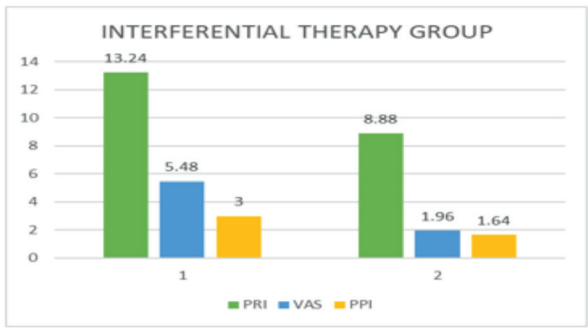
Subject position: sitting. In this, the subject was instructed to use their hands to move their head in a certain direction. For instance, to balance the force of their hands, they should pull their head backward while concurrently pushing their hands forward. Neck flexion – The position was sustained for 8–10 seconds in each of the following ways: neck lateral flexion for 8–10 seconds and then the identical motions were done on the left side, neck extension for 8–10 seconds. For two weeks, there will be ten repetitions each day.

**Ergonomics advices**

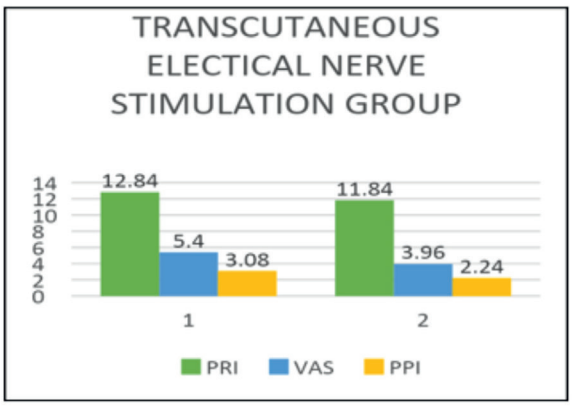
Neck should not be held in a fixed posture for a longer duration. Good postures should be maintained during work.

**Data Analysis**

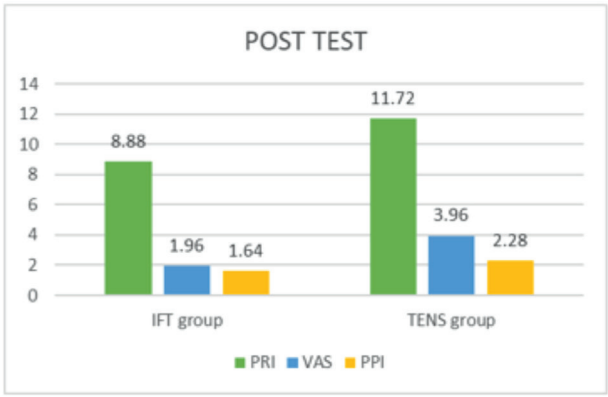
The data gathered were tabulated and analyzed using descriptive and inferential statistics. Each parameter was subjected to the mean and standard deviation (SD). An unpaired t-test was used to analyze the differences that were significant between the IFT group and the TENS group. The threshold for statistical significance was defined as a p-value of <0.0001.




**Graph-1: Comparison of Pre-test and Post-test values of Interferential therapy Group**




**Graph -2: Comparison of Pre-test and Post-test values of Transcutaneous electrical nerve stimulation Group**




**Graph -3: Comparison of Post-test values of Interferential therapy Group and Transcutaneous electrical nerve stimulation Group**

## Result

A statistically significant difference between the interferential therapy group and transcutaneous electrical nerve stimulation group as well as within each group was found by statistical analysis of quantitative data.

Using the short form of the MC Gill pain questionnaire, the interferential therapy group's post-test mean was 8.88 and the transcutaneous electrical nerve stimulation group's was 11.72. This demonstrates that the transcutaneous electrical nerve stimulation group received a higher score than the interferential therapy group.

This strongly suggests that interferential therapy in construction workers having cervical spondylosis along with static neck exercises is more effective than transcutaneous electrical nerve stimulation.

## Discussion

In this study, 50 subjects were assigned, 25 were in the interferential therapy group and 25 in transcutaneous electrical nerve stimulation group. Interferential therapy group received interferential therapy along with static neck exercises and transcutaneous electrical nerve stimulation group received transcutaneous electrical nerve stimulation along with static neck exercises in the course of two weeks. These two groups both got Ergonomic Advice. The outcome measures were a short form of the MC Gill pain questionnaire completed both at start and two weeks after the research. The P Value pertaining to both groupings were less than 0.0001. Which leads to the conclusion that Interferential therapy is statistically significant and more advantageous than Transcutaneous electrical nerve stimulation.

An early study by Sutariya N et al., stated that, the effectiveness of a high frequency current and a medium frequency current for pain relief will be compared. By using convenient sequential sampling, two groups of the 30 patients were created. Six people left the research without finishing it. There were two groups made up of 24 patients total. Six people left the research without finishing it. 12 patients were split between each group. Traditional therapeutic exercise plus SWD, IFT group combined with a Traditional therapeutic exercise group. The use of interferential therapy can be viewed as more beneficial based on the study's results, which are statistically significant and offer greater benefits to function and discomfort[11].

An early study by Sadeghi A et al., stated that the study intended to determine the impact examines the effects of isometric exercise on discomfort and impairment caused by cervical spondylosis. With neck discomfort and cervical osteoarthritis, 24 patients were enrolled, and they were randomly split into 2 arms: one receiving conservative therapy without exercise and the other receiving neck isometric strengthening exercises. For the examination of the patients, both the Neck Disability Index (NDI) and the Neck Pain and Disability Scale (NPAD) were used. The exercise arm significantly outperformed the control arm in terms of both NDI and NPAD, with mean scores of 17.41 and 25.33, respectively, and P-values of 0.035 and 0.001, respectively. Our study suggests that cervical spondylosis-related pain and

disability may be effectively alleviated by isometric exercise[13].

An early study by Albornoz-Cabello M et al., concluded that therapeutic exercises versus therapeutic exercises + interferential therapy Chronic illnesses patients with specific neck pain to assess the severity of the immediate therapeutic effect. 49 adults suffering from persistent with specific neck pain were taken. The therapeutic exercises with the participants were split into two groups based on the severity of their neck pain (grades I or II), which persisted for more than 12 weeks: the group that solely does therapeutic exercises (N = 24) and the interferential currents group (N = 25). The 11-point Numeric discomfort Rating Scale's primary outcome was the degree of neck discomfort that was currently experienced. The NNT for neck pain and disability and neck flexion Treatment benefit was analyzed at 2, with a 95% confidence interval of 2 to 4. P0.001) and 3 (95% CI: 2 to 11, P=0.029), respectively. To significantly reduce neck pain and impairment, interferential therapy is clinically more effective when combined with therapeutic exercises. However, persons with chronic neck pain did not have active cervical range-of-motion[16].

An early study by Rampazo ÉP et al., stated that Low- and medium-frequency currents are frequently utilized in the management of pain using transcutaneous electrical stimulation. The medium frequency alternating current therapy known as interferential current (IFC) therapy can penetrate deeper tissues and is said to lower skin resistance. IFC therapy has been shown in the literature to provide significant analgesic effects in individuals with neck discomfort, back discomfort, arthritis in the knees, and post-operative knee pain. Activating large-diameter, low-threshold nerve fibers with a 100 Hz IFC frequency has been hypothesized to cause analgesia by using the "pain-gating" system[17].

## Conclusion

In this study interferential therapy with static neck exercises among construction workers was found to be more successful than transcutaneous electrical nerve stimulation and therefore reduce sickness absenteeism and improve quality of life in subjects.

**Ethical Clearance:** Taken from institutional ethical committee. ISRB Application Number - 03/ 048/ 2022/ ISRB/ SR/ SCPT.

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**Conflict of Interest:** Nil.

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Original Article

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# Effectiveness of Core Muscle Strengthening in Bus Drivers having Low Back Pain using McGill Pain Questionnaire: Experimental Study

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**Abstract**

**Background:** This study was developed to determine the effectiveness of core muscle strengthening exercises in reducing low back pain among bus drivers.

**Purpose:** The purpose of the study is to determine the effectiveness of core muscle strengthening exercises in reducing low back pain among bus drivers.

**Materials and Methods:** The research project was conducted as a Quasi experimental study in Saveetha college of physiotherapy, Thandalam Chennai and RK Multispecialty physiotherapy clinic, Ayanavaram, Chennai. The interventional group received core muscle strengthening exercise for 6 weeks. Following the six-week treatment period, a post-test analysis was performed using the McGill Pain Questionnaire.**Study period:** from November 2022 to July 2023.

**Results:** The values were statistically analysed using paired 't-test and the Unpaired 't-test. The statistical analysis made with the quantitative data revealed a statistically significant difference before and after the intervention. The pre-test mean value of the Mc gill questionnaire scale was 55.53 and the post-test value was 19.60. This shows that the result value obtained for disability is less after the intervention.

**Conclusion:** From this result, it has been concluded that there is significant reduction in low back pain among bus drivers after the intervention.

**Key Words:** Low back pain, Core strengthening exercises, McGill Pain Questionnaire.

## Introduction

Discomfort felt between the inferior gluteal folds and the 12th rib is referred to as "low back pain" (LBP), whether or not it is accompanied by leg pain.[1] One of the most frequent medical disorders in primary care is low back pain. Acute back pain has a rapid start and lasts less than six weeks, while low back pain lasts between six and twelve weeks.[2] Chronic back pain appears for a length longer than or equivalent to twelve weeks. It is expected that between 70% and 85% of people may experience low back discomfort at some point in their lives. Ninety percent of these

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individuals will have several episodes. There is evidence that low back pain can impair function significantly, making it challenging to complete daily chores, and be dangerous.[3] Low back pain can result from muscular strains brought on by stretching, disc injuries, sciatica, spinal stenosis, aberrant spinal curves like scoliosis and kyphosis, as well as other disorders including arthritis and spondylitis.[4]

Workplace musculoskeletal conditions, especially low back pain, have a major financial impact on both the individual and the community. Low back pain has drawn the greatest attention among the different work-related musculoskeletal conditions that may be related to professional driving. Male truck drivers had a four times higher risk than sedentary employees of getting a herniated lumbar disc, and motor coach drivers were more likely to experience back or neck pain than non-drivers, reporting it 80% more frequently.[5]

It's significant that ergonomic and psychosocial risk variables are connected to occupational musculoskeletal disorders in professional drivers.[6] The most frequently stated physical concerns are prolonged periods of sitting, whole-body vibration, ergonomic mismatch among drivers, the type of car seat, and driving mechanics. Personal traits like age, gender, height, weight, and body mass index have an impact on the illnesses associated with drivers' work.[7]

The primary muscle group in charge of preserving spinal stability is the core muscles, which can be separated into two categories based on their functions and characteristics. The main muscles in this group are the transversus abdominis, lumbar multifidus, internal oblique muscle, and quadratus lumborum. The transversus abdominis and lumbar multifidus work together to form a co-contraction mechanism, and each lumbar spinal segment and the lumbar multifidus are physically related. The abdominal draw-in that is caused by a contraction stabilizes and keeps the segments of the spine in a neutral position.[8] The rectus abdominis, quadratus lumborum, internal and external oblique muscles, erector spinae, and hip muscle groups make up the weak abdominal muscles. By connecting the pelvic girdle to the thoracic segments rather than being directly linked to the spine, these muscles provide the spine more control. Therefore, the fundamental function of this group of muscles is to keep the spine stable. Stronger core muscles have a greater ability to produce torque, which can be used to counteract forces acting on the spine.[9] Exercises for segmental stabilization that emphasize the transversus abdominis and lumbar multifidus enhance spine stability. Subjects learned to contract their muscles while gradually extending breathing normally for 10 seconds while executing 10 contractions. Dynamic activities were then performed by the participants.[10]

## Aim

The purpose of the study is to determine whether core strengthening activities can help bus drivers with low back pain

## Material and Methods

Quasi experimental study was carried out with 30 subjects who have given their informed consent after being selected based on inclusion and exclusion criteria. The subjects were assigned into a single group through convenient sampling and the treatment protocol was given accordingly.

**Study period:** from November 2022 to March 2023.

**Inclusion Criteria:**

1. Bus drivers with low back pain
2. Subjects above 30-55 years of age
3. Driving more than 8 hours per day
4. Working for >5 years

**Exclusion Criteria:**

1. Drivers with history of road accidents
2. Any recent nerve injury
3. Recent fractures and surgeries.

**Outcome Measure:**

The three main classes of word descriptors sensory, emotional, and evaluative that patients employ to describe their subjective pain experiences constitute the foundation of the McGill Pain Questionnaire.

In order to assess the characteristics of pain experience, it also includes a scale for severity and

other factors. The purpose of the questionnaire was to collect quantitative data about clinical pain that could be statistically analysed. The administration of the questionnaire and the numerous metrics that can be generated from it are both described in this study. The three main metrics are the following: (1) the pain rating index, which is based on two separate numerical values that can be applied to each word description; (2) the number of words selected; and (3) the present pain intensity, which is based on a scale of 1 to 5.

**Procedure**

The subjects (n=30) received core strengthening exercises for 1 session 5 days/week for 6 weeks. Subjects were reassessed by a physiotherapist after the end of the 4th week to measure the degree of low back pain.

The Mc Gill pain questionnaire was used to evaluate how much pain each study subject was experiencing. All the subjects underwent pre- test measurements with a Mc Gill questionnaire. The post-test measurements were taken at the end of 6$^{th}$ week of intervention with the questionnaire.

**Treatment protocol**: Core strengthening exercises.

**1. Pelvic bridges:**

Pelvic bridges activate gluteal muscles to lift the hips which helps in core training by training the gluteus muscles and hip muscles. The subject is asked to lie on their back, bend both the knees and with feet hip width apart on the ground. The subject is instructed to place hands at the sides with palms facing inward. Then ask to raise the hips till the knees and shoulders are aligned. The position is held for 10 to 30 seconds and repeated for 10 times per session.

**2. Crunches:**

Crunches are the traditional core strengthening exercises. The subjects are instructed to lie on their back initially, then kneeling down with feet and hip wide apart on the ground. Spine and head are placed in an order with arms crossed across the chest. The subjects are then instructed to relax neck shoulders maintaining core stability. Then the back, pelvis and feet are maintained flat, tucking the chin and lifting the upper back, returning to the starting position by lowering the upper back gradually. The position is held for 10 to 30 seconds and repeated for 10 times per session.

**3. Straight leg raise:**

Straight leg raising exercises are effective core strengthening exercises that use hip performance in increasing the core strength. The subjects are instructed to lie on the mat and spread their legs comfortably. Then lift the straight leg six inches off the ground with a 3 second hold while taking slow, deep breath. The patients are guided to exhale while slowly lowering to the ground. Relax and repeat the same with the other leg. This exercise is to be repeated 10 times per session.

**4. Cat and Camel:**

The Cat Camel exercise works on stretching and strengthening core muscles as well as mobilizing and stretching the trunk. The subjects should begin with a quadruple position with knees and wrists positioned beneath shoulders. Hip, spine, and shoulder are aligned with spine in neutral.

- Cat pose: The subjects are asked to draw the back towards the floor with neck lifted towards the ceiling with a curvature of spine with a deep inhalation.
- Camel pose: Now exhale with chin and tailbone tucked in as if looking towards the floor. Spin e is raised towards the ceiling making a hump.

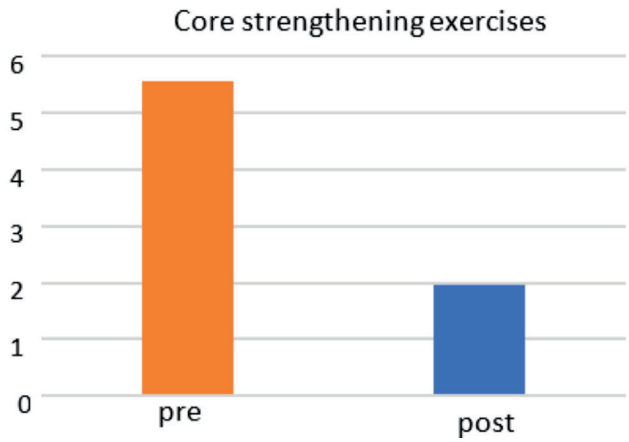
Repeat both the cat and camel pose for 10 times while holding each position for 10 to 30 seconds per each session.

**5. Squats:**

The subjects are instructed to begin the exercise with feet slightly wider than hip width apart and slightly pointed outward. Abdominals are engaged and weight is shifted to the heels with hips back and chest up, lowering into a squat. Then the heels are pushed to stand back up to the starting posture keeping the chest and core firm squeezing the gluteus muscles. Relax and repeat the exercise for 10 times per session.

**Data Analysis**

Using tabular and inferential statistics, the gathered data was evaluated. The mean and standard deviation (SD) were utilized for all parameters. The statistically significant differences between pre-test and post-test measures were examined using a paired t-test. The significance level of p 0.0001 was determined to be statistically significant.




**Graph - Pre and post-test mean values of McGill Questionnaire**

## Results

The statistical analysis made with the quantitative data obtained from the Mc Gill pain questionnaire revealed statistically noteworthy differences between the measurements taken before and after the test in bus drivers with low back pain. The pre-test mean value of the group before the intervention was 55.53 and the post-test measurement obtained after the intervention was 19.60.

## Discussion

The pre and post-test values of the intervention group were analyzed statistically. The statistical analysis revealed a significant difference between pre-test and post-test measurements. The post-test mean value of the Mc gill questionnaire scale among bus drivers with low back pain was 19.60. This shows that the result value for pain has been significantly low compared to the pre-test value. Identical research studies have been done, and the similar findings are as follows:

During the first three months of low back pain intervention, core exercises outperformed general exercise that showed reduced VAS scoring (from 10 to 7) significantly at the end of the intervention, according to Wang et al' **s** comprehensive review.[11] relearning the motor control of blocked muscles may be more crucial for LBP patients than core strengthening, according to Akuthota and Nadler. In this instance, it's possible that performance gains come from better neuronal recruitment and coordination rather than particular gains in stability or strength in the core.[12]

Over the course of the 12-week research by Wang, Xin, the lumbar muscle endurance of the experimental group was superior in which core training program was given. [200.80 92.98] The VAS score did not differ substantially, however the core group's Roland Morris Disability Questionnaire score at week 12 was considerably lower (3.33 0.58) The results of this study showed that the CMFST significantly decreased the prevalence of LBP, enhanced lumbar muscle endurance, and alleviated LBP-related dysfunction during military training.[13]

The findings of Goldby et al., who found that targeted core exercise; spinal stabilization for 10 weeks reduced pain in CLBP patients using VAS, and those of Koumantaki's Research demonstrated that individuals with low back pain continued to experience a significant pain reduction three months after using stabilization-enhanced core exercise.[14] Through a decreased risk of segmental buckling, Nadler et al.'s research looked at how core strengthening affects hip muscle imbalance and LBP in trained athletes. The subjects underwent core-strengthening program that included isolated abdominal strengthening squats and lunges, leg presses and strength training with free weights which showed rapid reduction in VAS after the intervention along with increased strength when observed using force plate dynamometer.[15] According to the study conducted by Cosio-Lima, Core strengthening exercises along with swiss ball training for 5 weeks showed increased muscle activity but no increase in the strength when observed using EMG for analysing muscle activity.[16]

The impact of a core strengthening program on 45 rowers over the course of eight weeks, two days per week, for 30 to 40 minutes, was examined by Tse et al. which showed that the core group's side flexion

tests had significantly improved; thereby increasing the ROM.[17]

Therefore, this study is evident showing that core strengthening exercises are effective in reducing pain and improving the strength which can be assessed using Mc Gill pain questionnaire. According to the findings, the core strengthening program may be an efficient way to manage bus drivers with low back pain and encourage a healthy lifestyle.

## Conclusion

From this result, it has been concluded that Core strengthening exercises are effective in reducing low back pain among bus drivers and improving the strength of the low back muscles, thereby leading to faster recovery.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/049/2022/ISRB/SR/SCPT).

**Funding:** Self

**Conflict of interest:** Nil.

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Original Article

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# Effectiveness of Pnf Stretching in Hamstring Tightness Population Having Low Back Pain

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**Abstract**

**Background**: One of the possible contributing factors of low back ache by hamstring stiffness on the ischial tuberosity. Movement restrictions or postural asymmetry lead to compensatory movement patterns of the lumbar spine, and subsequently increases stress on the spinal soft tissues and risk of low back pain (LBP), stretching and loosening the hamstring muscles can help relieve sciatic nerve root pressure and reduce the lower back pain.

**Purpose**: The aim of the study to determine effectiveness of PNF stretching in hamstring tightness population having low back pain.

**Materials and Methods**: Subjects who are willing to participate are separated into two groups and received treatment six times/week for two weeks in RENU'S Physiotherapy & Rehabilitation Centre , PNF stretching with hamstring strengthening exercise and conventional method of stretching with hamstring strengthening exercise, and informed about the study and signed consent were obtained.

**Results**: The PNF stretching group exhibited a substantial improvement in the pre-test and post-test, suggesting that the PNF stretching for hamstring tightness for low back pain.

**Conclusion:** According to the findings, PNF stretching technique has shown high significance in reducing hamstring tightness and reduced low back pain compared to conventional method of stretching and allowing participants with LBP to recover faster.

**Keywords**: Numerical pain rating scale, Oswestry Disability Index (ODI), conventional method of stretching, Range of Motion,goniometer

## Introduction

All industrialized nations experience a significant amount of low back pain, which is often treated in basic healthcare facilities. It is margin and above the inferior gluteal folds a may or may not be accompanied by leg pain. (sciatica). It's a complex condition, it may have a variety of etiologies in fact identifying the risk variables becomes challenging. Pain and disability are the two main signs of low back pain. The majority of adults experience back discomfort, which is also one of the most common causes of activity restriction and occupational incapacity worldwide.[1,2,3]

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Physical factors like intense physical strain, frequent lifting, postural stress, and vibration are just a few of the many determinants of low back pain and sciatica. Other determinants include social demographic traits and individual factors like lifestyle and physical capacity, gender, age, race, genetic factors, height, and weight, habits like smoking and alcohol use, poor general health, and, finally, psychosocial factors. There are many therapeutic interventions available for the treatment of chronic low back pain, including surgery, medication, manipulation, physical therapy,

behavior therapy.[4,5–9,10-16] The prevalence of low back pain is a significant clinical, social, economic, and public health issue. It is a condition having a wide range of potential etiologies, occurrence in numerous demographic groups, and classifications. As a result, the extensive body of literature on low back pain is not only diverse but often contradictory. According to definition, low back pain is a symptom that can only be determined by the patient themselves.[4,5-9] Stretching has been demonstrated to increase range of motion more effectively than warming up and massage, either alone or together.[17] The resistance of the muscle to variations in length during the range of motion is referred to as passive stiffness.

Series and parallel elastic components that help to absorb, transfer, and store energy make up the muscle's passive component in the hamstrings, a loss of flexibility and a rise in low back pain. While the subject's lower limb is stabilized in a rigid constraint, the instrumented straight leg raise test (iSLR) enables a quantitative and objective evaluation of the mechanical components of muscle contraction.[18] By reducing the lumbar- or low back-related movements, both hamstring tightness may well be to blame for the development or maintenance of back discomfort.

Stretching methods known as Proprioceptive Neuromuscular Facilitation (PNF) are proving to be successful in reducing hamstring tightness & it's made to stimulate proprioceptors in order to improve the response of neuromuscular processes. It improves sensorimotor control and lumbar muscle proprioception.[19,20] To increase flexibility, muscle strength, and range of motion, simple techniques such a variety of contract-relax, rhythmic stability, dynamic reversals, and combinations of these can be used. PNF aims to improve stability, mobility, movement control, muscle strength, and joint coordination whereas Contract relax, hold -relax, and contract-relax antagonist-contract appear to be the most often employed inhibition strategies in PNF stretching.[21] The greatest potential for muscle lengthening is offered by PNF techniques, especially those that involve reciprocal activation, such as hold relax (HR), on the premise that increased motor pool inhibition reduces muscle contractibility and hence permits higher muscle compliance.[22] The primary goals of the PNF idea are to improve joint synchronization, movement control, and mobility. As we included conventional stretching, there may be many conservative methods that have been recommended for the management of low back pain. These treatments include pelvic tilt exercises, flexion exercises, abdominal trunk curls, hamstring stretches, orthotic bracing, and general aerobic exercise like walking and swimming. Heat, cryotherapy, massage, ultrasound, traction, acupuncture, and electrical stimulation are some of the physiotherapy treatments employed. The most popular electrotherapy techniques are transcutaneous electrical nerve stimulation (TENS) and interferential current.

A low frequency amplitude-modulated medium frequency alternating current is used in interferential treatment (IFT). It has reportedly been shown to lessen pain, improve circulation, and have a soothing effect. Because of its deep skin penetration and minimal irritation, it is used efficiently and it has an advantage over other electrical currents in that it still produces low frequency effects in the tissues while having a relatively lower carrier frequency that is associated with decreased skin resistance.

## Aim

The aim of the study is to determine effectiveness of PNF stretching in hamstring tightness populations having low back pain.

## Material and Method

This is an experimental study done with 30 subjects with low back pain population, aged between 30 to 40 years of both genders from RENU'S Physiotherapy & Rehabilitation Centre, Vellore. Samples were randomly selected and allocated in

two groups and the study duration from October 2022 to November 2023.

**Inclusion Criteria:**

- Age: 30 to 40 years
- Gender: Male and Female
- Person with low back pain
- Subjects with score below 6 in numeric pain rating scale (NPRS)
- Subject willing to participate in the study

**Exclusion Criteria:**

- Fracture
- Neurovascular problem
- Tendinitis
- Bursitis
- Joint instability
- Tingling or numbness in the lower extremities

**Outcome Measures:**

Assessment was performed at baseline (before starting of treatment) and after two weeks of treatment.

- Numeric Pain Rating Scale (NPRS) [23]
- Oswestry Disability Index [24]
- 90-90 Hamstring test [23]
- Goniometer [23]

**Procedure**

A total of 30 people were chosen based on the inclusion and exclusion criteria, and their informed concern was obtained. They were also informed about the procedure's. Initially the patients underwent orthopedic assessment. The pain assessment was taken by using numeric pain rating scale (NPRS) and 90-90 hamstring special tests were done by the therapist to identify the hamstring tightness.

The duration of both groups treatments included:

- Repetitions: 8 to 12 repetitions
- Set: 2 to 3 sets.
- Rest interval: 15 to 30 seconds.
- Duration of session: 15 to 25(minutes/ session).
- No. of sessions per day: 1 session/day.
- Frequency: 6 days/week.
- Treatment duration: 2 weeks

All the exercises were done under the supervision of a physiotherapist.

**Pnf Stretching for Hamstring Along with Hamstring Strengthening**

**Bridging Exercises for Hamstrings:**

All of these bridging movements are fantastic, progressively challenging hamstring- and glute strengthening exercises.

- **Simple Bridge:** The hamstrings and glutes can be strengthened via bridging. Patient position is supine and feet flat on the floor as you lay on your back. Start with feet together, turn toes out to form a "V," and then step forward with heels. Hip distance between feet and knees should be used. Slightly flex abdominal muscles to bolster core and support lower back. A diagonal line to run from knees to hips, so tighten the glutes together and slowly lift buttocks off the ground as high as can without arching back. Hold for three seconds, then release gradually.[25]
- **Single Leg Bridging:** The hamstrings' stage 2 bridged. Ask the patient to elevate back into a bridge posture while maintaining the same patient position as for the straightforward bridge. Instead, elevate one foot off the ground and extend the knee while maintaining the bridge posture. Hold for three to five seconds, then lower the foot to the ground. Throughout the exercise, keep hips and pelvis lifted up and level; try not to let them sag to either one or both sides. [25]
- **PNF Stretching for Hamstring:** The PNF-hold Relax technique was used to the subjects, and while they were reclining supine, one lower extremity of each subject—the one that wasn't going to be checked or treated first—was Velcro-strapped to the couch. The hamstrings of the individual were stretched out until they felt a gentle stretch, and this position was held for 7 seconds.

One lower extremity of each patient that wasn't going to be examined or treated first underwent Velcro on PNF-hold relax technique.

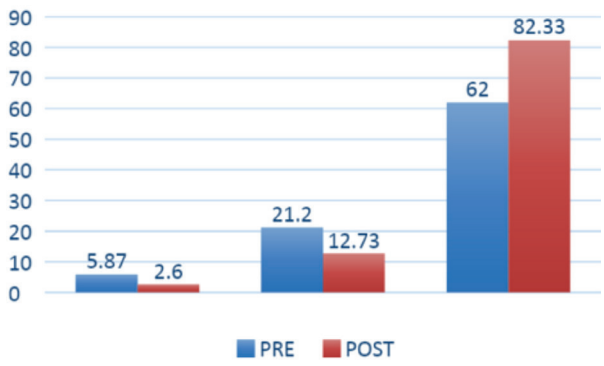
The patient was urged to relax for five seconds. After then, the patient feels a minor tension as the therapist passively extends the muscle. The posture was held for seven seconds. This technique was carried out five times each day for five days, with a 20-second rest in between.[25]

**Conventional Methods of Stretching along Hamstring Strengthening:**

- **Lying hamstring stretch:** Lie flat with the legs completely extended, either on a mat or the ground. To stretch the right leg, grasp the back of the knee with both hands, lift the leg toward the chest, and gradually straighten the knee until you feel a stretch. For 10 to 30 seconds, maintain the stretch. [25]
- **Lying hamstring stretch using a wall**: Look for an open door. Lie flat with the back straight and the left leg fully extended on the floor, either on the ground or a mat. The left leg should enter the doorway first. Next to the entryway, lean the right leg on the wall. To create a slight stress in the right leg, adjust the distance between the body and the wall. Hold the stretch for ten to thirty seconds. Three times, repeat.[25] Along with this hamstring strengthening was performed as mentioned in the previous group.

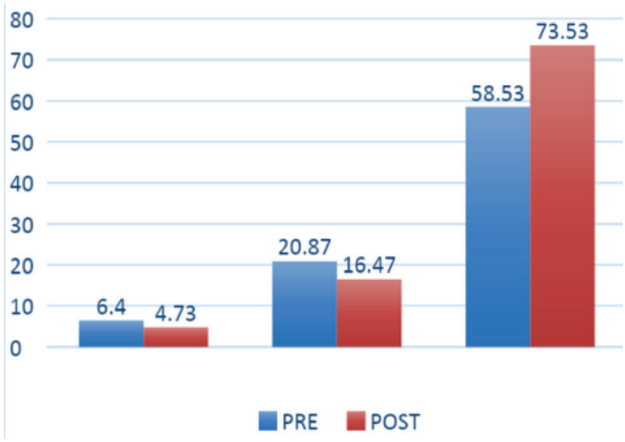
**Data Analysis**

## PNF group:



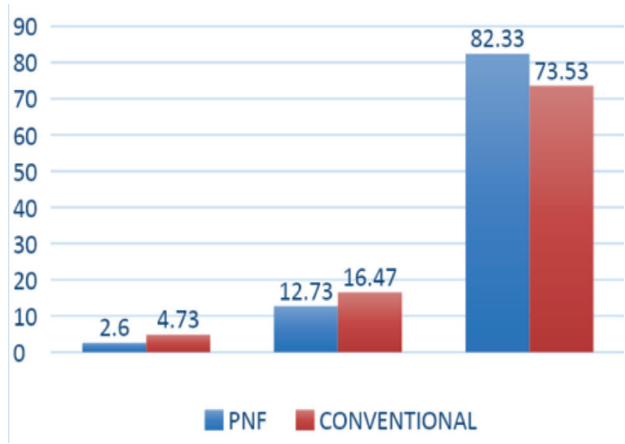

**Graph -1 Comparison of pre and post value of PNF group using NPRS, ODI, ROM**

**Conventional group:**




**Graph-2 Comparison of pre and post value of Conventional group using NPRS,ODI,ROM**

**Post-test values of both groups:**




**Graph-3 Comparison of post values of PNF and Conventional group using NPRS,ODI, ROM**

## Results

There is a significant improvement in NPRS, ODI, goniometer for range of motion(ROM) among the PNF group and conventional therapy group.

The NPRS post mean value in PNF group is 2.60 and in the Conventional group is 4.73 indicates equally significant in both the groups, with p value <0.0001.

The ODI post mean value in PNF group is 12.73 and Conventional group is 16.47with p value <0.0001.

The ROM post mean value in PNF group is 82.33 and Conventional group is 73.53,p value <0.0001.

## Discussion

The current study intends to compare the effects of traditional stretching methods and proprioceptive neuromuscular facilitation approach on flexibility in people with tight hamstrings. In this study 30 subjects having low back pain have been selected and marked pre-test values using outcome measures like ODI (Oswestry Disability Index), NPRS, and goniometer for ROM before and after the treatment. The goniometer and 90-90 test used to measure the range of motion and hamstring tightness.

Zakaria A, et al.,2012, states that PNF self-stretching through a therapist is benefited.[26] According to this study PNF hold-relax technique is clinically superior to conventional method of stretching in terms of increasing range of motion through 90-90 test,improving hamstring flexibility.

Lim KI, et al.,2014 According to the study, static or PNF stretching is significant in reducing hamstring tightness.[27] This study states, PNF promotes muscle relaxation prior to stretching in order to lessen reflexive components that trigger muscle contraction, increasing ROM through voluntary muscle contraction.

Ghanbari A, et al.,2013 study concluded that compared to static and PNF stretching, PNF is effective in hamstring extensibility.[28] As per this study holding a relaxed position is a sort of PNF stretching that makes passive muscle elongation more comfortable. The fact that autogenic inhibition through activation of group I fibers, thereby muscle relaxation of tight muscles, thus increasing ROM, may be the cause of the improvement brought on by PNF hold-relax. The results of the present study demonstrated that PNF stretching and conventional method of stretching were successful in reducing hamstring tightness and pain .PNF stretching was superior to conventional method of stretching by NPRS and ODI showed a marginally significant difference in the study's outcomes but less than conventional group.

**Ethical Clearance:** Taken from the Institutional ethical committee. ISRB number-03/100/2022/ ISRB/SR/SCPT.

**Funding:** Self

**Conflict of Interest:** Nil

## Conclusion

According to the findings, PNF stretching technique has shown high significance in reducing hamstring tightness and benefited in reducing low back pain and allowing recovery faster. Based on the result analysis, the PNF stretching technique proposed here might be considered in persons who require low back discomfort among the IT population.

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Original Article

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# Comparison of Hand Grip Strength Between Physiotherapy Students and Dental Students

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**Abstract**

**Background:** In hand treatment assessments, hand grip strengths are utilized as a measure of strength. For all occupations, having a strong grip is a necessary requirement for success. Differences in the nature of the work, the workplace, and the things that professionals handle may be responsible for these behaviors. A good hand grip is highly helpful in a variety of hand-intensive occupations like physiotherapy and dentistry. Musculoskeletal disorders, especially in the hand and wrist region, are common and have a great impact on work life.

**Purpose**: The need for this study is to evaluate and compare the differences in hand grip strength between physiotherapy and dental students and to see if clinical training for physiotherapy students and dental students will have an impact on their hand grip strength.

**Materials and methods:** 100 subjects were selected from Saveetha Institute of Medical and Technical Sciences based on the selection criteria where 50 subjects were physiotherapy students(interns) and 50 subjects were dental students(interns). The hand grip strength of the subjects was assessed with the help of a hand dynamometer and the measurements were recorded. The entire study was conducted from November 2022 to March 2023.

**Result:** The results of this study shows that there was a difference between both the groups and that physiotherapy students have better hand grip when compared to the dental students.

**Conclusion:** The results and the data obtained from this research concluded that grip strength of physiotherapy students is more than that of dental students.

**Keywords:** Physiotherapy students,Dental students, Hand grip strength, Hand dynamometer.

## Introduction

Measurement of handgrip strength is an important aspect of hand assessment[1]. In hand treatment examinations hand grip strengths have been employed as a measure of strength[2]. In order to assess general strength, work capability, the severity of disease and injury processes, and the likelihood of success in rehabilitation, grip strength has been used[3]. It is extensively acknowledged that tests of grip strength is an objective indicator of the functioning of the upper extremity's functional system[4] and is frequently used in clinical practice

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as an objective indicator of body function since it is connected with both upper extremity and overall body strength[5]. It is one of the best indicators of the limb's overall strength[6]. Grip strength, which is the amount of force utilized by the hand to pull on or suspend from things, is a specific example of hand strength. It is the strength and force that the hand is capable of producing. Different types of grips exist. Strong muscles are necessary for a stable carrying hold. Evidence-based medicine routinely uses grip strength testing for clinical decision-making and outcome assessment[7].

Consistent posture, manual therapy methods, repetition, working while injured, and heavy workloads are the risk factors for the physiotherapy profession that should be of particular concern. Manual treatment techniques and repetition are most frequently used by hand injury physiotherapists, particularly for injuries to the wrist and base of the thumb.

The hand-wrist discomfort and thumb pain have been identified as an issue by physiotherapists who use manual treatments[8], and they have an impact on the physiotherapist's capacity to use manual treatments since they affect the strength and function of the hand-wrist and thumb[9].

Both hand dexterity and grip strength are essential skills for a dental professional. Hand grip strength refers to the force used by the hand to grasp or hang an object, while hand dexterity deals with the coordination of the tiny muscles in the hand[6.] Dental professionals who only stood to work reported the most hand/wrist pain, whereas those who alternated between sitting and standing reported the least[10.] Dentists experienced issues as a result of their poor posture, excessive wrist and finger use, and repeated motion[4]. When doing dental operations, dental assistants and dental hygienists may endure hand pain.

After lengthy treatments, grip strength may become decreased, changed, and uncomfortable with throbbing, altered sensations, and stiffness in the hands[11.]

## Aim

To compare the handgrip strength of physiotherapy students and dental students.

## Materials and Method

This is a cross-sectional study conducted on 100 subjects. Prior to participation in this study,the subjects were explained about the study and informed consent was taken. 50 Physiotherapy Students (group A) and 50 Dental Students (group B), aged between 22-24 years, were taken from Saveetha Institute of Medical and Technical Sciences. Convenient sampling was used in this study.

Subjects: The subjects were selected based on the inclusion and exclusion criteria from Saveetha College of Physiotherapy and Saveetha Dental College ,The sample size was 100 subjects where 25 males and 25 females were assessed in each group.

**Selection criteria:**

**Inclusion Criteria:**

- Physiotherapy Interns
- Dental Interns
- Age:22-24
- Gender: both male and female
- BMI:normal BMI (18.5-24.9)
- Asymptomatic subjects without any clinical complications related to the upper limb

**Exclusion criteria:**

- Recent fractures of the wrist.
- Any pain due to pathology in wrist.
- Soft tissue injury of the wrist.
- Subjects pursuing fitness training.

**Outcome measures**

**Jamar Hand Dynamometer**

The most common evaluation equipment for assessing grip and squeeze strength is a Jamar hydraulic dynamometer. A hand dynamometer can be used by physical therapists and other medical practitioners to assess patients' development before and after therapy.

Using a hand held dynamometer to measure grip strength is the most commonly used technique. It is used for measuring the muscular force produced by the forearm and hand's flexor mechanisms. The three basic types of handgrip dynamometers are as

follows. These include hydraulic, air, and spring-loaded compression tools that are weighed in pounds or kilograms. For accuracy, a hydraulic dynamometer is best[12]

Study Period: November 2022 to March 2023.

**Procedure**

100 subjects were selected from Saveetha Institute of Medical and Technical Sciences based on the inclusion and exclusion criteria out of which 50 subjects are physiotherapy students(interns) and 50 subjects are dental students(interns). The hand grip strength of the subjects was assessed with the help of a hand dynamometer. The subject was asked to sit with their shoulder adducted and elbow at 90° on the arm rest and wrist in neutral position.

The student was made to sit with hip and knee flexed to 90° with the foot flat on the ground and then the measurements were taken.

Preparation of apparatus:

The desired spacing should be set on the adjustable handle. Before shifting the handle from one position to another, make sure the handle clip is situated at the lower post from the gauge. Inaccurate readings will occur if the handle is not positioned correctly. The red peak-hold needle should be anticlockwise rotated to zero.

**Position of subject:**

Sitting

**Test position:**

Shoulder adducted and neutrally rotated, elbow flexed $90^0$, forearm and wrist in neutral position.

**Instructions to the subjects:**

Ask the individual to squeeze as hard as they can without holding the breadth with their dominant hand for 5 seconds while the instrument is comfortable in their hand. With a 30-second break in between, perform each test three times.

Record the reading (average) after the individual has used the equipment.

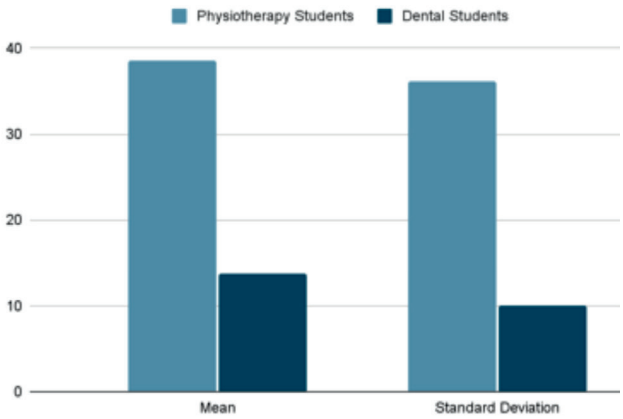
Before taking a new reading, reset the peak hold needle to $0^6$

**Data Analysis**

**Graph - 1**

Comparison of hand grip strength between physiotherapy students and dental students.

INTERPRETATION: The mean hand grip strength of physiotherapy students is higher than that of dental students.




## Result

- Statistically significant difference between Physiotherapy Students and Dental Students was found by statistical analysis of quantitative data.
- Using Jamar Hand Dynamometer, the hand grip strength was measured among students which showed that the hand grip strength of male students in both the groups is higher than the female students .
- The mean hand grip strength of physiotherapy students is 38.6 and that of dental students is 36.1.
- The mean and standard deviation is plotted in graph 1
- Statistical analysis of the samples reveals that there is a difference between both the groups and that physiotherapy students have better hand grip when compared to the dental students.

## Discussion

A particular aspect of hand strength is grip strength, which is the force used by the hand to pull or hang from things. It is highly helpful in a variety of hand-intensive occupations, such as physiotherapy and dentistry. Musculoskeletal conditions are

frequent and have a significant influence on work life, particularly in the hand and wrist region. This study is required in order to assess and compare the variations in hand grip strength between physiotherapy and dental students and to determine which group is more adversely affected sooner in their careers.

This study was conducted with 100 subjects out of which 50 were physiotherapy students and 50 were dental students. Ethical concerns and permissions were taken prior to the beginning of the study. The outcome measure used was hand grip strength in kilograms with a hand dynamometer. The grip strengths were taken in sitting position where the Shoulder and elbow was flexed to $90^0$ and wrist in neutral position.

The results showed that grip strength was greater in physiotherapy students than in dental students. Both male and female subjects participated in the study where both were of equal proportions in the age group of 22-24. The working hours were taken into consideration by a self-administered questionnaire which showed that both the groups work for equal hours. The mean value of the male physiotherapy students is 26.9 and the standard deviation is 6.4. The mean value of male dental students is 44.3 and the standard deviation is 6.8 and the mean of the female dental students is 28 and standard deviation is 4.8.

The mean value of the measurements for Physiotherapy Students was 38.6 and that of Dental students was 36.1. The standard deviation of Physiotherapy Students was 13.8 and that of Dental Students was 10.4.

The main idea of the study was to contrast the hand grip strengths of both of the groups. Measurements of grip strength are routinely used to offer an objective assessment of the results of hand injuries[9]. They can also be used to determine whether more physiotherapy is necessary while treating hand injuries[13]. Evaluation of hand grip strength has drawn interest among all muscle function tests as a straightforward, safe indicator of upper extremity muscle strength. For all vocations, having strong grips is a necessary requirement for success[2]. Such phenomena may be accounted for by variations in the nature of employment, the workplace, and the objects that employees must handle[1].

Similar findings have been recorded in the following studies,

A study by Zakariya MP et al. found that the average power grip strength of dentists was 79.45, whereas that of physiotherapists was 80.96, with a mean difference of 1.51[6]. Rucha Kulkarni et.al found that grip strength was measured in three positions: neutral, flexion, and extension, with readings of below 100 mm hg, between 100 and 200 mm hg, and above 200 mm hg. Dental professionals have weak grip strength, as evidenced by the fact that the p value for all three studies was 0.0001[11]

Dentistry is a specialized area of medicine that calls for strong pinching and repetitive finger motions. Dentists also suffer from the highest rates of musculoskeletal issues because of bad posture, unsuitable working habits, and poor mechanics. Their wrist joint performs the majority of the labour.

Their hand and fist are needed for all major surgeries, minute treatments, scaling, etc. The diameter of their instruments varies slightly.

Moreover, extended treatments may impair their grip strength[11] Impairment in grip strength is a sign of higher postoperative problems, a longer hospital stay, and a decline in physical condition, so it is important to consider the patient's occupation when measuring grip strength in patients. Determining the effectiveness of various treatment strategies and procedures requires a valid and reliable assessment of handgrip strength.[14]

Consistent posture, manual therapy methods, repetition, working while injured, and heavy workloads are the risk factors for the physiotherapy profession that should be of particular concern. Manual treatment techniques and repetition are most frequently used by hand injury physiotherapists, particularly for injuries to the wrist and base of the thumb.The hand-wrist discomfort and thumb pain have been identified as an issue by physiotherapists who use manual treatments[8], and they have an impact on the physiotherapist's capacity to use manual treatments since they affect the strength and function of the hand-wrist and thumb[9]. Understanding how little adjustments to the body and its components might impact hand grip performance in work life and in daily activities is crucial for rehabilitation.

The technique of grip strength assessment offers usefulness as a safe screening tool to examine a person's health.

## Conclusion

The results and the data obtained from this research concluded that grip strength of physiotherapy students is more than that of dental students.

**ISRB Approva**l: This research has been approved by the ISRB committee. ISRB no: 03/050/2022/ISRB/SR/SCPT

**Funding:** Self

**Conflict of Interest:** no conflict of interest during this research.

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Original Article

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# Efficacy of Low Impact Aerobic Training Versus Upper Limb Strengthening Exercise in Fatigue Level among Individuals with Chronic Obstructive Pulmonary Disease

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**Abstract**

**Background:** A disorder characterized by airway obstruction and breathing difficulty is known as chronic obstructive pulmonary disease. Fatigue is one of the typical signs and symptoms of COPD. Fatigue is the term used to describe a persistent feeling of exhaustion, and it can have a significant negative influence on person's capacity to carry out everyday tasks.

**Purpose:** The purpose of this study is to analyze how low impact aerobic training and upper limb strengthening exercise is effective in dyspnea and fatigue level among individuals with COPD.

**Materials and Methods:** The 106 subjects were selected based on inclusion and exclusion criteria from Hepziba Chest Clinic and Spirometry centre, Nagercoil. The pre and post-test values were measured using the BORG scale and Fatigue Severity Scale. The subjects were allocated into two groups. Low impact Aerobic training group:(n=53) received aerobic training with conventional exercise and Upper limb strengthening group:(n=53) received upper limb strengthening exercise with conventional exercise. The study was done for four weeks. The entire procedure was performed from October 2022 to july 2023

**Results:** When comparing the low impact Aerobic training group with upper limb strengthening group, the low impact Aerobic training group indicates significant ($p<0.0001$) effect in lowering the fatigue level as assessed by Borg scale and Fatigue Severity Scale.

**Conclusion:** The study concluded that Low impact Aerobic training had a significant effect compared to upper limb strengthening exercise on Dyspnea and Fatigue Severity Scale among individuals with COPD.

**Keywords:** Chronic Obstructive Pulmonary Disease, Aerobic training, Upper extremity exercise, BORG Scale, Fatigue Severity Scale.

## Introduction

Fatigue affects more than half of COPD patients, which has a significant detrimental effect on functional impairment, level of activity, health-related quality of life (HRQL), mortality, morbidity, hospitalization rate, and length of hospital stay.

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Patients with COPD may have lower limb muscles that are less able to withstand stress and are more susceptible to exhaustion as a result of limb muscle dysfunction, lack of use, and other factors. One of the objectives of comprehensive COPD patient care should be to reduce fatigue[1].

The main symptom that prevents patients from exercising and increases their fear of exercise is dyspnea. The importance of exercise training for this patient population cannot be overstated. Recently, COPD patients have employed high-repetition, low-impact aerobic exercise training as a method for peripheral muscle training without straining their respiratory systems[2].

Pulmonary rehabilitation is a crucial non-pharmacological treatment option for persons with chronic obstructive pulmonary disease[3]. Comprehensive pulmonary rehabilitation decreases dyspnea, improves exercise tolerance. Despite being a multimodal treatment, exercise training is the foundation of pulmonary rehabilitation's benefits [4].

International recommendations state that exercise training, which is widely recognized as the foundation of pulmonary rehabilitation, is the greatest approach currently known for improving exercise tolerance and muscular function in persons with chronic obstructive pulmonary disease (COPD)[5]. Aerobic exercise training improves functional status and, if the training intensity is sufficient, it results in a physiological training effect in people with Chronic Obstructive pulmonary disease. [6] As far as we know, there isn't a comprehensive assessment of the literature on the effects of exercise training on fatigue in COPD patients, and it's rare to discover research whose primary goal is to examine these effects[7].

Exercise has been shown to increase the anomalies that CRD patients' peripheral and central nervous systems exhibit[8]. Due to its association with significant clinical outcomes like mortality, quality of life, and exercise intolerance, independent of a reduction in lung function, muscle dysfunction is particularly significant in COPD. Therefore, increasing muscular function is thought to be a key therapeutic objective in the treatment of COPD[9]. It is already advised for patients with aggravated COPD to engage in aerobic exercise after leaving the hospital to boost their activity tolerance, strengthen their skeletal muscles, and lessen their experience of dyspnea[10].

## Aim

To determine and compare the effect of low impact Aerobic training and upper limb strengthening exercise in COPD patients.

## Materials and Methodology

A total of 106 subjects were selected from Hepziba Chest clinic and Spirometry Center, Convenient sampling method was used to gather the sample.

**Inclusion criteria:**

- Men and women between the age of 40 – 60 years
- people with mild COPD (Stage II- GOLD criteria)

**Exclusion criteria:**

- Previous lung surgery
- Malignant disease
- long-term oxygen treatment
- Musculoskeletal, rheumatic, cardiac or neurological disorders
- Patients with cognitive impairment
- Active pulmonary tuberculosis
- Diagnosis of other chronic lung disease

**Outcome Measures**

**1) Borg Scale**

The Borg scale measures a person's sense of their exertion, breathlessness, and weariness during physical work. The Borg RPE scale starts at 6, and the extreme measure is 20. On a scale of 6 to 20, the scoring system assesses the extreme levels of effort.

- **6:** rest
- **7:** extremely light
- **8 to 11:** very light to light exertion
- **12 to 16:** somewhat hard to hard exertion
- **17 to 20:** very hard to maximum exertion

**2) Fatigue Severity Scale**

The Fatigue Severity Scale (FSS) is a 9-item scale which measures the severity of fatigue and its

effect on a person's activities and lifestyle in patients with a variety of disorders. Answers are scored on a seven-point scale where 1 = strongly disagree and 7 = strongly agree. This means the minimum score possible is nine and the highest is 63. The higher the score, the more severe the fatigue is and the more it affects the person's activities.

**Procedure**

Total of 106 subjects were selected according to the inclusion and exclusion criteria and the participants were explained about the treatment safety and simplicity of the procedure and written consent was obtained. Subjects willing to participate were randomly allocated into two groups, Low impact Aerobic training group and upper limb strengthening exercise group. A routine history collection and detailed assessment was carried out for the patients. The study was done for four weeks. The entire procedure was performed from October 2022 to july 2023.

**Low Impact Aerobic Training Group (Group A)**

The low impact Aerobic training group received low impact aerobic exercise with conventional exercise like walking and Diaphragmatic breathing for a duration of 40 minutes. Walking was performed for about 30 minutes and Diaphragmatic breathing for 10 minutes.

**Walking:**

Done for a total duration of 30 minutes.

Warm-up Phase (5 minutes): The Warm-up phase was started with a slow and relaxed pace for the first 2-3 minutes. The subjects were focused on active exercise of upper and lower limbs and gentle movements like arm circle and Toe tap. Walking Phase (20 minutes): The subjects were asked to walk at brisk pace with posture upright, shoulders relaxed, and engage the core muscles and asked to swing their arms naturally as they walk. Cool-down Phase (5 minutes): The subjects were asked to reduce their walking pace and intensity and are asked to perform Quadriceps, Hamstring, Calf, Biceps and Triceps stretching exercises for two repetitions each.

**Diaphragmatic Breathing:**

The Diaphragmatic breathing exercise was done for a total duration of 10 minutes. The subjects were made to sit comfortably in a chair with relaxed position, feet flat on the floor. The subjects were asked to place one hand on their chest and other hand on the abdomen just below the ribcage. The subjects were asked to take slow and deep breath through their nose and hold it for 2 seconds and exhale slowly through mouth. This pattern was continued for 10 repetitions and 3 sets.

**Upper Limb Strengthening Exercise Group (Group B)**

The upper limb strengthening group received upper limb strengthening exercise with conventional exercise like thoracic mobility exercise and Diaphragmatic exercise for a total duration of 40 minutes.

**Thoracic Mobility Exercise:**

The following movement pattern were performed with coordinated breathing exercises.

Shoulder Flexion

- Shoulder Extension
- Shoulder Abduction
- Shoulder Adduction

**Shoulder Flexion:**

The subject was made to stand with back straight and feet flat on the floor. The subjects were asked to hold a half liter water bottle in each hands with palm facing forwards and they are asked to slowly push the weight towards the ceiling, with arms straightened without locking the elbows and hold that position for few seconds and return back to the normal position. While the weights are raised the subjects were asked to inhale and during lowering the weights the subjects were asked to exhale. Progression was made by gradual increase in weight.

**Shoulder Extension:**

The subjects were made to stand with back straight and feet flat on the floor. A weight is given on both the hands of the subjects. The subjects were asked to keep the arms straight and slowly raise their arms parallel to the floor. While the weights are raised the subjects were asked to inhale and during lowering the weights the subjects were asked to exhale. Progression was made by gradual increase in weight.

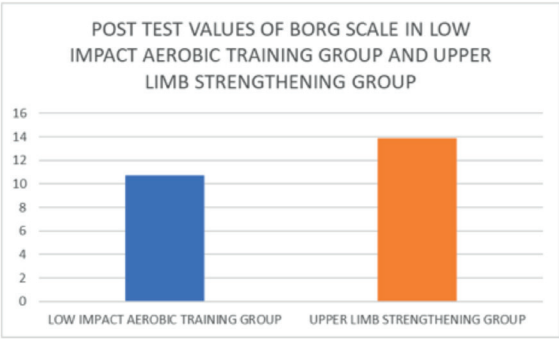
**Shoulder Abduction & Adduction:**

The subjects were made to stand comfortably with back straight and feet flat on the floor. The subjects were asked to hold the weights in their hands and slowly raise their arm to the side until their shoulder level. While the weights are raised the subjects were asked to inhale and during lowering the weights the subjects were asked to exhale. Progression was made by gradual increase in weight.

**Diaphragmatic Breathing:**

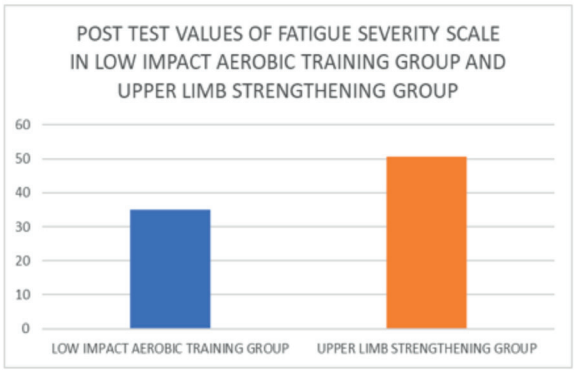
The Diaphragmatic breathing exercise was done for a total duration of 10 minutes. The subjects are made to sit comfortably in a chair with relaxed position, feet flat on the floor. The subjects were asked to place one hand on their chest and other hand on the abdomen just below the ribcage. The subjects were asked to take slow and deep breath through their nose and hold it for 2 seconds and exhale slowly through mouth. This pattern was continued for 10 repetitions and 3 sets.

**Data Analysis**




**Graph No - 1**

INTERPRETATION: Graph No - 1 shows that low impact aerobic training group is more effective than upper limb strengthening group in reducing Dyspnea level (BORG Scale)




**Graph No - 2**

INTERPRETATION: Graph No - 2 shows that low impact aerobic training group is more effective than upper limb strengthening group in reducing Fatigue level (Fatigue Severity Scale)

## Result

Statistical analysis of quantitative data showed statistically significant differences between the groups that were the Low impact Aerobic training group and the upper limb strengthening group. The Low impact Aerobic training group's post-test mean value on BORG Scale was 10.74, whereas the upper limb strengthening group was 13.89. This demonstrates that the BORG Scale in Low impact Aerobic training group is lower than in the upper limb strengthening group. In the Low impact Aerobic training group, post-test mean value for Fatigue Severity Scale was 34.87, while in the upper limb strengthening group, it was 50.64. This demonstrates that the Fatigue Severity Scale in Low impact Aerobic training group is lower than the upper limb strengthening group. The post-test results revealed that the Low impact Aerobic training group and the upper limb strengthening group had a substantial statistical difference, according to analysis. Thus Low impact Aerobic training group has high statistical difference than upper limb strengthening group.

## Discussion

The aim of the current study is to determine the efficacy of Low impact Aerobic training and upper limb strengthening exercise in fatigue level among individuals with COPD. Before and after the treatment, the outcomes were evaluated using the BORG Scale and the Fatigue Severity Scale. Beneficial effect were significantly greater in Low impact Aerobic training than the upper limb strengthening exercise. When the response were compared between both groups, the result showed significant difference in Low impact aerobic exercise than upper limb strengthening exercise.

An early study by Sankar UG, et al (2020) conducted a study among 30 subjects and are randomized into two groups. Group A (Low impact aerobic exercise) and Group B (Low intensity dynamic flexibility exercise). The study concluded that Low intensity aerobic exercise has better outcome than

Low intensity dynamic flexibility exercise1. Similarly in this study 106 subjects were randomized into two groups. Group A (Low impact aerobic training) and Group B (upper limb strengthening exercise) and concluded that subjects who performed Low intensity aerobic training has an better improvement in Fatigue level than subjects who performed upper limb strengthening exercise.

An early study by Soliman GS, et al (2019) conducted a study among 34 subjects**.** They were allocated into research and control groups. The control group (n=17) did not participate in any exercise training whereas the study group (n=17) performed three sessions of low- to moderate-intensity aerobic activity over the course of twelve weeks. The study's findings demonstrated that low- to moderate-intensity aerobic exercise improved lung function and lowered depressive symptoms in older COPD patients[11]. In this study concludes that fatigue significantly harms both one's physical and mental well-being**.** Thus, Regular exercise can increase energy levels, lower stress levels, and enhance overall stamina.

An early study by Donaire-Gonzalez D et al (2015) concluded that Increased low-intensity physical activity lowers the risk of COPD hospitalization, whereas increased high-intensity physical activity had no risk-reduction effects[12]. People with a variety of medical illnesses frequently experience fatigue, which can be made worse by hospitalization. It is feasible to reduce the necessity for hospitalization or reduce the length of hospital stay by successfully addressing and managing fatigue.

An early study by Stendardi L et al (2007), concluded that operational lung volumes and both the inspiratory and expiratory muscles play a significant role in the development of exercise dyspnea. Dyspnea may be impacted by changes in arterial blood gas content either directly or indirectly[13]. In this study level of Dyspnea is measured using BORG scale and concluded that the level of dyspnea is reduced after Low intensity aerobic exercise.

An early study by Bernard S, et al (1999) conducted a study among 40 subjects and were randomized into two groups. Group A (Aerobic training using calibrated ergocycle) and Group B (Aerobic training with strength training). The study concludes that greater improvement was seen in Aerobic training with strength training group that group with Aerobic training[14]. In this study both Low impact aerobic training and upper limb strengthening exercise on fatigue level was compared. Both have a positive impact on fatigue level among the individuals with Chronic Obstructive Pulmonary Disease.

## Conclusion

This study concludes that the both techniques used in the current study that is Low impact Aerobic training and upper limb strengthening exercise are effective in reducing the fatigue level among the individuals with Chronic Obstructive Pulmonary Disease. However, Low impact aerobic training is superior than the upper limb strengthening exercise in fatigue level among individuals with Chronic Obstructive Pulmonary Disease.

**Ethical clearance:** Approved by Institutional Scientific Review Board. (ISRB Application Number 03/051/2022/ISRB/SR/SCPT)

**Funding:** Nil

**Conflict of Interest:** Nil

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Original Article

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# A Study to Compare the Effect of Interferential Therapy with Ergonomic Changes Versus Core Strengthening Exercise on Low Back Pain Among Desk job workers: An Experimental study

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**Abstract**

**Background:** Desk job workers are spending 75% of work hours in high levels of sitting and improper

posture causing pain over the low back region.[1] Physical exercise is recommended for reducing low back pain and it promotes a healthy lifestyle and quality of life for the workers.[2]

**Purpose:** The aim of the study was to determine the effect of Interferential therapy with ergonomic changes versus core strengthening exercises on low back pain among desk job workers.

**Materials and Methods:** This was an Experimental study and the subjects were chosen from the KH shoe company, Ranipet. A total of (N=166) subjects participated in this study based on inclusion and exclusion criteria. The level of disability was assessed by using the Oswestry low back disability questionnaire and range of motion by modified Schober test and finger to floor test. The strengthening exercise was received by group B for 30 minutes and rest for 30 seconds. The entire study period was from September 2022 to July2023.

**Result:** This study showed clinically significant reduction of low back pain using interferential therapy. Hence, by the conventional criteria, this difference is considered to be statistically significant P<0.0001.

**Conclusion:** This study concluded that comparatively the interferential therapy with core strengthening exercise was more effective than the Interferential therapy with ergonomic changes.

**Key words:** Mechanical low back pain, Ergonomic modifications, Core strengthening exercise, Rest breaks.

## Introduction

A muscular tension, stiffness, or pain that is localized below the rib edge and above the inferior gluteal folds that may or may not involve the leg is referred to as low back pain.[1] People who have LBP exhibit fear, anxiety, and misinformation about LBP. Individuals should continue daily activities while managing their pain, going back to work as soon

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as possible, and avoiding rest positions in order to prevent disability.[2] About 70 to 80 percent of adults have low back pain, making it the most prevalent condition in the world. There is a correlation between employee's socioeconomic positions and musculoskeletal discomfort at distinct anatomical locations of pain and musculoskeletal diseases (MSDs), which are frequently linked to ergonomic risk factors.[3]

The musculoskeletal diseases most commonly affect the neck, shoulder, and low back region. Desk job workers are spending 75% of their work hours in a high level of sitting and causing discomfort in the low back region. Constant sitting can change the workers posture due to forward sitting and not being upright.[4] Changing the position of the posture during the rest break reduces the discomfort of the low back and it also relieves the pressure of the body parts. Usage of computers and phones, participation in meetings and reading are the key components of office work. Many office workers spend their whole workday at their desks, which necessitates prolonged sitting and it has been linked to increasing the musculoskeletal discomfort over time, especially in the low back region.[5]

Soft tissues may shorten as a result of prolonged sitting, so it reduces the range of motion that is possible for joints. Limiting the joint range of motion can cause musculoskeletal disorders and alter the normal biomechanics of the body.[6]

In some studies; the occupational factors include sedentary behavior and inactivity associated with LBP, during work time.[7-8] Long-term static positions and psychological problems are risk factors that can lead to persistent low back pain and disability. The physical exercise is recommended for the low back pain and it promotes healthy lifestyle and quality of life of the workers.[9] Clinical variables that have been associated to an increased risk of LBP include scoliosis, low back muscular endurance, poor lumbar stability and abnormal trunk movement.[10]

The IT professionals are exposed to so many risk factors such as musculoskeletal disorders, postural changes.[11]

## Aim

To compare the effect of interferential therapy with ergonomic changes versus core strengthening exercise on low back pain and functional ability among desk job workers.

## Methods

It was an experimental study. A total of (N=166) subjects were selected in the study. Convenient sampling method was used in the study. The subjects were assessed based on the inclusion and exclusion criteria.

**Inclusion criteria:**

- The workers with subacute pain
- Both the male and female
- The age group is between 21 to 45 years.

**Exclusion criteria:**

- The history of any lumbosacral injury
- Underwent recent surgery
- Pregnant women
- open wound

**Outcome measures**

The assessment was done to the subjects before starting the intervention and after the period of 6 weeks.

**Oswestry low back disability questionnaires:**

It is used to assess functional disability. The ten questions on the scale, each with six alternative answers, were given separate scores in addition to the total evaluation. According to the classification, minimum functional restriction is defined as 0–20%, moderate functional limitation as 20–40%, severe functional limitation as 40–60%, disability as 60–80%, and maximal functional limitation as 80% or more.

**Range of motion (ROM):**

The modified schober technique was used to measure the range of motion in the lumbar. The individual was requested to bend forward and backward while the assessment was being conducted; the junction of the venus' dimples on the lower back above 10 cm and below 5cm served as

the reference line, and it was noted with a marker. Finger to floor test was used to assess the ROM of lateral flexion. Both sides were instructed to bend laterally, and a measuring tape was used to obtain measurements. These points distinctions are the outcome measurements.

**Procedure**

The details of the study procedure were explained to the participants and they were asked to give their informed consent form to participate in the study. The total number of subjects (n=166) was randomly divided into two groups. Group A (n=83) and Group B (n=83). For Group A (Experimental group) Interferential therapy with ergonomic modifications such as to avoid the slouched position use the cushion pillow or folded towel to adjust the height of the chair at the level of eyesight to the computer, stay hydrated, set a timing to take a break from work because it gave the chance to stand up and walk around, place the small box or tab under the feet it helps to maintain the thigh parallel to the floor was given for the desk job workers. For Group B (conventional group) Interferential therapy with core strengthening exercises was given. The entire study period was from September 2022 to July 2023.

**Interferential therapy:**

To reduce the pain level of the patient, interferential therapy was given for both the group A and B. Interferential therapy which has the four leads has been placed over the lower back over the painful area in the diagonal manner. Frequency 20 Hz. Intensity should be raised depending on the patient's tolerance.

**Exercise regime:**

Before starting the exercise sessions for group B instruct the subjects to do warm up exercises for 5 to 10 minutes and cool down for 5 minutes after the session. Each exercise should hold for 3 to 5 seconds and 60 seconds relaxation between performing the exercises. The intensity of the exercise increases based on the level of the tolerance of the patient (repetitions and sets).

**Bird Dog exercise:**

The patient should be in a quadripod position. Asked the patient to contract the core muscles, while contracting asked them to raise their left arm forward and right leg backward. Instruct the patient not arch the low back while performing the exercise. Hold this position for 10 seconds before returning to the starting position and relax. Do the exercise for three sets of 10 repetitions and switch sides.

**Pelvic bridge:**

The patient should be in a crooked lying position. Ask the patient to contract the core muscle before doing the movement and instruct them to lift the butt off from the floor and continue to squeeze. Hold for 10 seconds and relax. Do the exercise for three sets of 10 repetitions.

**Plank:**

The patient should be in a prone position. Instruct the patient to lift their body by resting on the forearms and toes. The spine should be in a neutral position. Hold the plank position for 20 seconds and then lower down on the floor slowly and relax. The rest time for thirty seconds in between every repetition. Do this exercise for 5 repetitions.

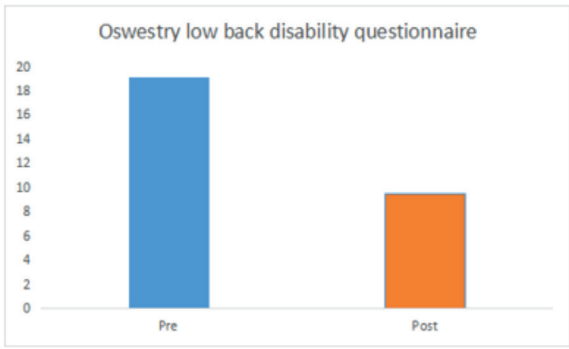
**Curls up:**

The patient was asked to lie on the floor on their back with knees bent at a 90 degree angle. Cross the arms over their chest. Slowly contract abdominal muscles and raise shoulder blades off the floor. Keep the head in line with the body. Do this exercise for 10 repetitions and 3 sets.

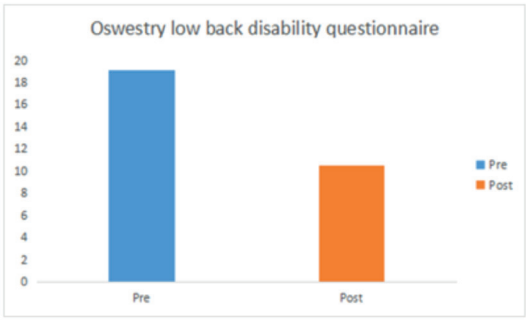
**Spiders pose:**

The patient should be prone to lying. Then the patient was asked to lift right arm and left leg simultaneously. Hold this position for 3 to 5 seconds and relax. Do these exercises 10 repetitions and 3 sets.

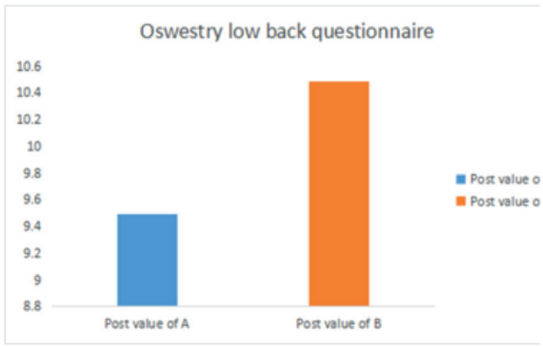
**Data Analysis**



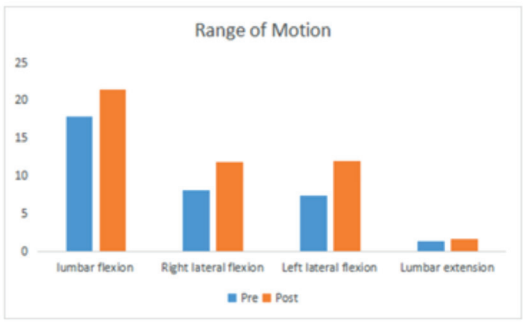

**Graph 1: Pre and post values of oswestry low back disability questionnaire for group A.**



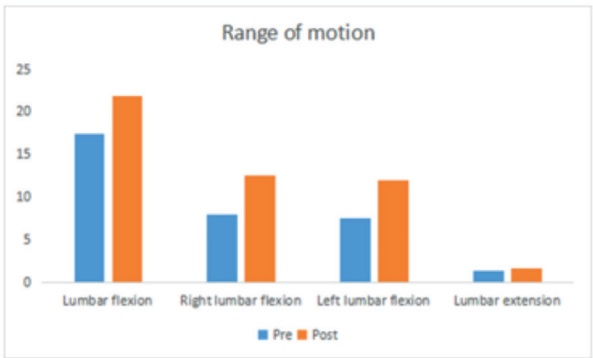

**Graph 2: Pre and post values of oswestry low back disability questionnaire for group B.**



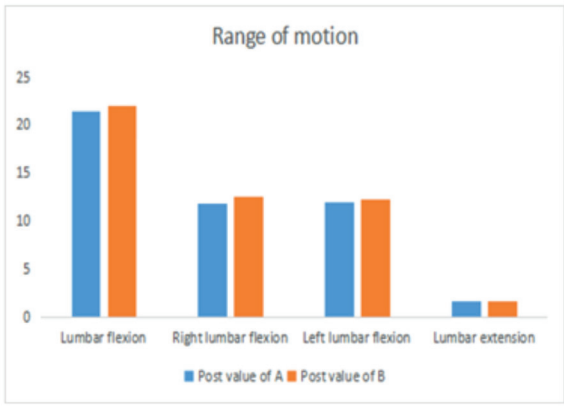

**Graph 3: Comparing the post values of the oswestry low back disability questionnaire for group A and B.**




**Graph 4: Pre and post values of Range of motion for group A.**




**Graph 5: Pre and post values of Range of motion for group B.**




**Graph 6: Comparing the post values of range of motion for group A and group B.**

## Results

Graph: 1 Group A represents the mean values of Oswestry low back disability questionnaire, the mean value of the pre and post was 19.14 and 9.49, t value was 52.6270, (P<0.0001). By conventional criteria, this difference was considered to be extremely statistically significant.

Graph: 2 Group B represents the mean value of pre and post was 19.14 and 10.49, t value was 47.1737, (P<0.0001). By conventional criteria, this difference was considered to be extremely statistically significant.

Graph: 3 represents the comparison of the post value for group A and B, t value was 3.1884, (P<0.0017). By conventional criteria, this difference was considered to be very statistically significant.

Graph: 4 Group A represents the mean value of pre and post for lumbar flexion was 17.84 and 21.49, t value was 22.3022, (P< 0.0001). For right lateral flexion pre and post value was 8.04 and 11.83, t value was 27.0962, (P<0.0001). For left lateral flexion pre and post value was 7.41 and 11.95, t value was 24.5698, (P<0.0001). For lumbar extension pre and post value was 1.310 and 1.654, t value was 35.9561, (P<0.000). By conventional criteria, this difference was considered to be extremely statistically significant.

Graph: 5 Group B represents the mean value of pre and post for lumbar flexion was 17.43 and 21.88, t value was 20.3602, (P<0.0001). For right lateral flexion

pre and post value was 7.93 and 12.54, t value was 29.0555, (P<0.0001). For left lateral flexion pre and post value was 7.58 and 12.02, t value was 24.6993, (P< 0.0001). For lumbar extension pre and post value was 1.3 and 1.636, t value was 35.9561, (P<0.0001). By conventional criteria, this difference was considered to be extremely statistically significant.

Graph: 6 Represents the comparison of post values of group A and B. For lumbar flexion the post value of A and B was 21.37 and 21.95, t value was 2.7581, (P <0.0065). For right lateral flexion, the post value of A and B was 11.83 and 12.54, t value was 4.3925, (P<0.0001). For left lateral flexion post value of A and B was 11.90 and 12.29, t value was 1.9858, (P<0.0486). For lumbar extension the post value of A and B was 1.639 and 1.676, t value was 2.3170, (P<0.0217).

By conventional criteria, this difference was considered to be extremely statistically significant. In this study, both the Group A and B showed significant improvement in the reduction of pain but comparatively Group B is more effective than Group A.

## Discussion

The study aimed to compare the effects of two interventions for low back pain in computer workers: Group A received interferential therapy with ergonomic changes, while Group B received interferential therapy with core strengthening exercises. Both groups showed significant improvements over the 6-week intervention, with reduced low back pain and discomfort. Group A benefited from ergonomic changes, including chair height adjustments, maintaining a horizontal posture, using back support, and incorporating rest breaks. These modifications likely alleviated strain on the back and improved overall comfort during computer work. Group B core strengthening exercises targeted key lumbar muscles, enhancing flexibility and endurance. This improvement in core strength contributed to reduced pain and improved functional ability during daily activities.

Stefano Gobbo et al. concluded that findings of their systematic analysis demonstrated that office workers who participated in the workplace fitness programme center experienced a reduction in low back pain symptoms as well as improvements in their quality of life and muscle strength and flexibility.[2]

Rattaporn Sihawong et al. concluded that, the exercise program to stretch the muscle and the endurance training were effective to decrease the incidence of low back pain among office workers.[6]

Sunyue Ye et al. 2017 concluded that their findings suggest that maintaining a somewhat warm office climate and ensuring adequate horizontal orientation of the computer monitor are crucial for preventing NP and LBP, particularly in female office workers who have suffered neck and/or back injuries and use computers often.[8]

## Conclusion

This study concluded that both the IFT with ergonomic changes and IFT with core strengthening exercise showed some significant improvement in the reduction of the low back pain. But comparatively the interferential therapy with core strengthening exercise was more effective than the Interferential therapy with ergonomic changes.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (ISRB Application Number 03/052/2022/ISRB/SR/SCPT).

**Funding:** self

**Conflict of interest:** Nil

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Original Article

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# Effectiveness of Balance Training and Strengthening Exercise on Pain and Functional Performance among the Athletes with Ankle Sprain

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**Abstract**

**Background:**. Ankle sprain happens more regularly in the athletic population. It results from the straining of ankle ligaments or collagen which produces the partial or full disruption of the ligaments fibers. Ankle injuries most commonly occur in the climbing of the wall ,indoor volleyball and events that occur in the grassland. This study was designed to inspect the effectiveness of balance training and strengthening exercise among the athletes with ankle sprain.

**Purpose:** To compare the effectiveness of balance training and strengthening exercise on pain and functional performance among the athletes with ankle sprain.

**Materials and Methods:** Total of 50 participants were selected according to the inclusion and exclusion criteria from the ortho speciality Neha clinic. The participants were treated for four weeks. The study duration from October 2022 to july 2023. Subjects willing to participate were randomly allocated into two groups: balance training group and strengthening exercise group. All the subjects underwent pretest measurement with VAS, FAAM and the same procedure repeated for post-test at the end of 4 weeks.

**Results:** The collected data was statistically analyzed using an unpaired t-test. When comparing the balance training group to the strengthening exercise group, the balance training group indicates more significant effects ($p<0.0001$) than the strengthening exercise in lowering pain and improving the functional performance, as assessed by VAS and FAAM.

**Conclusion:** Balance training was found to be more effective than strengthening exercise in reducing pain and improving functional performance among athletes with ankle sprain.

**Keywords:** Ankle sprain, VAS, FAAM, Ultrasound, Strengthening exercise, Balance training.

## Introduction

Ankle sprain happens more regularly in the athletic population. It results from the straining of ankle ligaments or collagen which produces the partial or full disruption of the ligaments fibers[1]. Ankle injuries most commonly occur in the climbing of the wall ,indoor volleyball and events that occur in the grassland prevention of the ankle sprain have the most beneficial effect among the sport population all over the world[2]. Females have the major risk of the ankle sprain when differentiated with the males.

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Lateral ankle sprain is more common than other ankle sprain types[3]. Lateral ankle sprain requires the only immobilization in the acute stage if there is only the pain and edema. If it involves the reduction of the range of motion over the ankle joint it requires the mobilization techniques along with the combination therapy of the exercise. In terms of the functional support the external applications are more effective in both the acute and the recurrent ankle sprain. Proper diagnosis and preventive measures are important in order to prevent the ankle sprain[4]. For the acute lateral ankle sprain treatment should be involved with the weight bearing with the mobilization techniques , external supportive appliances, exercise and application of the ice should be used. The individual with the chronic ankle instability may require the mobilizing techniques and rehabilitation programs such as the balance training and proprioceptive training[5]. Functional impairment is characterized by feeling of impairment , recurrent sprain or fright. In addition healthy persons may have the incidence of the sprained ankles that produces the discomfort and limitation of the movements over the ankle joint that affects the functional status of individual[6].

## Aim

To evaluate the effectiveness of balance training and strengthening exercise on pain and functional performance among the athletes with ankle sprain.

## Materials and Method

It was an experimental study conducted on 50 subjects with ankle sprain age between 15-25 years was taken from ortho speciality Neha clinic. Convenient sampling with a random allocation method was used in this study.

**Inclusion criteria:**

- Both men and women
- Age group 15-25 years
- VAS Score between 5-10
- FAAM score between 30-70%
- Sports person with the ankle sprain grade 2 and 3
- Subjects willing to participate in study

**Exclusion criteria:**

- Recent lower extremity fractures
- Previous ankle injury `
- Neurological impairment
- History of Diabetes

**Outcome measures**

Assessment was done before starting treatment and after 4 weeks of study.

- **Visual Analog Scale**

This scale has been determined to be one of the one of the most accurate pain outcome measures available. A straight line was drawn on the evaluation sheet with a 0 at the start and a 10 at the end, and the patients were asked to mark on the line based on the impression of pain, with 0 indicating "no pain" and 10 indicating "worst imaginable pain" [20].

- **Foot and Ankle Ability measure**

To evaluate the subject's physical function with ankle and foot related impairment, the FAAM was used. The FAAM consists of eight items, each of which is scored from 0 to 4, with a score of 0 denoting"unable to do '' and a score of 4 denoting "no difficulty at all". A final score can be determined by combining all of the points together divided by the maximum higher potential score multiplied by 100.The maximum highest potential score on the test is 32, and it can be expressed as a raw number. The patient may have reported more disability if the score was lower [21].

**Procedure**

Total of 50 participants were selected according to inclusion and exclusion criteria and the participants were explained about treatment safety and simplicity of the procedure and written consent was obtained.

Subjects willing to participate were randomly allocated into two groups: balance training group (N=25) and strengthening exercise groups (N=25). All the subjects underwent pretest measurement with the VAS and FAAM and the same repeated for post test at the end of 4 weeks. The participants were treated for four weeks. The study duration from October 2022 to july 2023.

**Balance training group**

Subjects treated with the ultrasound for the first two weeks followed by balance training from the second week, the following training is performed.

**1. Single leg stance (open and closed eyes)**

Ask the patient to stand barefoot and instruct them to stand on one leg unassisted.

**2. Single leg stance with the movement (open and closed eyes)**

**a) arms out for 30 secs on hard surface**

Ask the patient to stand on one leg unassisted and instruct them to open the arms away from the body and hold it for 30 secs.

**b) arms across the chest for 30-60 secs (open and closed eyes)**

Ask the patient to stand on one leg unassisted and instruct them to fold the hand across the chest and hold it for 30 -60 secs.

**3. single leg step down**

Ask the patient to stand on the corner of the steps on the side ways and instruct them slowly down the one leg like the step down by placing the one leg on the same place.

**4. Tandem standing**

Ask the patient to stand on hard surface and instruct the patient to place one leg behind the other in the same line.

**5. Heel and toe walking**

**Heel walking**

ask the patient to stand and instruct them to stand on the heel and walk without any assistance as you can.

**Toe walking**

Ask the patient to stand and instruct them to stand on their toes and walk without any assistance as you can.

**Strengthening exercise group**

Ultrasound was given to the patient for initial two weeks followed by strengthening exercise from the second week. The following exercise are performed:

**1. Inversion isometric exercise:**

Ask the patient to stand near the fixed object such as couch or table and instruct them to push against the object "down and inwards". Hold the position for 10 counts and repeat for 10 times.

**2. Eversion isometric exercise:**

Ask the patient to stand near the fixed object such as couch or table and instruct them to push against the object "up and outward". Hold the position for 10 counts and repeat for 10 times.

**3. Flexion isotonic exercise**

A resistance band is used. Ask the patient to sit on the couch with the leg extended resistance band wrap around the foot. Instruct the patient to pull the foot upward against the resistance. Repeat for 10 times.

**4. Extension isotonic exercise**

The resistance band is used. The resistance band is wrapped around the foot. Instruct the patient to push the foot downward against the resistance.

**5. Inversion isotonic exercise**

A resistance band is used . Ask the patient to sit on the couch with the leg extended. The resistance band is wrapped around the foot. Ask the patient to move the foot "down and inward" against the resistance.

**6. Eversion isotonic exercise**

The resistance band is used to ask the patient to sit on the chair, tie the resistance band on the fixed object and wrap the band on the foot. Instruct the patient to move the foot up and downward against the resistance.

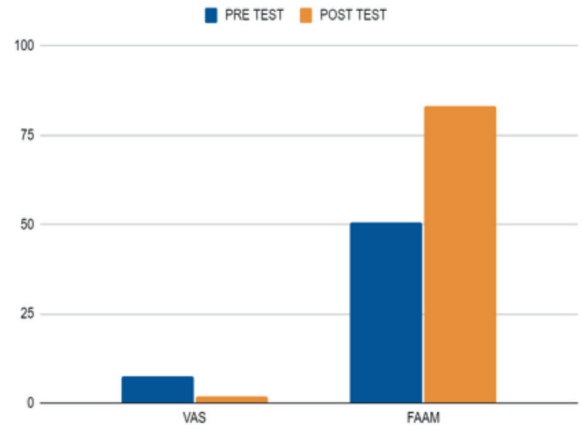
**7. Calf raise:**

Ask the patient to stand on the floor and instruct them to slowly raise the heel away from the floor and then land. Repeat for 10 times.

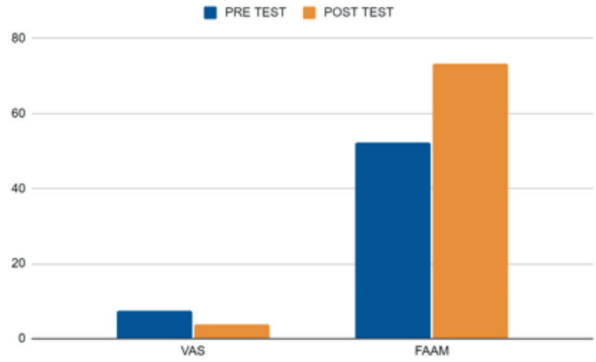
**8. Towel curls:**

Ask the patient to sit comfortably on the chair by placing the foot on the floor. Instruct the patient to place the towel under the foot and instructed to curl the toes to grip the towel and lift off the ground. Hold it for 5 seconds. Repeat for 10 times.

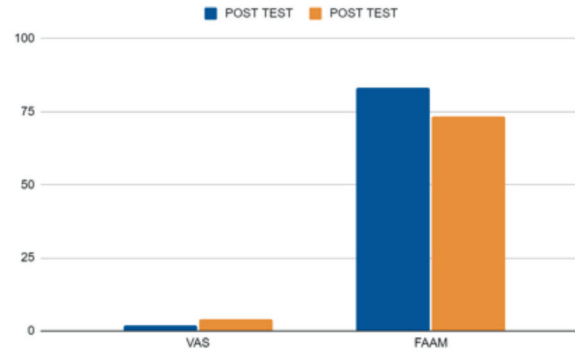
**Data analysis**




**Graph- 1 Comparison of Pre and post-test values of VAS and FAAM in balance training group**




**Graph - 2 comparison of pre-test and post-test values of VAS and FAAM in strengthening exercise groups.**




**Graph - 3 comparison of post test values of VAS and FAAM in both groups.**

## Result

The FAAM post test mean value in the strengthening group was 73.32(+7.09), while it was 83.04(+8.13) in the balance group. This indicates that the balance group FAAM score was significantly higher than the strengthening group with P <0.0001.

The balance group VAS post-test value was 2.04(+1.34), whereas the strengthening group was 3.84(+1.18). This indicates the balance group VAS was significantly higher than the strengthening group with the P <0.0001.

Statistical analysis of the VAS and FAAM post-test values revealed that the balance training group and strengthening group showed similar statistically significant differences. As a result, the balance training group exceeds the strengthening group statistically.

## Discussion

The goal of the study is to compare the effectiveness of balance training strengthening exercise on pain and functional performance among the athletes with ankle sprain. It also assess the effectiveness in terms of reducing pain and improving functional performance. This comparison is demonstrated with a duration of 4 weeks. The outcome result was measured by VAS and FAAM before and after treatment. Beneficial effects were significantly greater in balance training than the strengthening exercise. When the responses were compared between both groups, the result showed a significant difference in the balance training group than the strengthening exercise group. In strengthening exercise group pre-intervention mean of FAAM was 52.12(+10.02) and VAS was 7.5(+1.74). where; after treating the subject with strengthening exercise, the mean value of VAS is decreased to 3.84(+1.18) where; as FAAM was increased to 73.32(7.09), which shows statistically significant difference between the groups. In the balance training group pre-intervention mean of FAAM was 50.64 (+11.01) and VAS was 7.5(+1.74). After treating the subject with balance training exercise, the mean value of is VAS decreased to 2.04(+1.34) where; as the FAAM was increased to 83.04(+8.13), which shows statistically significant difference between the groups. Based on the statistical analysis, both groups showed improvement in VAS and FAAM. However, subjects in balance training groups who received balance training exercise showed better improvement in VAS and FAAM

than the subjects in the strengthening groups who received strengthening exercise. AN early study by Mc Keon PO, Ingersoll CD, et.al., (2008) conducted the randomized control trial on does the balance training improve function and postural control in those with chronic ankle instability concludes that functional performance and static postural balance are increased after the prolonged balance training programme done in the various of directions [6].An early study by Rivera MJ, Winkelmann ZK, et.al., (2017) conducted the study an evidence based review concludes that proprioceptive training has more beneficial effects and reduces the risk of further impairment or worsening condition on the patient with the previous ankle sprain during physical functioning [7].An early study by maxwell et.al.,(1992) therapeutic ultrasound its effect on the cellular and molecular mechanism of inflammation and repair concludes that the ultrasound may increase or decrease the healing mechanism depending on the various influences and its significance [8].An early study by Ivins D, et.al., (2006) conducted the study concludes that using of supportive devices may helpful in the protection of the recurrent of the ankle sprain. The proprioceptive exercise may also be helpful [9].An early study by Verhagen EA, et, al., (2013) a review of study concludes that the ultrasound is helpful in the overall improvement by reducing the pain and able weight bear in the involved leg with the acute ankle joint [14].An early study by van den Bekerom et, al.,(2011)cochrane database systematic review states that the ultrasound has little more beneficial effect over the acute ankle sprain [15].

## Conclusion

According to the study, balance training and strengthening exercise both reduce pain and improve functional performance. The findings suggest that the balance training exercise is more beneficial than strengthening exercise in lowering pain and enhancing functional performance in athletes with ankle sprain.

**Ethical clearance:** The research work has been approved by the ISRBCommittee. (ApplicationNo:03/053/2022/ISRB/SR/SCPT)

**Funding:** self

**Conflict of interest:** Nil

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Original Article

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# Effect of Strain Counterstrain Technique and Core Strengthening Exercises on Pain and Functional Status among Middle Aged People with Chronic Low Back Pain

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**Abstract**

**Background:** Low back pain (LBP) is characterized as "pain along the posterior portion of the body from the lower border of the twelfth rib to the lower gluteal folds. A technique called strain counterstrain method is used to treat musculoskeletal pain. Core strengthening exercises can also lead to significant improvements in pain reduction and functional status. The goal of this study is to find the effectiveness of strain counterstrain technique and core strengthening exercises in treating low back pain.

**Methods**: Total of 100 participants were chosen from Capital hospital, Vijayawada by convenient sampling, During study period from September 2022 to July 2023. A written consent form was obtained from them. After obtaining pre-test of VAS and Oswestry disability questionnaire the patients were categorised randomly into two groups. GROUP A received Strain counterstrain technique alone and GROUP B received Strain counterstrain technique with core strengthening exercises.

**Result**: A statistically significant difference was found between GROUP A and GROUP B as well as within the group, according to the statistical analysis performed on the quantitative data.

**Conclusion**: The findings of the present study demonstrate improvements in both Strain counterstrain technique and core strengthening exercises among middle aged people with chronic low back pain. However, (GROUP B) shows an extremely significant improvement compared to (GROUP A).

**Key points**: Strain counter strain, core strengthening exercises ,chronic low back pain.

## Introduction

Pain in the region of the back from the lower edge of the twelfth rib to the lower gluteal folds is referred to as low back pain (LBP).[1] Chronic low back pain (CLBP) is described as pain in the lower back that lasts longer than three months. The spine, intervertebral discs, and surrounding tissues are subjected to repetitive damage or overuse, which results in low back discomfort.[2] Many people have reported experiencing low back discomfort frequently, Low back pain affects 75-84% of the general population, Compared to men, women has a higher chances of persistent low back pain and age group of 42-64

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years saw the greatest reported rates of lower back pain for both sexes (33.3%).[3] Mobility disability affects the majority of CLBP sufferers. Lower back pain is characterized by muscle spasms, tightness, and tingling feelings, stiffness early in the day, deficits in coordination and movementparticularly in cases with pain extending to the lower extremities,[4] If neglected, chronic low back discomfort can lead to complications. It interferes with blood pressure regulation, increasing the risk of hypertension which can result in a heart attack, stroke, or even death.[5] Patients are typically diagnosed based on their history and additional characteristics such as Palpation: A doctor will use their hands to feel around the low back to look for any tense or spasming muscles, sensitive spots, or abnormalities in the joints.[6] For patients with CLBP without widespread pain, moderate- to high-intensity exercise will be taken into consideration.[7] Although the electrical modalities have not been proven to be successful interventions, massage is currently advised in both the acute and chronic stages of back pain. Spinal manipulation increases psychological wellbeing while offering modest short- and long-term relief from back pain.[8] The positional release technique known as Strain Counterstrain (SCS) is used to treat chronic low back pain .[9] Orthopedic problems are frequently treated with SCS. The purpose of strain-counterstrain is to unblock the lymphatic system's pump mechanism so that it can function normally, to restore fascia to its normal state and to reduce tightness in muscles and other connective tissues.[10] With Strain-Counterstrain therapy, joints influenced by the now-relaxed muscle operate optimally, extending the range of motion and reducing pain in the affected muscles.

**Purpose**

To compare the effectiveness of strain counterstrain technique and core strengthening exercises in the individual's with chronic low back pain.

## Materials and Methods

It was an experimental study conducted on 100 participants from Capital hospital ,Vijayawada using Convenient sampling. The participants were separated into two equal groups based on random allocation.

**Inclusion criteria:**

- Middle aged persons (35 to 50 years) with chronic low back pain
- People with severe back pain (VAS score above 6)
- People with reduced Functional status (Back pain functional scale)
- Duration: Greater than 3 months (pain)

**Exclusion criteria:**

- Subjects With Any Fractures, Cardiovascular, Nervous, Pulmonary or Metabolic disorders were excluded
- Subjects who were not willing to participate will be excluded
- Spinal surgery
- Infection in the spine.

**Outcome measure:**

VAS scale & Oswestry disability questionnaire

**Procedure**

After acquiring participants that fit the selection criteria, A sample of 100 individuals between the ages of 35 to 50 years were selected from Capital hospital Vijayawada. They were briefed about the study and the intervention after which their informed consent was taken. Following that, they were placed into two groups, namely Group A and Group B, each having 50 participants. Demographic information, as well as the VAS and Oswestry disability questionnaire score were collected to measure the degree of pain at the start and after the completion of the fourth week. The pre-test and post-test values are compared and evaluated statistically. And comparison is done within the groups.

**Treatment Protocol:**

Group A: Strain Counterstrain technique

Group B: Core strengthening exercises along with strain counterstrain technique.

Exercise Regime for core strengthening exercises procedure:

1. Bird Dog:

Duration: Start with 5-10 repetitions on each side, holding the position for 5-10 seconds. Gradually

increase to 10-15 repetitions with longer holds.

- Intensity: Begin on your hands and knees, extend one arm forward while simultaneously extending the opposite leg backward, maintaining a stable core and neutral spine.

- Frequency: Aim for 2-3 sets, 2-3 times per week.

2. Cat-Camel Stretch:

- Duration: Perform slow, controlled movements, going through the range of motion for 10-15 repetitions.

- Intensity: Start on your hands and knees, arch your back up like a cat, and then lower your belly and extend your spine downward.

- Frequency: Include this stretch in your routine daily or as needed for pain relief.

3. Pelvic Tilts:

- Duration: Perform 10-15 repetitions, holding the tilt for 5-10 seconds.

- Intensity: Lie on your back with knees bent, gently flatten your lower back against the floor by tilting your pelvis backward.

- Frequency: Incorporate pelvic tilts into your routine daily or as recommended by your healthcare professional.

4. Bridge:

- Duration: Start with 10-15 repetitions, holding the bridge position for 5-10 seconds. Gradually increase to 15-20 repetitions with longer holds.

- Intensity: Lie on your back with knees bent, lift your hips off the floor, engaging your glutes and core muscles.

- Frequency: Aim for 2-3 sets, 2-3 times per week.

5. Modified Side Plank:

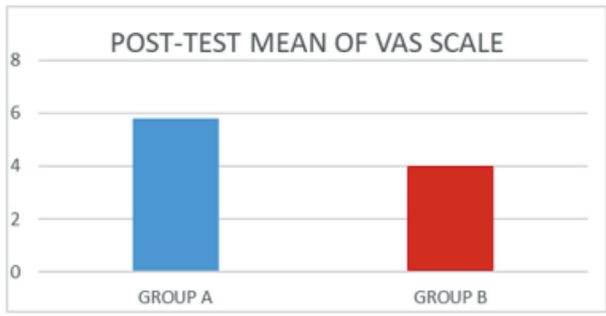
- Duration: Begin with 10-15 seconds on each side, gradually increasing to 30-60 seconds.

- Intensity: Start by lying on your side, resting on your forearm with knees bent, lift your hips off the ground, creating a straight line from your head to your knees.

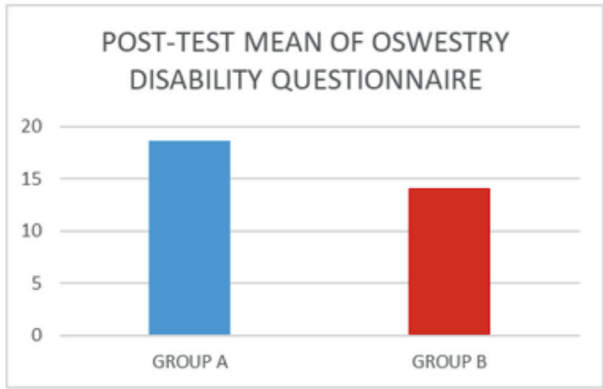
- Frequency: Include modified side planks in your routine 2-3 times per week.

**Data analysis**

The collected data were tabulated and assessed using descriptive and inferential statistics. The parameter was subjected to a mean and SD calculation. The analysis of significant variations between pre- and post-test measures were done using a paired t-test. A significant change between two groups was examined using an unpaired t-test.




**Graph-1: Comparison of post-test values of Group-A and Group-B using VAS Scale**




**Graph-2: Comparison of Post-test Mean of Group-A and Group-B using Oswestry Disability questionnaire**

## Results

When compared with the pre-assessment, the post assessment shows there is a significant decrease in the pain by using the VAS and Oswestry Disability Questionnaire. The statistical mean value of VAS scale pre intervention was 7.04 and Oswestry Disability Questionnaire was 23.5 and the mean value of VAS scale post intervention was 5.80 and Oswestry Disability Questionnaire was 18.56 with

p value less than 0.0001 .Group B the VAS scale pre intervention was 7.02 and Oswestry Disability Questionnaire was 22.5 and the mean value of VAS scale post intervention was 4.00 and Oswestry Disability Questionnaire post intervention was 14.1 with p value<0.0001. The same way the Oswestry Disability Questionnaire in both groups are analysed. The group with strain counterstrain along with core strengthening exercises shows a significant difference in the pain than the people who were given the Strain counterstrain.

The post mean value for VAS scale is 5.80 and the Oswestry disability questionnaire is 18.56 in the Strain counterstrain technique whereas the post mean value for the VAS scale is 4.00 and the questionnaire is 14.10 in the people with core strengthening exercises along with strain counterstrain technique with t values 13.7811 in VAS and 14.5395 Oswestry disability questionnaire and p value is<0.0001

## Discussion

The goal of the study is to determine whether the Strain CounterStrain Technique and core strengthening exercises are useful for treating middle-aged adults with chronic low back pain. According to a recent systematic analysis, the likelihood of experiencing low back pain for the first time in a year ranges between 6.3% and 15.3%, whereas the likelihood of experiencing low back pain at any time in a year is estimated to be between 1.5% and 36%. In many parts of the world, low back pain is the primary factor in activity restriction and work absence, and it is also connected with a significant financial burden.

According to research by ChouR et al., people with chronic low back pain (CLBP) have less muscle mass and more fatty infiltration in their lumbar extensors. Although decreases in pain and impairment following Strain-Counterstrain treatment for low back pain have been documented in case studies, Lewis and Flynn et al. (2001) claimed that there is no experimental evidence to support the use of this technique for the treatment of acute low back pain.[11]

Core strengthening exercises are simpler for patients with CLBP. Additionally, patients can freely conduct core strength training at home without any specific equipment, which is crucial because home-based exercise regimens might provide additional advantages for determined In contrast to the control group, the group given core exercises demonstrated a greater drop in pain intensity and an increase in range of motion, according to a 2014 study.[15]

Some of the exercises performed include Pelvic Bridging, Plank, Cat and Camel, Bilateral Straight Leg Raise, and other exercises that strengthen the muscles surrounding the lumbar spine. Cramping is lessened as a result of them helping to improve blood circulation. Exercises that involve aerobic activity include knee lifts, diagonal toe touches, lunges, criss-cross, and others. According to Gatti et al. (2000)[17], functional tasks that are a daily concern for CLBP patients are the primary basis for evaluating the severity of a disability. Thus, while being difficult exercises, core training and trunk balance training can lessen impairment.

In addition, the Strain-Counterstrain is referred tool of spinal manipulative therapy, The lumbar and sacral areas are passively positioned in various degrees of flexion, extension, lateral flexion, and rotation, according to Assesndelft et al. in 2003, A comprehensive study found no improvement in its efficacy in treating severe low back pain.[16] Thus, it is clear that for patients with chronic low back pain, core strengthening activities are superior to the Strain counter strain method. Pain was rated by participants on a 10-cm visual analogue scale, which has been shown to be valid and reliable According to Price et al 1983, Duncan et al 1989, and Price et al 1994, each participant's pain was summarised as the mean of three ratings on the visual analogue scale: minimum pain in the last 24 hours, current pain, and maximum in the last 24 hours. [18]According to a study by Wong CK and Schauer C (2004), patients were surveyed to examine the reliability and validity of Strain Counterstrain (SCS). All participants showed important pain reductions with the VAS in both muscle groups by the end of the research. The SCS organizations tended to reduce pain. [19]

Costa et al. established the superiority of motor control exercises over electrotherapeutic modalities used to treat chronic nonspecific low back pain. Subjects in the treatment group were treated to specific exercises targeting the activation of the transversus abdominis and multifidus. When appropriate control was developed subjects progressed to more complex functional tasks. [(20)]

The strain counter strain method has an advantage over other pain-relieving strategies such as the integrated neuromuscular inhibition method and manual pressure release. This finding had the same results showing that the Strain counter strain technique was beneficial in reducing pain but slightly different in results when combined with exercise therapy.[21]

## Conclusion

From the results obtained in the study it can be concluded that core strengthening exercises along with strain counterstrain show significant effect on chronic low back pain among middle aged people compared to the Strain-Counterstrain technique

**Ethical Clearance**: Taken from the institutional ethical committee.ISRB number 03/054/2022/ISRB/SR/SCPT

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Original Article

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# Compare the Effectiveness of Soft Tissue Mobilization and TENS with Stretching Exercises and TENS for Low Back Pain among Online Motorbike Delivery Workers

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**Abstract**

**Background:** The majority of the time that drivers are at work is spent seated this causes low back pain in motorbike riders, motor bike riders were more likely to have Low Back Pain. The workload of each workers different, according to the type of work. Workloads can be mental, physical and social.

**Purpose:** To compare the effectiveness of soft tissue mobilization and TENS with stretching exercises and TENS for low back pain among online motorbike delivery workers.

**Materials and Methods:** Total of 60 subjects were selected based on the inclusion and exclusion criteria. The detailed procedure of the study was explained to the subjects, and the informed consent form was collected. The subjects were chosen from A.K.B Physiotherapy and Rehabilitation centre. The pre and post test values were measured using the numerical pain rating scale and low back pain rating scale. The subject were allocated in to two groups soft tissue mobilization and TENS group and stretching exercises and TENS group.The study duration was 4 weeks. study period:october 2022-june 2023.

**Result:** Statistical analysis of post test result revealed that both the group show similar results but soft tissue mobilization and TENS exceeds the Stretching exercises and TENS statistically with a p value of<0.0001 .

**Conclusion:** Soft tissue mobilization and TENS is more effective than stretching exercises and TENS in reducing low back pain among online motorbike delivery workers.

**Keywords:** Soft tissue mobilization, stretching exercises, TENS, low back pain NPRS, low back pain rating scale, online motorbike delivery workers.

## Introduction

The majority of people will at some point in their lives have low back discomfort, which is a very common ailment. Depending on socioeconomic position, occupational distribution, pain perception, and other factors, the effects and outcomes of low back pain are anticipated to differ greatly within and within groups[1] Acute traumatic pain is frequently accompanied by strong muscular spasms around the damaged structures. It is frequently considered

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in clinical practice that similar responses follow non-traumatic pain[2]. The economic impact of LBP on society is primarily due to the significant number of lost working days (indirect expenses), and less so because of the high cost of direct medical care. There is a significant percentage of people with persistent LBP[3]. The majority of these illnesses are caused by a variety of mechanical causes, although other underlying pathologic pathways play a significant role[4,5]. In online transportation service work the most popular sport in the world is cycling, but bikers can sustain a wide range of motion. The majority of chronic LBP problems lack any anatomical or radiological abnormality that may be seen[6]. It is challenging to define a precise exposure-response link between Whole body vibration exposure and low back diseases due to the numerous potential causes of low back pain[7]. The effectiveness of massage treatment in treating low back pain is not backed by any research. The thorough massage therapy can help relieve acute low back discomfort. (soft-tissue manipulation, corrective exercise, and posture education), two components of massage therapy, and placebo[8,9]. To create a safe stretching program, follow these guidelines: warm up lightly before stretching exercises; use static stretching; stretch before and after a workout; start with mild exercises and progress to moderate ones; alternate exercises for different muscle groups; stretch slowly and gently until tightness rather than pain is felt[10]. Stretching out greatly expands range of motion, but it also tends to make muscles more rigid and passive tense[11]. There are three types of stretching: static, dynamic, and proprioceptive neuromuscular facilitation (PNF). The opposing muscle is normally contracted first, followed by an isometric contraction of the target muscle[12]. The evidence regarding TENS effectiveness is contradictory and has to be described as well as analyzed[13,14]. Emerging population-specific systematic reviews and meta-analyses reveal that both HF and LF TENS can relieve pain, especially when used at a strong, painless intensity[15] Many treatments are frequently prescribed for persistent back pain, but only a small number have undergone thorough analysis.[16]

## Aim

To compare the effectiveness of soft tissue mobilization and TENS with stretching exercises and TENS for low back pain among online motorbike delivery workers.

## Methods and Materials

Total of 60 subjects were selected based on the inclusion and exclusion criteria .The detailed procedure for performing the study was explained to the subjects, and the informed consent form was collected from them before starting the study. The pre and post test values were measured with the help of the low back pain rating scale and the numerical pain rating scale (NPRS).The subjects were split into two groups according to the inclusion and exclusion criteria. soft tissue mobilization and TENS (n=30) .The subject received soft tissue mobilization and TENS with frequency(50-100Hz for 30 minutes)for 3 session per week and continued for 4 week.

Stretching exercises with TENS (n=30) were given TENS with frequency(50-100Hz for 30 minutes) and stretching exercises for 3 days a week, and it was continued for 4 weeks. For each session, 3 sets and 10 repetitions were given.

**Inclusion Criteria:**

1. Both men and women
2. Age between 18-45 years
3. NPRS score between 5to10
4. Motor bike delivery workers
5. Subjects willing to participate in the study.

**Exclusion criteria:**

1. Subjects with severe trauma
2. Congenital disorder of spine
3. Patient with neurological deficit
4. Spinal surgery
5. Cervical radiculopathy
6. Tumor and shoulder disease

**Outcome Measures**

Numeric Pain Rating Scale [NPRS] : This scale has been determined to be one of the most accurate pain outcome measures available. This scale starts at 0 and ends at 10 based on the pain severity[17].

Low Back Pain Rating Scale : This scale has values from 0 to 4 which indicates the pain intensity while doing daily activities[18].

**Procedure**

The inclusion and exclusion criteria were used to choose a total of 60 subjects. The detailed procedure

for performing the study was explained to the subjects, and the informed consent form was collected from them before starting the study. The pre and post test values were measured using the numerical pain rating scale (NPRS) and low back pain rating scale .The subject willing to participate were randomly allocated in to two groups soft tissue mobilization and TENS group and stretching exercises and TENS group.

**Soft tissue mobilization and TENS group:**

The subject was mobilized in the low back region using techniques like deep tissue massage and effleurage on muscles like the quadratus lumborum, gluteus muscle, and piriformis. The patient was in the prone position, and the therapist should have been standing to the side. Deep strokes and massage were given for 30 minutes, with 20 strokes given every two minutes.With this TENS with frequency 50-100 Hz for 30 minutes in prone position for low back area was given.

**Stretching exercises and TENS group:**

The subjects treated with stretching exercises were given with TENS with frequency 50-100 Hz for 30 minutes in prone position for low back area was given.

**Child's pose:**

The individual is instructed to keep their hands and knees on the ground and to reposition their hips such that they are resting on their heels. next they walk their hands out in front as their hips fold inward and hinge. They place their belly against their thighs. palms facing down, extend arms out in front of or next to their body . They concentrate on inhaling deeply and relaxing any stiff or tense muscles. Up to a minute, they maintain this posture.

**Knee to chest stretch:**

The test subjects should lie on their backs, their feet flat on the ground, and their knees bent in both directions. Lengthen the left knee out straight or keep it bent. Holding hands behind the thigh or at the top of the shinbone, they clasp their hands together, and keep their hips from raising. Draw their right knee into their chest. They hold this position for 30 seconds to 1 minute while taking a deep breath to let go of any tension. Continue with the opposite leg.

**Seated spinal twist:**

Asking the subject to Lie down on the floor and extend both of their legs in front of you. Their left knee is bent, and they position their foot outside of their right thigh. Their left thigh's outside is where their right arm should be placed .Putting their left hand behind for stability. Turn to the left side, starting at the base of their spine. Stay in this position for up to one minute. Continue on the opposite side.

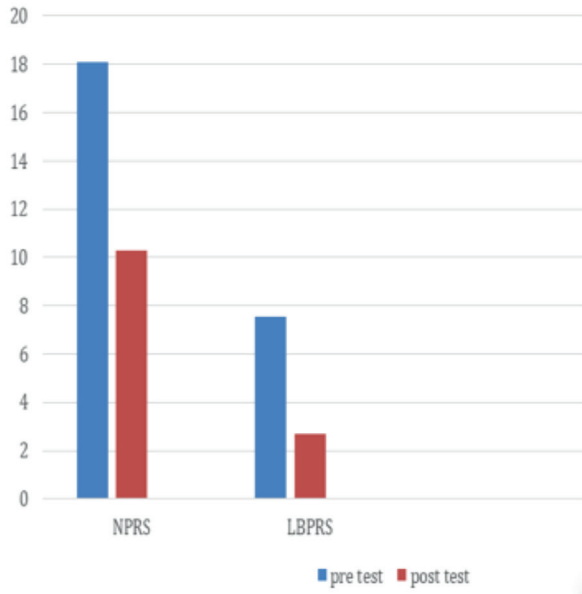
**Cat and cow:**

The subjects were positioned on all fours with their hands and knees on the ground in a tabletop configuration. Inhaling to look up, they press into their hands and feet, allowing their belly to fill with air. Exhale while tucking their chin into their chest and arching their back upward. Continue moving in this manner, moving with each breath. Spend one to two minutes doing this.

**Cobra stretch:**

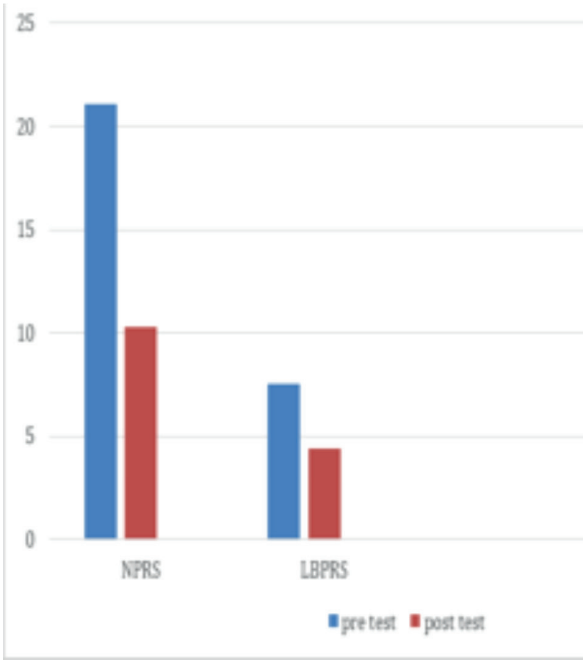
They were instructed to lay on their stomachs with their hands extended in front and palms facing down, elbows tucked under their shoulders.Separate their feet just a little bit. Lift the head and chest gently. Maintain your core and lower back strength while taking deep breaths. Gently close their eyes while pressing their pelvis onto the floor. Hold this position for between 30 and 60 seconds.

**Data Analysis**



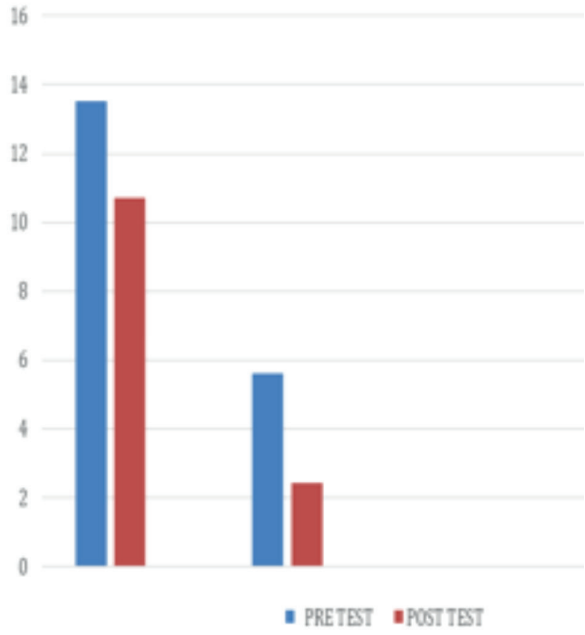

**Graph -1: comparison of pre and post test values of soft tissue mobilization and tens group.**

Interpretation: Graph -1 shows that the values are extremely statistically significant.




**Graph -2 : comparison of pre and post test values of stretching exercise and tens group**

Interpretation: Graph -2 shows that the values are extremely statistically significant.




**Graph -3: comparison between post values of soft tissue mobilization and tens with stretching exercise and tens.**

Interpretation: Graph -3 shows that the values are extremely statistically significant.

## Result

The comparison between post test values of soft tissue mobilization and TENS, using NPRS is 17.80(+4.56) and the post test values of stretching exercise and TENS using NPRS is 10.27(+3.24). and post test values of soft tissue mobilization and TENS, using low back pain rating scale is 5.67(+1.45) and the post test values of stretching exercise and TENS using low back pain rating scale is 2.67(+1.18).The results are statistically significant with p value of < 0.0001.

Statistical analysis of post test result revealed that both the group show similar results but soft tissue mobilization and TENS exceeds the Stretching exercises and TENS statistically with a p value of<0.0001.

## Discussion

The goal of the present study is to compare the effectiveness of soft tissue mobilization and TENS with stretching exercises and TENS for low back pain among online motorbike delivery workers. The comparison is demonstrated for 4 weeks and outcome results were measured using NPRS and low back pain rating scale .when the response where compared they show significant difference between the two groups. soft tissue mobilization and TENS shows greater effect than stretching exercises and TENS

In soft tissue mobilization and TENS group pre-intervention mean of low back pain rating scale was 22.60(+4.73) and NPRS was 7.53(+1.60).After treating the subject, the mean value of low back pain rating scale and NPRS is decreased to 17.80(+4.56) and 5.67(+1.45), which shows difference between the groups that is statistically significant. In stretching exercises and TENS group pre-intervention mean of low back pain rating scale was 21.07 (+4.89) and NPRS was 7.53(+1.60).After treating the subject the mean value of NDI and NPRS is decreased to 10.27(+3.24) and 2.67(+1.18), which shows statistically significant difference between the groups.

Based on the statistical analysis, both groups showed improvement. The subject treated with soft tissue mobilization and TENS showed better improvement in low back pain rating scale and Numerical pain rating scale than the subjects in stretching exercises and TENS group.

An early study by Rachmat N(2020) has concluded that Low back pain is common in motorcyclists. Age, time spent riding per day and position change

were the factors found considerably higher among motorcyclist students suffering from low back pain[19].

An early study byRoshani Gautam(2023)has concluded that It is recommended that there should be some government regulations for the working hours and other safety measures for the ride sharing company[20]

## Conclusion

According to the study both soft tissue mobilization with TENS and stretching exercises with TENS reduces the low back pain in online motorbike delivery workers. The finding suggests that soft tissue mobilization with TENS is more beneficial and lowers the low back pain in online motorbike delivery workers.

**Ethical Clearance:** Taken from institutional ethical committee. ISRB number 03/055/2022/ISRB/SR/SCPT

**Funding:** Self

**Conflict of Interest:** Nil

**ISRB approval:** This research work has been approved by ISRB committee.

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Original Article

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# Effectiveness of Interferential Therapy with Hip Muscle Strengthening Exercises and Ultrasound Therapy with Hip Muscle Strengthening Exercises for Piriformis Syndrome

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**Abstract**

**Background:** Sciatic nerve irritation caused by the piriformis muscle ,which results in Buttock pain, sciatica, or both is known as piriformis syndrome. The prevalence of PS with sciatic nerve piercing is 17% and 81% respectively, while it was present in 17.2% suffering from low back discomfort.

**Purpose:** The purpose of this study is to find the effectiveness of interferential therapy with hip muscle strengthening exercises and ultrasound therapy with hip muscle strengthening exercises for piriformis syndrome.

**Materials and Methods:** About 220 participants were selected by using FAIR test and visual analogue scale on inclusion and exclusion criteria. Written informed consent was collected before the commencement of the study. The 220 participants were allocated into 2 groups. Interferential therapy group (n=110) and ultrasound therapy group (n=110). Interferential therapy group were given interferential therapy with hip muscle strengthening exercises and the ultrasound therapy group were given ultrasound therapy with hip muscle strengthening exercises. The intervention was given 5 times a week for a total duration of 2 weeks. Study Period: October 2022-June 2023.

**Results:** The collected data was statistically analyzed using paired and unpaired t test, when comparing the Interferential therapy group to the ultrasound therapy, the Interferential therapy group indicates significant effects $P<0.0001$ in piriformis syndrome, as assessed by VAS.

**Conclusion:** This study concluded that the Interferential therapy group was found to be more effective than the ultrasound therapy group in patients with Piriformis Syndrome.

**Key Word:** Sciatic nerve, VAS, Buttock Pain, Stretching, FAIR test.

## Introduction

Sciatic nerve irritation caused by the piriformis muscle, which results in buttock pain, sciatica, or both, is known as piriformis syndrome. Intimate connections exist between the sciatic nerve and the piriformis muscle, with the sciatic nerve typically

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emerging from the pelvis below the muscle at the greater sciatic notch[1]. The causes of piriformis syndrome includes sciatic nerve compression, microtrauma, injury, swelling, muscle spasm, local ischemia[2].

In addition to piriformis tenderness, and a positive straight leg raise sign, the symptoms also include weakness and gluteal atrophy[3]. Patients commonly report greater pain after sitting for more than 15 to 20 minutes [4]. In a general population survey, it was discovered that PS happens 12.2-27% of the time over the course of a lifetime and 2.2-19.5% of the time over the course of a year. Three times more Women than men experience piriformis syndrome. The prevalence of PS with sciatic nerve piercing is 17% and 81%, respectively, while it was present in 17.2% suffering from low back discomfort [5].

The diagnosis of piriformis syndrome was made using the Flexion Adduction Internal Rotation (FAIR) test [6].

The two therapeutic modalities that are most frequently employed are ultrasound and interferential therapy.

Electrotherapy in the form of interferential therapy completes a nerve block, helping to retrain the pain receptors and reduce the muscle spasm. Two medium-frequency currents with marginally different frequencies interfere with one another to provide the therapeutic effects of interferential treatment. Circuits A and B, -which conduct current at 4000 Hz and 3980 Hz respectively, provide a low frequency of 20 Hz, which is very helpful in pain modulation [7].

In order to minimize edema and inflammation in a particular location, ultrasound therapy aids in improving the blood flow to that area. High-frequency sound waves, such as ultrasound, have a frequency between one and three MHz [8].

Due to the weakening of the hip abductor and extensor muscle group, the piriformis muscle is overloaded, which causes it to shorten and finally compress the sciatic nerve. It is therefore necessary to strengthen such muscles in order to lessen the strain on the piriformis muscle. The exercises which include, hip abductor strengthening exercises are side lying leg raise, step up to knee raise, banded jumping jacks, bridge with banded abduction, Hip extensor strengthening exercises are glute bridge, jump squat, walking lunge, standing hip extensor exercise [9]. The Visual Analogue Scale (VAS), a method for quantifying pain, is used to assess pain intensity. Before, during, and after the course of treatment, the scores were recorded. With 10 points, the Visual analogue scale (VAS) has a range of 0 to10 . 0n a scale of 0 to 10,where 0 is no pain,10 is considered the worst possible pain[10].

## Aim

To find the effectiveness of interferential therapy with hip muscle strengthening exercises and ultrasound therapy with hip muscle strengthening exercises for piriformis syndrome

## Materials and Method

- Interferential therapy
- Ultrasound therapy
- Theraband
- Yoga Mat

This study was conducted in the saicharan physio centre, Murugappa street, Arakkonam, tamilnadu-631001 for piriformis syndrome patients. About 220 participants were selected based on inclusion and exclusion criteria. This study includes both male and female, age groups from 30-60 years. Written informed consent was obtained. Participants willing to participate were split into two groups: Interferential therapy group and ultrasound therapy group.

**Inclusion criteria**

- Subjects with age group of 30-60 years
- Both male and female are included
- Gluteal pain with or without radiation through sciatic nerve pathway
- Lumbosacral radiculopathy

**Exclusion criteria**

- Previous surgical history involving lumbar and or hip region
- History of buttocks or hip infection
- Malignancy

- Diabetic neuropathy
- Vascular disease

**Outcome measure**

- VAS (Visual Analogue Scale)

**Procedure**

The study was conducted in the saicharan physio centre, Murugappa street, Arakkonam, tamilnadu - 631001 for piriformis syndrome patients. About 220 participants were selected based on inclusion and exclusion criteria. This study includes both male and female, age groups from 30-60 years. Written informed consent was obtained. Participants willing to participate were randomly alloted into two groups Interferential therapy group and ultrasound therapy group. Participants underwent Visual Analogue Scale (VAS) scores will be assessed before the initiation of the treatment and after the two weeks of treatment.

**A. Modality:**

- **Interferential therapy Group**

The patient was positioned Prone lying and carefully inspected. The Power duration and dose were both set to zero before turning on. Furthermore, the patients were instructed to report any discomfort of 20Hz was administered for ten minutes. Treatment was administered three times a week.

- **Ultrasound therapy group:**

The patient was positioned Prone lying and carefully inspected. The Power duration and dose were both set to zero before turning on. Furthermore ,the patients were instructed to report any discomfort or extreme heat ultrasound therapy of 3MHz (approximately 1.5 intensity) was administered for ten minutes. Treatment was administered three times a week.

**B. Exercises:**

**Hip muscle strengthening Exercises for both the groups**

- **Hip abductor strengthening exercises are:**

**1. Step up to knee raise:**

The participant was asked to step on the foot stool using their right foot drive their left knee up towards their chest and up to hip height, then the participant asked to step onto the foot stool with right foot then step the right foot to ground and return to starting position after bringing their left foot back to the ground under control. The exercise is performed for 10 reps for 3 sets [11].

**2. Side lying leg raise:**

The participant was instructed to lay on his left side with the legs straightened out and used his left hand to hold the head high and then advised to lift the leg for 45 degrees and let it down. That is one repetition. patient advice 10 times on the other side also[11].

**3. Banded jumping jacks:**

The participant asked to wrap his ankles with a little band. and his feet should be around hip , and while standing in a quarter-squat stance, their hands should be at their chest. Participants advised to jump the feet out and back in landing each time with a gentle foot. Exercise repeated for 10 times [11.]

**4. Banded bridge abduction:**

The participant instructed to looping a mini band or tying an exercise band around their thighs just above the knee, the participant advised to Keep their heels planted on the ground at roughly shoulder distance apart and then advised to lift the pelvis to bridge the body and to contract the glutes. keep the spine neutral and core braced.at the peak of the movement the participants advised to spread the knees apart while keeping the heels planted to stretch the band and then slowly asked to come back to neutral and lower the pelvis[11].

- Hip extensor strengthening exercises are:

**1. Jump squat:**

The participant instructed to place the feet hip distance apart as their stand and the toes facing forward, hold a sandbag in front of their chest with both hands. The participant advised to bend the knees and push the hip back until thighs are parallel to the floor while maintaining a flat back and an upright posture. When they delicately touch the ground, quickly squat down to start the next repetition[11].

**2. Glute bridge:**

The participant instructed to supine lying and advise the patient to bend the legs and arms. The feet should be apart by hip-width. Holding the dumbbell across the hip increase 12 to 16 inches should separate the feet from their butt. Squeeze the glutes, stabilize the core, and drive into heels to lift the pelvis. Lift body high enough for knees to meet the shoulders in a straight line. After holding for 30 seconds, return hips to the ground. One repetition equals this finish 2-3 sets of 10 repetitions [11].

**3. Walking lunge:**

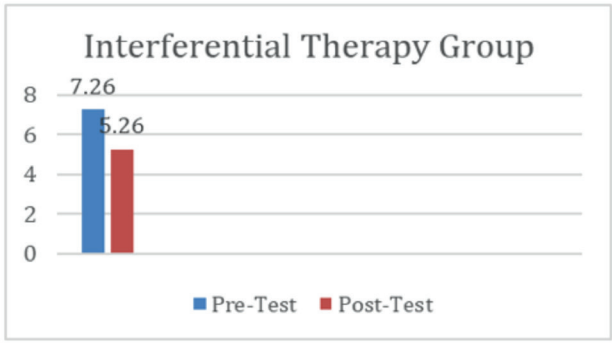
The participant instructed to hold two dumbbells at arm's length by sides, take a tall stance with the feet hip-width apart as much as possible, move forward with their right foot, bending both knees until the front thigh is parallel to the ground and the knee is 90 degrees bent. Stop for a moment. In order to step into the subsequent lunge, push through the left foot. Make sure the participant performs an equal number of steps or repetitions on each leg, continue rotating legs with each step[11].

**4. Standing hip extensor exercise:**

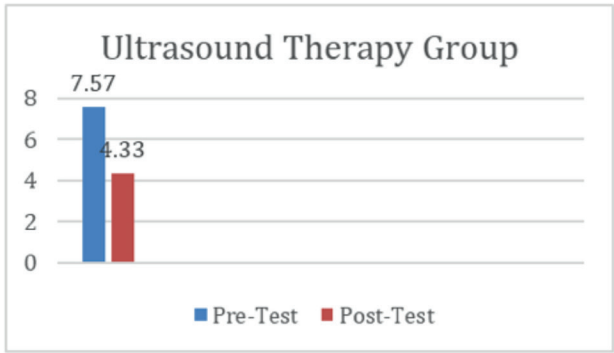
The participant instructed to stand with the heels together and toes slightly turned out, stand tall with hands on the hips. Reposition the right foot so that the big toe is gently on the ground, the participant heel is somewhat inward. Squeezing their right glute, elevate their right leg as high as. The participant advised to maintain a tall torso. Resuming where left off, softly tap their right foot's toes on the ground, then repeat. Equalize the repetitions on both sides[11].

**Data Analysis**

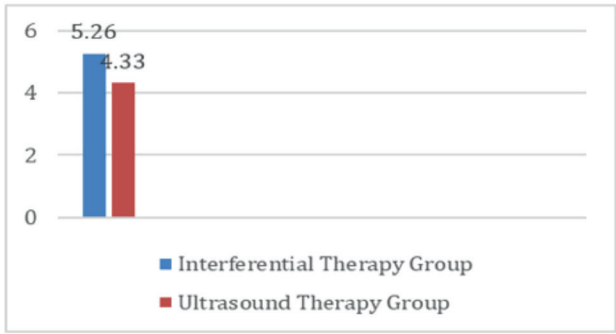
For this study, 220 participants with piriformis syndrome of male and female between the age of 30 to 60 were selected. The participants with pain measured by VAS before and after the treatment to provide pre-test and post-test values respectively.




**Graph-1: Comparison of pre-test and post-test values of VAS in Interferential therapy Group**




**Graph-2: Comparison of pre-test and post-test values of VAS in Ultrasound therapy Group**




**Graph-3: Mean value of VAS Comparison between interferential therapy with hip muscle strengthening exercises and ultrasound therapy with hip muscle strengthening exercises**

## Result

Visual Analogue Scale scores were assessed before the initiation of the treatment after the treatment for taking pre-test and post-test values respectively.

The VAS post-test mean value in the interferential therapy group was 5.26 (+1.19) while it was 4.33(+1.02) in the ultrasound therapy group. This indicates that the interferential group VSA Scores significantly

higher than the ultrasound therapy group, with a P<0.0001.(Table-3)

Statistical analysis of the VAS post-test results revealed that the interferential therapy group and ultrasound therapy group showed similar statistically significant differences. As a result, the interferential therapy group is better than the ultrasound therapy group in relieving pain using the VAS scale.

## Discussion

The VAS post-test mean value in the interferential therapy group was 5.26 (+,1.19) while it was 4.33(+1.02) in the ultrasound therapy group. This indicates that the interferential group VAS scores significantly higher than the ultrasound therapy group, with a P value of <0.0001.

Based on the statistical analysis, both groups showed improvement in visual analogue scale (VAS). However, subjects in interferential therapy group who received interferential therapy with hip muscle strengthening exercise showed better improvement in VAS than the subjects in the ultrasound therapy group who received ultrasound therapy with hip muscle strengthening exercise. Similar results were found in previous studies.

Clipa Adriana et. al 2012 concluded that the optimal technique of treatment involved an individually designed physical programme based on the severity of functional lumbar deficit and level of lumbar discomfort. At the end of 11 days of treatment, they observed an improvement in the pain score for 70% of patients with a reduction of at least 2 points on the VAS, an improvement in articular mobility for the lumbar spine for 21 patients, and a negative result for the straight-leg raising test in 12 patients (63%) of the patients. They believe that physical therapy programmes are the first choice in terms of effectiveness and speed in reducing sciatica pain, despite the fact that this study only involved only a few patients, given the range of conditions that can cause it, the wide age differences between patients, and the different lengths of sciatica episodes[12].

O Kenechi Nwaka et. al 2017 concluded that with no post-procedure problems, all 221 US-guided subgluteal sciatic nerve injections were technically successful. Patients who underwent follow-up reported symptom alleviation in 68% of cases. Most individuals who saw no improvement had subpar preoperative screening[13].

Ibrahim M Moustafa, Aliaa A Diab 2013 Concluded that the lumbar extension traction in addition to interferential therapy and hot packs showed more improvement with lumbosacral radiculopathy.[14]

## Conclusion

This study concludes that both the intervention with exercises used in the present study i.e., Interferential therapy with hip muscle strengthening exercises and ultrasound therapy with hip muscle strengthening exercises are effective in reducing pain, reducing disability. However, Interferential therapy with Hip muscle strengthening exercises is more beneficial than ultrasound therapy with hip muscle strengthening exercises in reducing pain and improving functional status of people with Piriformis syndrome.

**Ethical clearance**: Taken from Institutional ethical committee. ISRB number-03/056/2022/ ISRB/SR/SCPT

**Funding**: Self

**Conflict of Interest**: Nil

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Original Article

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# Comparison of Low Level Laser Therapy with Cryostretch and Ultrasound Therapy with Cryostretch among Individuals with Upper Trapizitis

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**Abstract**

**Background:** One of two important superficial muscles, the trapezius extends laterally to the scapular spine and longitudinally from the occipital bone to the lower thoracic vertebrae.Scapulae movement and arm support are two of its roles.

**Purpose:** To determine and compare the effect of low level laser therapy with cryostretch and ultrasound therapy with cryostretch in upper trapizitis patient.

**Materials and Methods:** A total of 322 subjects were selected randomly based on inclusion and exclusion criteria. Written informed consent obtained from the participants who met a pre-defined inclusion and exclusion criteria. History of pain was collected from the patient. In this study, the samples were randomly divided into two groups and group A had a low level laser therapy with cryostretch and group B had a ultrasound therapy with cryostretch. Treatment was administered for weeks three times a week.

**Results:** The statistical analysis of the data using paired and unpaired t-tests revealed a substantial improvement in the participants who received cryostretch ultrasound therapy.

**Conclusion:** The study concluded that ultrasound therapy with cryostretch was more effective in reducing the pain when compared to low level laser therapy with cryostretch in patient with upper trapizitis.

**Key Word:** Ultrasound,Low Level Laser therapy, Upper trapizitis, Numerical Pain Rating Scale(NPRS), Neck Disability Index(NDI).

## Introduction

One of two important superficial muscles, the trapezius extends laterally to the scapular spine and longitudinally from the occipital bone to the lower thoracic vertebrae. Scapulae movement and arm support are two of its roles. The descending, ascending, and intermediate trapezius regions are all functioning. By attaching to the clavicle and scapula and controlling the cervical spine through muscle, the muscle contribute to the rhythm of the scapulo-humeral joint.

Symptoms include a headache with tension in the temples, eye pain, a stiff neck, limited range of motion, and a sensitivity to weight on the shoulder.

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For both working men and women, neck pain has been the most prevalent primary complaint1. Treatment for trigger points in the trapezius involves myofascial release. It works by releasing the tension in the tightened muscle and enhances lymph drainage and circulation. It affects connective tissue viscoelastic characteristics. It corrects the alignment of the muscles. Ice has been utilized as a form of treatment for a very long time.

The most often utilized substance for musculoskeletal injury testing is ice. Vasoconstriction, decreased tissue metabolism, reduced oxygen uptake, inflammation, and muscular spasm are among side effects of cryotherapy. After releasing a trigger point, stretching the muscle prolongs pain alleviation[2].

Numerous approach can be used to treat myofascial pain, including manual therapy, acupuncture, stress management, electrotherapy, body mechanics and ergonomic training, dietary counselling, and various pharmaceutical management techniques[3].

Upper trapezius muscle involvement is mostly indicated by neck pain that is frequently felt in the back of the neck and between the bases of the neck and shoulder. At some point in their life, around two-thirds of people will have neck pain. Upper trapezius spasm patients have received medical and physical therapy care for a sizable portion of their cases[7].

## Aim

To find the comparison between low level laser therapy with cryostretch and ultrasound therapy with cryostretch in patient with upper trapizitis.

## Material and Method

A total of 322 subjects were selected randomly based on inclusion and exclusion criteria**.** Written informed consent obtained from the participants who met a pre-defined inclusion and exclusion criteria. History of pain was collected from the patient. In this study, the samples were randomly divided into two groups and group A had a low level laser therapy with cryostretch and group B had a ultrasound therapy with cryostretch.Treatment was administered for weeks three times a week.

**Inclusion criteria:**

- Upper trapezius pain
- Gender: male and female
- Age group: 25 to 45 years of age
- Myofascial Trigger Point in upper trapezius

**Exclusion criteria:**

- Myofascial Trigger Point injection in prior 6 month
- Shoulder surgery
- Fibromyalgia
- Cervical radiculopathy

**Outcome measures:**

Assessment was performed at baseline (before starting of treatment) and after four weeks of study.

- Numeric Pain Rating Scale [NPRS]
- Neck Disability Index[NDI]

**Procedure**

A total of 322 subjects were selected randomly based on inclusion and exclusion criteria. Written informed consent obtained from the participants who met a pre-defined inclusion and exclusion criteria. History of pain was collected from the patient. In this study, the samples were randomly divided into two groups and group A had a low level laser therapy with cryostretch and group B had a ultrasound therapy with cryostretch.

**Group A: Low Level Laser Therapy with Cryostretch Group**

The patient was positioned (sitting) and carefully inspected. The power duration and dose were both set to zero before turning on. Furthermore, the patients were instructed to report any discomfort or extreme heat. A single wavelength of light is produced by low level laser therapy, which is a non-invasive light source treatment. It produces no heat, noise, or vibration. Depending on the patient's sensitivity, low-level laser therapy between 600 and 1070 nm was administered for ten minutes and cryotherapy for 2mins. Treatment was administered for weeks three times a week.

**Group B: Ultrasound Therapy with Cryostretch Group**

The patient was positioned (sitting) and carefully inspected. The power duration and dose were both set to zero before turning on. Furthermore, the patients were instructed to report any discomfort or extreme heat ultrasound therapy of 3MHZ(approx. 1.5 intensity) was administered for ten minutes and cryotherapy for 2mins. Treatment was administered for weeks three times a week.

Both group were treated with following exercises with 10 repetitions and 2 sets

- Ear to Shoulder Stretch
- Crocodile Stretch
- Cobra Stretch
- Cat and Camel Stretch
- Self hug Stretch

**Ear to Shoulder Stretch**

Position: Sitting

The subjects were instructed to cross their legs on the floor and stretch their spine. Subjects were told to keep their hands clasped behind their back, move them toward their right hip. As they exhale then tuck their right ear gently towards their right shoulder.

**Crocodile Stretch**

Position: Prone lying

The subject were instructed to tuck their hands beneath their head as they lay on their stomach on the floor. They were told to relax their head over the right hand and close their eyes, ask to place their right palm on top of the left palm on the ground.Ask the subjects to extended their leg as much as feasible.

**Cobra Stretch**

Position: Prone lying

The subjects were instructed to lie down on the mat, straighten their legs, and place their hands on the ground,palms facing down,They were told to slowly elevate their upper backs while pressing their hips into the mat and keeping their head and neck in a neutral position.

**Cat and Camel Stretch**

Position: Squat

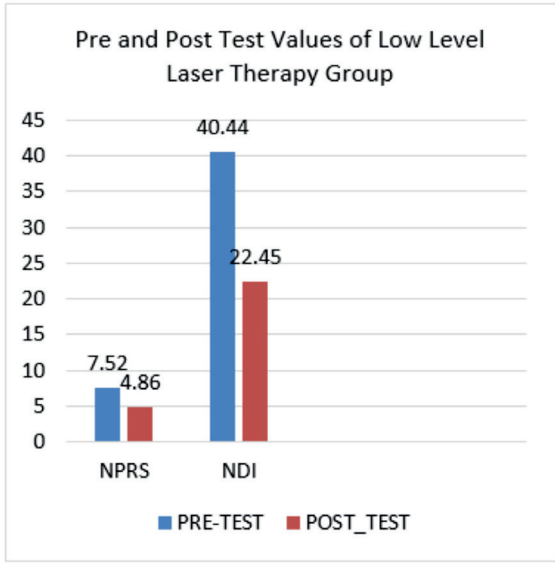
The subjects were instructed to squat on the ground. They were told to slowly elevate their upper backs while pressing their hips into the ground and turn their back up toward the ceiling and stretch for 15 to 30 sec.

**Self Hug Stretch**

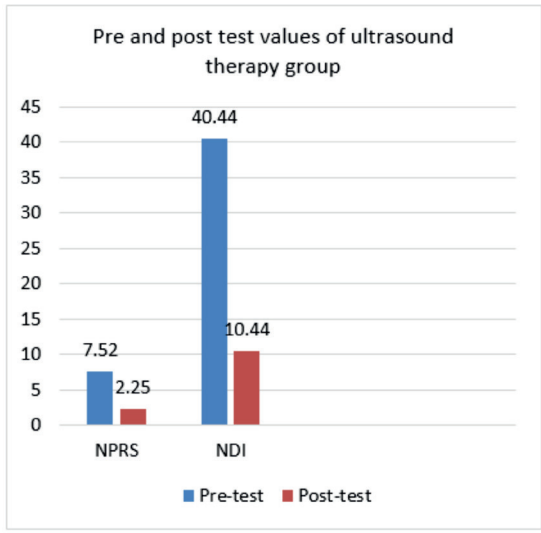
Position: Standing

The subjects were instructed to stand straight and hold their arms out to the sides of their body at shoulder height. They were told to straighten their arms and hold their upper torso in both of their arms.

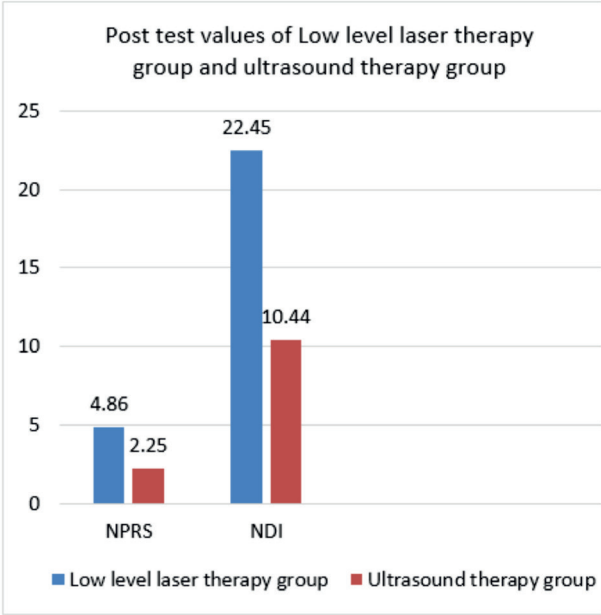
**Data Analysis**




**Graph 1: Comparison of Numerical Pain Rating Scale and Neck Disability Index Between Pre-test and Post-test values within the Low level laser therapy with cryostretch group**




**Graph 2: Comparison of Numerical Pain Rating Scale and Neck Disability Index Between Pre-test and Post-test values withnin Ultrasound therapy with cryostretch group**




**Graph 3: Comparison of Numerical Pain Rating Scale and Neck Diability Index Between Post-test values within the low level laser therapy with cryostretch group and Ultrasound therapy with cryostretch group**

## Result

The NPRS Post test mean value in the low level laser therapy group was 4.86, while it was 2.25 in the ultrasound therapy group. This indicates that the low level laser therapy group NPRS scores were significantly higher than the ultrasound therapy group with the P-value of <0.0001

The NDI Post test mean value in the low level laser therapy group was 22.45 whereas the ultrasound therapy group was 10.44. This indicate that the low level laser therapy group NDI score were significantly higher than the ultrasound therapy group with the P-value of <0.0001

Statistically analysis of the NPRS And NDI post test result revealed that the Low level laser therapy group and ultrasound therapy group showed similar statistically significant differences. As a result, the ultrasound therapy group exceeds the low level laser therapy group statistically.

## Discussion

The goal of the present study is to compare the effectiveness of low level laser therapy with cryostretch and ultrasound therapy with cryostretch in management on upper trapizitis.and also to assess the effectiveness in terms of reducing pain and improving neck function.This comparision is demonstrated with duration of 4 weeks.The outcome result were measured by NPRS and NDI scale before and after treatment.Beneficial effect were significantly greater in Ultrasound therapy with cryostretch than the low level laser therapy with cryostretch.When the response was compared between both groups, the result showed a significant difference in ultrasound therapy with cryostretch group than low level laser therapy with cryostretch group.

In Low level laser therapy with cryostretch group pre-intervention mean of NPRS was 7.52 and NDI was 40.44. After treating the subject with low level laser therapy with cryostretch, the mean value of NPRS and NDI is decreased to 4.86 and 22.45, which shows statistically significant difference between the groups.

In Ultrasound therapy with cryostretch group pre-intervention mean of NPRS was 7.52 and NDI was 40.44. After treating the subject with Ultrasound therapy with cryostretch, the mean value of NPRS and NDI is decreased to 2.25 and 10.44, which shows statistically significant difference between the groups.

Based on the statistical analysis, both group showed improvement in NPRS and NDI. However, the subject in Ultrasound therapy with cryostretch group who received Ultrasound therapy with cryostretch showed better improvement in NPRS and NDI than the subjects in the low level laser therapy with cryostretch group who received low level laser therapy with cryostretch.

An early study by M. Priyanka and T. G. Tilak Francis et.al.(2017) revealed that dry needling therapy is more successful than cryotherapy in treating the tigger point of the upper trapezius muscle in terms of decreased pain intensity and increased range of motion[17].

An early study by Mayuriparab, Njlima bedekar et. al.(2020) revealed that Myofascial release and cryostretch were both shown to be beneficial in lowering pain . When compared to cryostretch, the myofasial release immediately improved cervical lateral flexion range of motion more[18].

An early study by Priyakannan et.al.(2012) study that laser therapy can be a useful treatment plan for treating myofascial trigger points and minimising the disability brought on by musculoskeletal dysfunction[21].

An early study by MA Yildirim, O Kadriye et.al. (2018) study that due to its non-invasive nature, lack of discomfort, and ease of usage, ultrasound therapy can be utilized to treat trigger points in patients who choose not to have injectable therapy[20].

An early study by Ebrullbulbu, Aysegul Cakmak et. Al(2004) study that Because of its noninvasiveness, simplicity, and short-term administration, laser therapy may be helpful as a therapeutic option for myofascial pain syndrome[19].

An early study by Walaa Abu Taleb, Aliaa Rehan Youssef et. Al(2016) revealed that pressure release utilizing an algometer on the upper trapezius myofasial trigger points quickly increased passive coontralateral side-bending ranges when compared to placebo and myofasial pressure release, but active range only improved when compared to placebo[9].

An early study by Haytham M El-Hafez, Hend A Hamdy et. Al(2020) revealed that subjects with upper trapezius trigger points can benefit from instrument assisted soft tissue mobilization and stripping massage treatments to reduce their pain and improve their function[8].

## Conclusion

This study concludes that the both the techniques used in the current study that is low level laser therapy with cryostretch and ultrasound therapy with cryostretch, are helpful for lowering pain increasing range of motion and reducing disability. However,ultrasound therapy with cryostretch is superior than low level laser therapy with cryostretch in individuals with upper trapizitis.

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Original Article

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# To Compare the Effect of Ischemic Compression versus Dynamic Stretching Exercises on Pain in Subjects with Upper Trapezitis

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**Abstract**

**Background:** The most prevalent musculoskeletal ailment is trapezitis, which primarily affects the upper trapezius muscle due to overuse or strain.

**Purpose:** The purpose of this study is to find out the effect of ischemic compression and dynamic stretching exercises on pain in subjects with upper trapezitis.

**Materials and Methods:** A total of 40 subjects were chosen from Neha Clinic and assigned to two groups, namely the ischemic compression group along with Transcutaneous Electrical Nerve Stimulation (TENS) (n=20) and the dynamic stretching exercises group along with TENS (n=20), based on inclusion and exclusion criteria. Visual analog scale (VAS) and cervical range of motion (CROM) were used as outcome measures. The entire process was performed from November 2022 to April 2023.

**Result:** The mean value of ischemic compression at the post-test was found to be higher than the mean value of dynamic stretching exercises, with a p-value of less than 0.0001

**Conclusion:** The findings of this study suggest that ischemic compression is more effective than dynamic stretching exercises in reducing pain associated with upper trapezitis.

**Keywords:** Transcutaneous Electrical Nerve Stimulation (TENS), upper trapezitis, Visual Analog Scale (VAS), Cervical Range of Motion (CROM).

## Introduction

The trapezius muscle is a large back muscle that resembles a trapezoid in shape.[1] It extends laterally from the spine of the scapula and descends from the outward protrusion of the occipital bone to the lower thoracic vertebrae. As one of the postural muscles, the trapezius is susceptible to overloading.[2] Upper trapezitis commonly arises from overuse or strain of the trapezius muscle.

Ischemic compression is a technique that applies continuous digital pressure to trigger points using an acceptable force. When the ischemic pressure is released after 8 to 20 seconds, the local area experiences improved blood circulation, increased oxygen supply, and enhanced nutrient delivery.[3]

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Dynamic stretching exercises can improve flexibility, range of motion, muscle tightness, and blood flow. It can positively influence force and power when performed for longer durations, potentially enhancing performance.

## Aim

To find out the effect of ischemic compression and dynamic stretching exercises on pain in subjects with upper trapezitis.

## Material and Method

It was a comparative study which included 40 subjects with upper trapezitis, age between 18-30 years. Convenient sampling with random allocation method was done in this study. The entire process was performed from November 2022 to April 2023.

**Inclusion criteria:**

- Individuals diagnosed with upper trapezitis.
- Age range between 18 and 30 years.
- Presence of palpable trigger points in the upper trapezius muscle.
- Positive jump sign during clinical examination. Age

**Exclusion criteria:**

- History of intervertebral disc prolapse.
- Previous cervical spine fractures.
- Diagnosis of cervical radiculopathy.
- Severe pain with a score above 8 on the VAS.

**Outcome measures:**

Assessment was done before and after the end of 8 weeks of study.

- Visual analog scale (VAS) to assess the pain.

It involves a straight line with end points representing different levels of a subjective experience, such as pain, anxiety, or overall well-being.

- Cervical range of motion (CROM) to assess the lateral flexion. It used to assess the movement and flexibility of the cervical spine.

**Procedure**

A sample size of 40 participants was included in this study based on a randomization method. Prior to their involvement, subjects provided written consent by signing a consent form. The participants in the ischemic compression group received ischemic compression for pain relief, consisting of 9 sets performed three days per week over a two-week period. Additionally, they received Transcutaneous Electrical Nerve Stimulation (TENS) for 10 minutes in each session, with a total of four sessions per week.

On the other hand, the participants in the dynamic stretching group engaged in dynamic stretching exercises, which involved performing two sets of 15 repetitions for five different stretches. These exercises were conducted over a two-week duration. Similar to the ischemic compression group, they also received TENS for 15-30 minutes during each session, with a total of four sessions per week.

These protocols were implemented to assess the effects of ischemic compression and dynamic stretching exercises, combined with TENS, on pain reduction in individuals with upper trapezitis.

**Group A: Ischemic compression:**

Positioning: Participants were comfortably seated. Pressure: Direct pressure was applied to the trigger point using fingers. Pressure was initially moderate and gradually increased to a tolerable level. Duration: Each compression session lasted from 30 seconds to 2 minutes. Sensation: Participants reported experiencing a satisfactory sensation during the compression. Adequate rest periods were provided between successive treatments.

**Group B: Dynamic stretching exercises:**

**Side flexion stretch:**

Starting position: Participants were seated with their feet shoulder-width apart and arms in a relaxed position. Targeted side: The desired site on the upper trapezius was identified. Execution: Participants tilted their head to the opposite side of the targeted upper trapezius muscle, elongating the neck while avoiding lowering the shoulder. A gentle stretch was applied along the side of the targeted upper trapezius. Duration: The stretch was held for 15-30 seconds. Return to starting position: Participants brought their head back to an upright position and lowered their arm back down to their side. Frequency and repetitions: The stretch was repeated 2-3 times on each side.

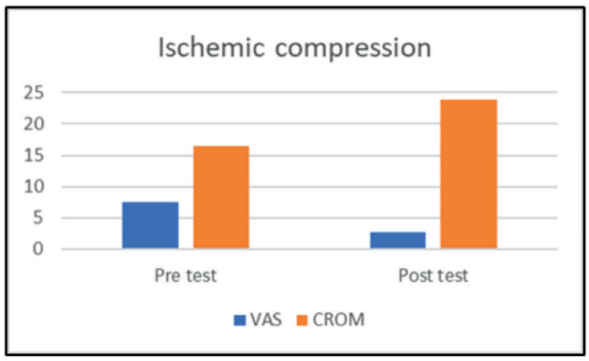
**Lateral flexion stretch:**

Starting position: Participants were seated with their feet shoulder-width apart and arms in a relaxed

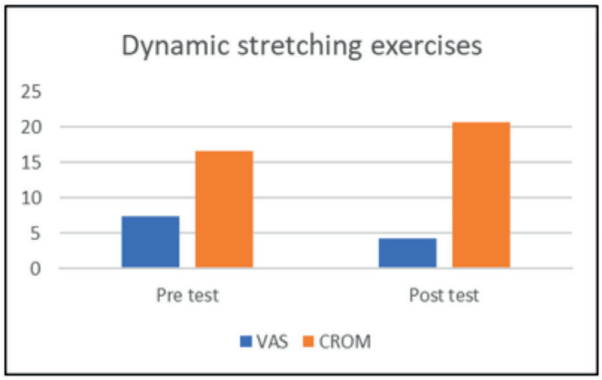
position. Stretching movement: Participants tilted their head to the side, bringing their ear closer to the shoulder. A gentle stretch was applied along the side of the neck and upper trapezius, beginning with the affected side. Hand placement: The hand was placed on the opposite side of the head, applying slight downward pressure. Duration: The stretch was held for 15-30 seconds. Return to starting position: Participants brought their head back to an upright position and lowered their arm back down to their side. Frequency and repetitions: The stretch was repeated 2-3 times on each side. Return to starting position: Head is brought back to an upright position. Arm is lowered back down to the side.

**Data analysis**

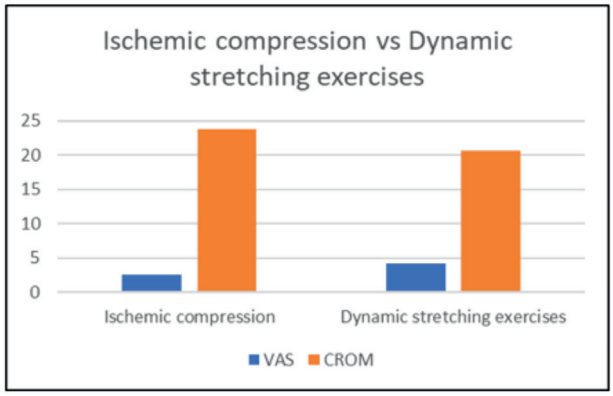
Using descriptive and inferential statistics, the data collected were tabulated and analyzed. The mean and standard deviation (SD) were applied to all parameters. The significant differences between the ischemic compression group and the dynamic stretching exercises group were analysed using an unpaired t-test. A p-value of <0.0001 was known to be statistically significant.




**Graph - 1 shows that the values are extremely statistically significant**




**Graph - 2 shows that the values are extremely statistically significant**




**Graph - 3 shows that the values are extremely statistically significant.**

## Result

The study examined the effects of ischemic compression and dynamic stretching exercises on pain (assessed by VAS) and range of motion (assessed by CROM) in individuals with upper trapezitis. The pre-test and post-test values of VAS and CROM were analysed for Group A (Ischemic Compression) and Group B (Dynamic Stretching Exercises).

The mean VAS score significantly decreased from 7.45 to 2.65 in Group A and from 7.45 to 4.25 in Group B, indicating a reduction in pain intensity. Similarly, the mean CROM significantly increased from 16.5 to 23.8 in Group A and from 16.5 to 20.6 in Group B, indicating an improvement in range of motion.

Graph 1 visually represents the comparison of pre-test and post-test values of VAS for Group A and Group B, demonstrating a substantial reduction in pain intensity after the interventions.

The mean VAS score was significantly lower in Group A (2.65) compared to Group B (4.25), indicating a greater reduction in pain intensity in Group A.

Graph 2 illustrates the comparison of post-test values of CROM for Group A and Group B. Group A exhibited a higher mean CROM (23.8) compared to Group B (20.6), suggesting a greater improvement in range of motion in Group A.

The mean CROM was significantly higher in Group A (23.8) compared to Group B (20.6), indicating a more pronounced improvement in range of motion in Group A.

Graph 3 represents the comparison of post-test values of VAS for Group A and Group B, indicating a greater reduction in pain intensity in group A.

In conclusion, both ischemic compression and dynamic stretching exercises resulted in significant improvements in pain reduction and range of motion in individuals with upper trapezitis. However, Group A (Ischemic Compression) showed superior outcomes in terms of pain reduction (VAS) and range of motion (CROM) compared to Group B (Dynamic Stretching Exercises). These findings suggest that ischemic compression may be more effective in alleviating pain and improving functional outcomes for individuals with upper trapezitis.

## Discussion

The objective of this study was to compare the efficacy of ischemic compression and dynamic stretching exercises in reducing pain and improving range of motion in individuals with upper trapezitis. The results demonstrated that both interventions led to significant improvements in pain reduction and range of motion, but ischemic compression showed superior outcomes compared to dynamic stretching exercises.

The findings of this study are consistent with previous research. Pathan et al. (2021) reported that ischemic compression effectively reduced pain and improved discomfort and referral patterns in patients with upper trapezitis.[4] Similarly, Ahmad et al. (2022) found that both spray stretches and sustained pressure techniques were effective in increasing pain tolerance and range of motion in individuals with trigger points in the upper trapezius muscle.[5] These studies support the use of ischemic compression as a viable treatment option for pain management in upper trapezitis.

Dynamic stretching exercises have also been shown to have positive effects on pain reduction and range of motion. Iwata et al. (2019) demonstrated that dynamic stretching resulted in increased range of motion and reduced passive stiffness in the hamstring muscles.[6] Jhaveri et al. (2018) compared myofascial release and muscle energy technique in the management of trapezitis and found that both interventions were effective in improving pain, disability, and range of motion.[7] These findings suggest that dynamic stretching exercises can be beneficial for improving flexibility and reducing stiffness in various musculoskeletal conditions.

In this study, the mean value of pain reduction (measured by VAS) in the ischemic compression group was significantly higher than that in the dynamic stretching exercises group. This suggests that ischemic compression may be more effective in reducing pain associated with upper trapezitis.[8] Ischemic compression is known to release trigger points, improve blood circulation, and promote tissue healing and recovery. The release of trigger points can help alleviate muscular tightness and reduce pain. Additionally, the temporary increase in blood flow after releasing the compression brings fresh oxygen and nutrients to the affected area, further aiding in pain relief and healing.

The mean value of range of motion (measured by CROM) in the ischemic compression group was also significantly higher than that in the dynamic stretching exercises group.[9,10] Ischemic compression has been shown to improve joint range of motion and muscle function. By releasing trigger points and stimulating mechanoreceptors, ischemic compression helps restore normal muscle function and improve joint mobility. This may explain the greater improvement in range of motion observed in the ischemic compression group.

While both interventions showed significant improvements, it is important to consider individual preferences and contraindications when selecting the appropriate treatment for upper trapezitis. Ischemic compression may not be suitable for individuals with specific medical conditions or over areas of acute inflammation, open wounds, infected tissues, or compromised blood circulation. Dynamic stretching exercises, on the other hand, may be more accessible and suitable for a wider range of individuals.[11,12] Additionally, combining these interventions with other modalities such as Transcutaneous Electrical Nerve Stimulation (TENS) can further enhance their effectiveness in pain management and functional improvement.[13,14,15]

It is worth noting that the current study has some limitations. The sample size was relatively small, and

the study duration was limited to two weeks. Future studies with larger sample sizes and longer follow-up periods could provide more robust evidence of the efficacy and long-term effects of these interventions. Additionally, assessing other outcome measures such as quality of life, functional disability, and patient satisfaction could provide a more comprehensive evaluation of the interventions' effectiveness.

In conclusion, this study suggests that both ischemic compression and dynamic stretching exercises are effective in reducing pain and improving range of motion in individuals with upper trapezitis. However, ischemic compression showed superior outcomes compared to dynamic stretching exercises. Healthcare professionals can consider incorporating ischemic compression as a valuable treatment option for pain management and functional improvement in individuals with upper trapezitis. Further research is warranted to explore the long-term effects and optimal treatment protocols for these interventions.

## Conclusion

In conclusion, this study provides empirical evidence supporting the efficacy of ischemic compression as a viable management strategy for individuals with upper trapezitis. The findings indicate significant improvements in pain levels and range of motion following the intervention. Ischemic compression demonstrates positive effects on flexibility, muscle tightness, range of motion, in the management of upper trapezitis.

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**Conflict of Interest:** Nil

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Original Article

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# Comparing Microcurrent Therapy Versus Ultrasound Therapy for Subjects with Chronic Temporomandibular Joint Dysfunctions

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**Abstract**

**Background:** This study was designed to compare the effectiveness of Microcurrent therapy versus Ultrasound therapy in subjects with Chronic Temporomandibular Joint Dysfunctions.

**Purpose:** To compare the effectiveness of Microcurrent therapy versus Ultrasound therapy using the McGill Pain Questionnaire.

**Materials and Methods:** This experimental study has been conducted from November 2022 to April 2023. A total of 24 adults with Chronic Temporomandibular Joint Dysfunctions have been selected using the inclusion and exclusion criteria. They have been split into 2 groups Group A (n=12) and Group B (n=12) were assigned. Group A got Microcurrent therapy, whereas Group B received Ultrasound therapy. The McGill Pain Questionnaire was used to evaluate the subjects.

**Results:** The mean value of Microcurrent therapy at the post-test was found to be higher than the mean value of Ultrasound therapy with a p-value of <0.0001.

**Conclusion:** The result suggests that Microcurrent therapy shows a significant effect in reducing pain in Chronic Temporomandibular Joint Dysfunctions when compared to Ultrasound therapy.

**Key Word:** Microcurrent Therapy, Temporomandibular joint dysfunction, McGill pain questionnaire, Ultrasound therapy.

## Introduction

A general name for discomfort and dysfunction of the masticatory muscles and temporomandibular joints is temporomandibular joint dysfunction (TMD). The most noticeable characteristics are discomfort, restricted or limited jaw motion, and joint sounds when moving the jaw. The upper and lower chambers of the maxillary joint cavity are separated by the joint disc. While the lower chamber predominantly serves as a hinge or pivot during the early opening, the upper chamber slides during the mouth's maximum openness. While the lower chamber predominantly serves as a hinge or pivot during the early opening, the upper chamber slides during the mouth's maximum openness. The

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temporomandibular joint is categorized as a gingival joint since it contains a moving hinge and socket. A fibrous connective tissue capsule that is connected to muscles and tendons encircles it.[2]

The primary symptom of temporomandibular joint illnesses is pain in the muscles of the masticatory system and the temporomandibular joint. The causes of TMJ discomfort are numerous. Even though age, gender, heredity, trauma, hypermobility, stress, parafunction, and occlusal abnormalities are all associated with the persistence of TMJ dysfunction-related pain. TMJ dysfunction has a multifaceted etiology. The dysfunction may be caused by biopsychosocial, biomechanical, neuromuscular, and neurological causes. Injury to the head, neck, or cervical spine is frequently regarded as a major risk factor.[3]

There was no statistically significant difference in the 1-year incidence of TMJ indications and/or symptoms between men and women, which was 12%. The greatest incidence rates were reported TMJ noises (10%) and clinically recorded TMJ discomfort (8%) respectively. At the follow-up, around 25% of individuals who had baseline TMJ indications and/or symptoms improved. Men and individuals with bilateral contacts in centric relation, a normal transverse intermaxillary relationship, and a stable mandibular position in centric occlusion were substantially more likely to have subjects with a non-symptomatic TMJ.[4]

Electric currents comparable to those produced by the body during tissue healing are used in microcurrent treatment (MCT). It could be especially helpful in situations when endogenous healing has not worked. MCT can aid in the healing of a range of bone and skin lesions. Microcurrent therapy (MCT) appears to play a crucial part in the healing process.[5]

An electrotherapy technique called microcurrent therapy (MCT) is used to alleviate musculoskeletal discomfort. MCT transmits tiny electric currents of around 1 mA over the skin without causing muscle contractions or other observable effects.[6] Faster healing and better pain management are both possible with microcurrents. Millions of an ampere, or 10-6 amps, are used to quantify the strength of the microcurrent the devices deliver. In contrast to other technologies where it may be felt, the microcurrent is below the threshold of feeling due to the low current. The duration of a microcurrent pulse is around 0.5 seconds, which is 2,500 times greater than that of earlier technologies. Small instruments called microcurrent tools are provided with vinyl/ graphite gloves. The gloves' purpose is to give tactile sensitivity and power cells. However, gloves are typically no longer worn in current practice due to technological advancements. The equipment includes two wires that provide an alternating positive and negative square wave via the gloves to the sick tissue. A similar square wave with a slope of and a voltage is used by a microcurrent at a given frequency, but two channels are fed by four-body connections.[7]

Ultrasound is a technique that is frequently employed in physical therapy. Its heat and mechanical actions change cell signaling, plasma membrane permeability, ion and molecule flow, and other physiological processes that lead to damage healing. The third most often used physiotherapy technique is ultrasound treatment.[8]

## Aim

This study aims to determine whether Microcurrent therapy has an effect on pain subjects with Chronic Temporomandibular Joint Dysfunction when compared to Ultrasound therapy.

## Material and Method

It was a comparative study conducted on 24 subjects with Chronic Temporomandibular Joint Dysfunction, aged between 20 - 40 was taken. Convenient sampling with a random allocation method was used in the study.

**Study period:** From November 2022 to April 2023

**Inclusion criteria:**

1. People of age between 20 – 40 years
2. Both male and female subjects were diagnosed with temporomandibular joint pain.
3. Limited mouth opening
4. Persistence of pain for at least 3 months

**Exclusion criteria:**

1. Recent fracture on TMJ joint.
2. Mouth Carcinoma, Mouth ulcer.
3. Metal implants in and around the mouth.

**Outcome Measure:**

Assessment was performed at baseline (before starting treatment) and after two weeks of study.

- McGill pain questionnaire was used to assess pain.

**Procedure**

**Group A: Microcurrent Therapy.**

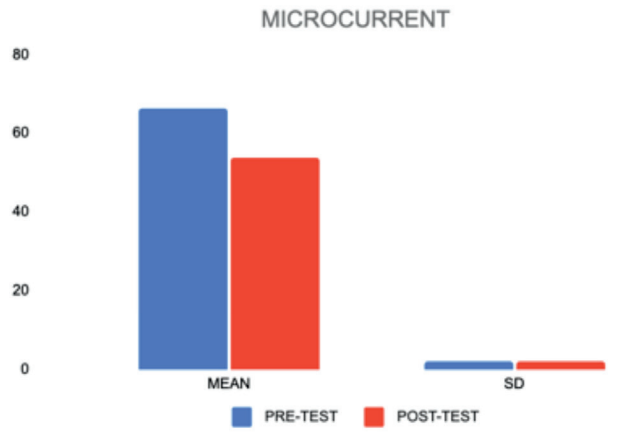
The participants were given Microcurrent therapy. During the application, a gel was used for the transmission of microcurrent on the subject's skin for 2 weeks 6 sessions per week at a frequency of 0.3 Hz, with an amplitude of 40 µA for ten minutes. The treatment was provided in circular strokes using the direct contact method.

**Group B: Ultrasound therapy.**

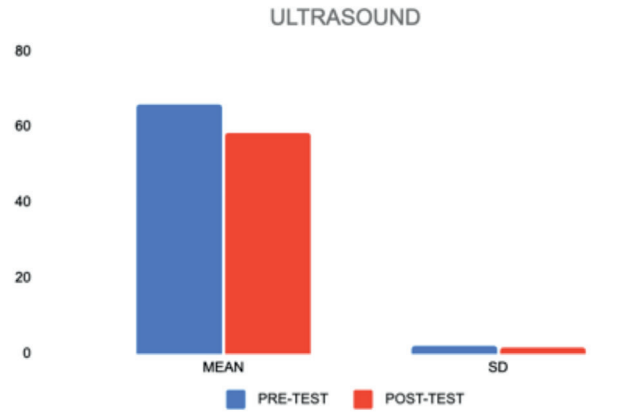
The participants were given Ultrasound therapy. During the application, a gel was used for the transmission of ultrasonic waves between the transducer and the subject's skin for 2 weeks 6 sessions per week at 1.8 w/cm2 for 10 min per session. A coupling agent was used in the ultrasound therapy. A Bionics Innovation Unit was used at a frequency of 1 MHz and wavelength of 1.5 mm in the continuous mode. The treatment was provided in circular strokes using the direct contact method.

**Data Analysis**

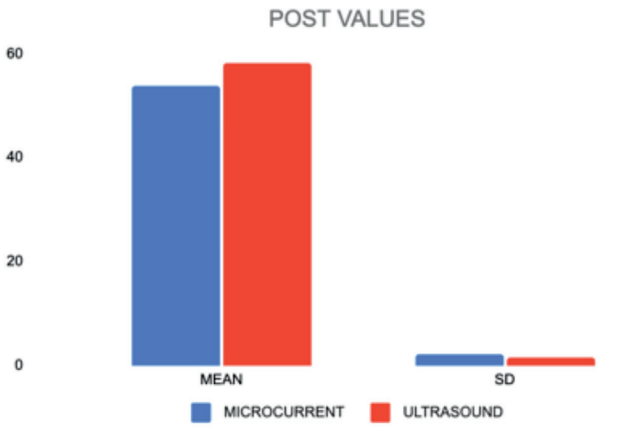
Using tabular and inferential statistics, the gathered data was evaluated. The mean and standard deviation (SD) were utilized for all parameters. The statistically significant differences between pre-test and post-test measures were examined using a paired t-test. When utilizing the unpaired t-test to look at significant changes in the experimental group, the significance level of $p < 0.0001$ was determined to be statistically significant.




**Graph No. 1: Graph No 1. Comparison of pre-test and post-test values of Microcurrent therapy using McGill pain questionnaire.**




**Graph No. 2: Graph No 2. Comparison of pre-test and post-test values of Ultrasound therapy using McGill pain questionnaire.**




**Graph No. 3: Graph No.3: Comparison of post-test values of Microcurrent therapy and Ultrasound therapy using McGill pain questionnaire.**

## Results

The results of the study demonstrated significant improvements in pain reduction for individuals with Chronic Temporomandibular Joint Dysfunction who underwent either Microcurrent therapy or Ultrasound therapy. The Pre-test to post-test analysis revealed a substantial decrease in pain intensity, as assessed by the McGill Pain Questionnaire for both groups.

Comparing the post-test values of the McGill Pain Questionnaire for Group A and Group B. The mean McGill Pain Questionnaire was significantly higher in Group A (53.75) compared to Group B (58.25), indicating a more pronounced improvement in pain relief in Group A.

## Discussion

The purpose of this study was to compare the effectiveness of Microcurrent therapy shows a significant effect in reducing Chronic Temporomandibular Joint Dysfunction when compared to Ultrasound therapy.

In this study, 24 subjects were assigned, 12 were in Group A and 12 in Group B. Group A received Microcurrent for 6 sessions/week, and Group B received Ultrasound 6 sessions/week for a duration of 2 weeks.

The outcome measures were the McGill pain questionnaire performed at baseline and after 2 weeks of study.

According to Graph no.3, the present study shows improvement in both the groups i.e. Microcurrent therapy and ultrasound therapy for all measured variables but Microcurrent shows more effectiveness in reducing pain.

The orofacial region is a source of trigeminal discomfort. First-order neurons of the trigeminal nerve produce increased pain signals that are projected onto the tripartite ganglia at the peripheral nociceptors of the orofacial region after absorbing repetitive noxious stimuli or severe uncontrolled inflammation. Ganglia of the trigeminal nerve like dorsal root ganglia in function. Second-order neurons in the caudal trigeminal nucleus of the brainstem are then the recipients of pain signals. Second-order neurons are found in the caudal nucleus of the trigeminal nerve, which mimics the dorsal horn of the spinal cord. There are three sets of nuclei in the brainstem that make up the trigeminal nucleus. The pars oralis and the pars interpolaris are the first and second central nuclei of CN V, respectively. Both deliver tactile signals to the orofacial region. The caudate nucleus of the caudal section or caudate nucleus of the trigeminal nerve, which transmits pain sensation in this afflicted location, is the third spinal nucleus.[9–11]

According to a clinical investigation, people with TMJ discomfort may have fewer neurons on either side of the brainstem, especially in the ventromedial rostral area, which is in charge of descending pain pathways or pain modulation. Therefore, in individuals with severe TMJ dysfunction, the decrease of neurons in descending pain modulation may enhance pain perception.[12-15] Microcurrents at a certain frequency have been shown to enhance muscle regeneration. Transcutaneous delivery of low-intensity direct current (DC) and/or alternating current (AC) using frequency-controlled adhesive electrodes in the microampere (A) range is known as microstimulation. The current must be low enough to elicit intercellular modulations, such as increased protein synthesis and high levels of adenosine triphosphate (ATP), but not exceed a particular intensity (for example, over 1000 A), which results in a decrease in ATP production. Preclinical and clinical research has demonstrated that MS triggers cellular tissue regeneration, such as tendon scarring. physiological restoration following a cycle of ongoing stress. The benefits of multiple sclerosis have also been shown to last for a longer period; interestingly, the number of DOMS rose without regard to treatment. [16]

Saranya B et. al, the study concluded that the effect of Microcurrent is effective in improving functional mouth opening and showed better and immediate effects in the relief of pain.[17]

Bavarian R et. al, study concluded that microcurrent is an effective treatment that can be used to reduce pain in patients with temporomandibular pain.[18]

Sarnaik R et. al, the study concluded that the microcurrent also enhances circulation at the cellular

level. Consequently, as the blood flows more actively through the pain area, it supplies more oxygen and promotes a faster and more natural healing process.[19]

## Conclusion

In conclusion, this study provides evidence for supporting the effectiveness of Microcurrent therapy as a management strategy for Chronic Temporomandibular Joint Dysfunction. The findings demonstrate significant improvements in pain relief following the intervention. These positive outcomes align with recent research emphasizing the benefits of Microcurrent therapy. Microcurrent therapy shows a potential increase in relieving pain. Further research and long-term follow-up studies are necessary to validate these results and assess the long-lasting effects of Microcurrent therapy in the management of Chronic Temporomandibular Joint Dysfunction.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, and institutional regulations. (Application Number 03/059/2022/ISRB/SR/SCPT)

**Funding:** This study is a self-funded study.

**Conflict of interest:** Nil

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Original Article

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# Effects of BOSU Ball Exercises Versus Wobble Board Exercises on Pain and Balance in Individuals with Pes Planus

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**Abstract**

**Background:** Pes planus, usually called flat foot is a deformity that causes the medial longitudinal arch to collapse and makes the foot flat to the floor level. Flat feet may be caused by aging, pregnancy, heredity, physiological condition or an injury to the foot ligaments. Weight-bearing exercises are performed on an unstable surface such as wobble board and BOSU ball as part of the balance board training technique.

**Purpose:** To find out the effect of BOSU ball exercises versus wobble board exercises among individuals with pes planus.

**Materials and Methods:** A sample of 30 was taken using a navicular drop test on the arch of the foot, NPRS on pain, and Berg balance scale on balance. According to the selection criteria for the study which was divided into two groups, a BOSU ball with ultrasound (n=15) and wobble board with ultrasound (n=15) were given. Interventions were given as 6 sessions a week for 2 weeks. The entire process was performed from November 2022 to April 2023.

**Result:** The mean value of BOSU ball exercises at the post-test was found to be higher than the mean value of wobble board exercises with a p-value of <0.0001.

**Conclusion:** The study concludes that the BOSU ball with ultrasound therapy has a higher positive outcome in managing pes planus.

**Keywords:** Pes planus, BOSU ball, wobble board, FFI, NPRS, Berg balance scale

## Introduction

Flatfoot is a condition where the arch present in the midfoot collapses while walking. It is also called "Pes planus". Pronated feet are also related to flat feet.[1] The foot comprises three sections: Hind, mid, and forefoot. The Transverse Arch, Medial Longitudinal, and Lateral Longitudinal are formed.[2] Muscles such as the tibialis anterior and extensor digitorum longus helps in the stability of the foot and give support to the medial arch. Flatfoot can be identified in clinical practice using a variety of methods, including clinical diagnosis, footprint analysis, and radiographic study.[3-5]

The flat foot has been linked to family history, infant footwear, obesity, living in a city, age, gender, and foot length.[6-8] At the knee and throughout the

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lower extremities, the foot is critical in bearing the stress of floor contact and shaping the technique of alignment of posture and joint movement.8 When the Medial Longitudinal Arch becomes too loose to support the arch, the foot pronates excessively, causing the heel to evert and the body weight to transfer medially, compressing the Medial Longitudinal Arch. It's also included as a health modifier.[9] Symptoms of the flat foot include swelling around the ankle, muscle cramping, muscle pain in the foot or leg, arch, ankle, heel, or outside of the foot pain, Changes in the pattern of gait or pain while walking, and drifting toes. A study from India found that early footwear use, combined with a gain in overall weight and ligamentous laxity, increases the occurrence of flat feet.[10] In a healthy adolescent age group, males had a higher prevalence of flat feet than females. Flat feet were linked to higher BMI and shorter body height across all severity levels.[11] A wobble board is a multidirectional balance board consisting of a round, disk-like platform resting on a partially or partially attached ball attached to the center and bottom of the platform, allowing for many planar movements. Wobble board exercises are widely used for maintaining balance.[12]

On the other hand, the name "Bosu" is derived from David Weck's invention, Both Sides Up, a piece of equipment with a hemispheric shape that allows users to use each part with varying degrees of instability. Bosu ball which is made of plastic and contains industrial fibers that have unique adhesion, semi-elastic properties, and great pressure resistance. The BOSU ball, which has two sides and a circular, flat component, is primarily used to improve posture, balance, and the tone of the body's muscles.[13-17]

## Aim

To find out the effect of BOSU ball exercises and wobble board among individuals with pes planus using a navicular drop test on the arch of the foot, NPRS on pain, and Berg balance scale on balance.

## Materials and Method

A sample size of 30 subjects aged between 18-25 years, clinically diagnosed as pes planus were taken into consideration. The entire process was performed from November 2022 to April 2023.

**Inclusion criteria**

- People aged between 18-25 years
- Subjects with navicular drop test positive.
- Subjects with foot pain

**Exclusion criteria**

- Recent foot injuries
- Neurological disorders

**Outcome Measures**

1. Navicular drop test (NDT) used to measure the arch of the foot.
2. Numeric pain rating scale (NPRS) to assess pain.
3. Berg balance scale (BBS) to assess balance.

**Procedure**

In this current study, the subjects were randomly allocated into two groups: Group A, which received BOSU ball exercises with ultrasound therapy, and Group B, which received wobble board exercises with ultrasound therapy. The study followed a single-blind design, where the subjects were unaware of the group they were assigned to.

**Group A: BOSU ball exercises**

Positioning the BOSU ball: The BOSU ball was placed on a flat surface with the flat side down and the dome side up.

Procedure: In this study, 15 subjects performed BOSU ball exercises consisting of 15 repetitions and 3 sets, in addition to receiving ultrasound therapy.

**Single limb stance**

The participants were instructed to lift one foot off the ground and place the sole of the foot in the center of the BOSU ball's dome. They were then asked to balance by engaging their core muscles and stabilizing their standing leg. The participants were instructed to hold the single limb stance for a specific duration, such as 30 seconds as a starting point. They were then asked to switch to the other leg and repeat the exercise.

**Double limb stance**

The participants were instructed to Stand at the center of the Bosu ball, with both feet positioned

on the dome. The feet should be shoulder-width apart, toes pointing forward. Ask them to engage the core, keep their shoulders relaxed, and maintain good posture. The participants were then asked to balance and stabilize the body on the Bosu ball. The participants were asked to hold the double limb stance for a specific duration, such as 30 seconds to begin with. Progressively, the duration was increased and movements like squats were added. After completing the desired duration, the participants were asked to step off the Bosu ball safely and rest.

**Group B: Wobble board exercises**

Positioning the wobble board: the board is placed on a rounded base to create an unstable surface.

Procedure: In this study, 15 subjects were given wobble board exercises (15 repetitions; 3 sets) with ultrasound therapy. The participants were instructed to stand at the Centre of the wobble board with their feet shoulder-width apart. The knees were kept in a slight bend position and the core was engaged.

**Forward Movement**

The participants were asked to weigh forward, allowing the board to tilt towards the front. As the board tilts, patients were asked to maintain balance and control the movement using their core and leg muscles. Patients were asked to try to maintain a controlled and slow movement without jerking or sudden shifts.

**Backward Movement**

Once the participants have mastered the forward movement, they can progress to the backward movement. The participants were asked to shift their weight backward, causing the wobble board to tilt towards the back. Again, patients were asked to focus on maintaining control and balance throughout the movement.

**Ultrasound therapy**

Frequency-3MHz,

Duration-15 minutes,

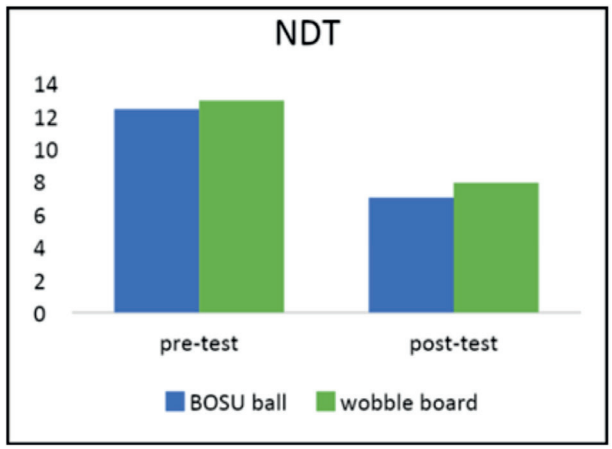
Mode-continuous mode; 6 sessions per week

**Procedure**

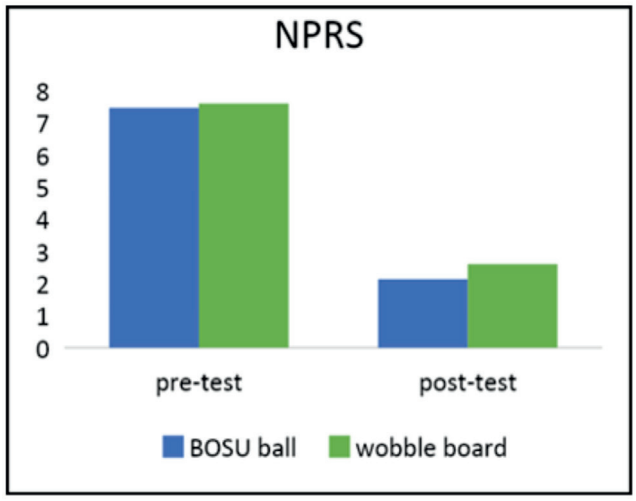
This program was prescribed for all the subjects. During the application, a gel was used for the transmission of ultrasonic waves between the transducer and the subject's skin. The treatment was provided in longitudinal strokes using the direct contact method throughout the arch.

**Data Analysis**

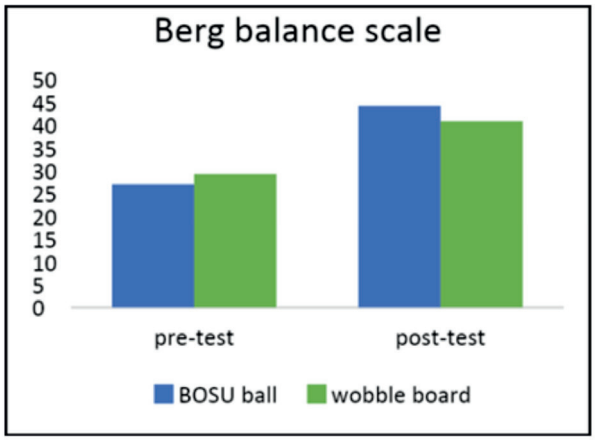
Using descriptive and inferential statistics, the data collected were tabulated and analyzed. The mean and standard deviation (SD) were applied to all parameters. The significant differences between the BOSU ball exercise group and the wobble board exercise group were analysed using an unpaired t-test. A p-value of <0.0001 was known to be statistically significant.




**Graph – 1 Comparison of pre-test and post-test values of Group A and Group B using NDT**




**Graph – 2 Comparison of pre-test and post-test values of Group A and Group B using NPRS**




**Graph – 3 Comparison of pre-test and post-test values of Group A and Group B using the Berg balance scale**

## Result

Comparing the two intervention groups, Group A (BOSU ball) exhibited a greater reduction in pain intensity, a pronounced improvement in arch of the foot and balance compared to Group B (Wobble board exercise).

These findings suggest that BOSU ball may be a more effective approach in alleviating pain, and enhancing balance and arch of the foot for individuals with pes planus.

Overall, the study highlights the positive impact of both interventions on pain, balance and arch of the foot in individuals with pes planus, with BOSU ball demonstrating superior results.

## Discussion

The foot becomes overpronated, causing the heel to evert and the weight of the body to transfer sideways, compressing the medial longitudinal arch, which is too loosened to the point where it can no longer support the arch. Due to the synchronization in their biomechanics, the decrease in height of the arch affects the ability of the foot, which leads to inflammation or tenderness in the foot. A study from India found that early footwear use, combined with a gain in overall weight and ligamentous laxity, increases the occurrence of flat feet.[18]

There has been extensive research on the treatment of flatfoot. In their investigation of the impact of footwear on the flatfoot, Rao and Joseph claimed that wearing suitable footwear could aid in arch normalization.[19] Bosu ball research demonstrates that exercises for the lower extremities performed with dynamic cushions on an unstable surface may result in greater activity than similar exercises for the upper limbs performed in the same posture on a stable or unstable surface.[20] When exercising on an unstable surface as opposed to one that is stable, proprioceptive muscles must contract more forcefully in response to the strength of the visual input.[21,22] Also, the two most difficult balance aids the BOSU Ball and the wobble board show a kinematic perturbation that is almost eight to ten times greater than that of simply standing on the floor.[23]

Studies on the mechanism of action of balancing training have revealed that it decreases antagonist muscle co-activation, despite having no effect on the agonist muscle's level of muscle activation.[24] Another study showed that the wobble board balance, practiced for eight weeks, significantly improved dynamic balance.[25] Training on unstable surfaces violates the principle of training specificity, creates unique demands, and may therefore improve dynamic balance.[26]

According to Unver B, Erdem EU, and Akbas E, 6 weeks of short foot exercises provide a decrease in navicular drop, pain in the foot, and disability of the medial midfoot in pes planus.[27] The objective of a training regimen in the BOSU ball should not focus on increasing strength but rather focus on increasing stability, balance, and proprioceptive capabilities stated by Behm et al.

## Conclusion

In conclusion, this study provides evidence supporting the effectiveness of BOSU ball training as a management strategy for pes planus. The findings demonstrate significant improvements in foot function, pain levels, and balance following the intervention. These positive outcomes align with recent research emphasizing the benefits of balance training on foot stability and function. BOSU ball exercises show potential for strengthening intrinsic foot muscles, restoring the medial longitudinal arch, and enhancing postural stability. Further research and long-term follow-up studies are necessary to

validate these results and assess the long-lasting effects of BOSU ball training in the management of pes planus.

**Ethical clearance:** Taken from the institutional ethical committee. ISRB number-03/ 060/ 2022/ ISRB/ SR/ SCPT.

**Funding:** Self.

**Conflict of interest:** Nil

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Original Article

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# A Study to Compare the Kinematic Chain Exercise Versus Theraband Exercise on Pain for Subjects with Flat Foot

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**Abstract**

**Background:** Pes Planus (flatfoot) only becomes a medical issue when symptoms appear. This disease occurs in both young children and adults. When the medial longitudinal arch (MLA) has raised to the point where it cannot be maintained, the flatfoot changes form. This condition causes over pronation of the foot in contrast to normal feet, resulting in heel eversion and moving the weight load inward to compress the MLA.1-2

**Purpose:** To compare the effectiveness of kinematic chain exercise and TheraBand exercise session among the young adults with flat foot.

**Materials and Methods:** 30 subjects participated and were taken from Saveetha college of physiotherapy based on specific criteria and assigned to two groups. Pre and post assessment was taken using Numerical Pain Rating Scale [NPRS] and Foot Functional Index Scale [FFI]. The interventions were given for 2 Weeks and the study was conducted from November 2022 to April 2023. .

**Results:** The study's results revealed that both groups exhibited significant improvements in flat foot, with a p-value < 0.001. However, Group A showed more statistical significance than Group B.

**Conclusion:** In conclusion, the commencement of two- week intervention plan, kinematic chain exercise showed a marked outcome on pain subjects with flat foot

**Keywords:** Pes Planus, Kinematic chain, TheraBand, Young adults, FFI , NPRS.

## Introduction

Pes Planus (flatfoot) becomes a medical problem when symptoms emerge.In contrast to normal feet, this disorder makes the foot overpronation, causing heel eversion and shifting the weight load inward to compress the MLA. [1-2] Patients with Pes Planus should receive conservative care unless there are signs of rheumatic, intramuscular, genetic, or collagen issues. Pes planus is defined as having a regular arch when not bearing weight or tiptoeing and a flattening arch when standing. [3-5] It inverts the foot and acts as a plantar flexor. Flat feet are more common in people with Neurological or Muscular conditions including Cerebral Palsy, Muscular

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Dystrophy, and Spina Bifida. [6] A flat foot can result in ankle swelling, cramping in the leg or foot muscles, pain in the arch, ankle, heel, or outside of the foot, alterations in gait, pain while walking, and migrating toes. [7] The kinetic chain concept is applied in a range of therapeutic contexts, including as prosthetics and orthodontics, neurorehabilitation, sports medicine, and musculoskeletal medicine. [8]

Closed kinetic-chain (CKC) movement to strengthen and regulate knee muscles Exercises in the OKC are performed with free distal and fixed proximal extremities.[9] The usage of axial-load exercises, commonly referred to as CKC exercises, are now used more frequently than ever before.[10] After post-posterior cruciate or lateral collateral ligament reconstruction or damage, the OKC flexion exercise should be avoided due to moderate to large flexion angles and resistive pressures. [11] The anterior cruciate ligament won't be in danger and the exercise can be used to improve the hamstring muscles. [12]

Kinetic chains can be quickly discovered by biomechanical evaluations like gait analysis. For instance, tibial internal rotation brought on by foot pronation results in knee valgus and hip internal rotation. [13] TheraBand exercises are a safe instrument for improving the nervous-muscular system, muscle strength, and functional capacity. [14] TheraBand is an advanced resistance workout that might boost muscle growth and strength. Resistance training using TheraBand has been shown to improve strength and postural stability. [15,16] TheraBand has been shown to improve strength, mobility, and function while also reducing joint discomfort. [17] TheraBand provides resistance; this resistance is created by stretching force and may strengthen weakened muscles. [(18)] TheraBand strength training may help women avoid muscle disability. [19] TheraBand is being used in an advanced resistance exercise that could help people get stronger and more powerful muscles. [20]

## Aim

The study is intended to compare the effect of Kinematic chain exercise and TheraBand. exercise on subject with flat foot with pain in young adults.

## Material and Methods

It was an experimental study conducted on 30 subjects. convenient sampling with random allocation method was used in this study. The entire study process was conducted from November 2022 to April 2023. .

**Inclusion criteria:**

1. Young adults aged between 18-25 years.
2. Subjects of study with Foot pain or discomfort
3. Visible foot deformity
4. Over pronation

**Exclusion criteria:**

1. Recent Sprained ankle
2. Neurological conditions
3. Normal gait pattern
4. No visible deformity

**Outcome measures:**

The assessment was performed at baseline (before starting of treatment) and after two weeks of study.

- Numerical Pain Rating Scale (NPRS)
- Foot Functional Index Scale (FFI)

**Procedure**

30 participants were chosen and divided into two groups according to the selection criteria: participants had to be between the ages of 18-25, both male and female, and they had to score between grades of 0-10 on the numerical pain rating scale (NPRS) and a self-administered index consisting of 23 items divided into 3 sub-scales. Each item is rated on a 0 – 10.Group A underwent 30 minutes of kinematic chain exercise (chest fly using dumbbells, step up forward exercise, wall slide exercise), with each set of exercises consisting of 5-8 repetitions and a 2-minute rest period. TheraBand exercises were given to Group B. For 30 minutes, Group B underwent TheraBand exercises with 5-8 repetitions of each set and a 2-minute rest period between sets. For two weeks, the study was carried out five days per week. The same outcome measure was used for the post-test following the termination of the treatment protocol.

**Group A: Kinematic chain exercise**

1. Chest fly using dumbbells**.**
    - Position yourself in front of the Swiss ball as it is placed on the ground.

- Roll forward after sitting on the Swiss ball so that the ball is supporting your head, upper back, and shoulders.
- You should stand with your feet shoulder-width apart, firmly planted in the ground.
- Throughout the exercise, keep your spine in a neutral position. Squeeze the dumbbells:
- Keeping your palms facing inward while holding a dumbbell in each hand with an overhand grip, raise your arms straight up above your chest.
- Your elbows should be slightly bent, and your arms should be at shoulder width.
- Pulling your belly button nearer your
- spine can help you engage your core muscles before beginning the exercise.
- Return to the starting position: Squeeze your chest muscles and use them to draw the dumbbells together as you slowly raise your arms back up to the starting position. Maintain a small bend in your elbows throughout the action.

2. Step up (forward) exercise:

- Find a stable bench, step, or platform that is at or just below knee height.
- Standing with your feet shoulder-width apart, face the bench, step, or platform.
- Make sure your entire right foot is firmly planted on the bench by placing it there.
- Keep your posture upright and your core engaged the entire exercise.
- Straightening your right leg, step up onto the bench with a push with your right foot. As you push up, exhale.
- Lift your left foot off the ground and shift your whole weight to your right leg.
- At the peak of the movement, pause briefly and make sure your right leg is fully stretched.
- Get back to where you were by gradually lowering your left foot.

Keep your back completely against the wall the entire time to focus on maintaining perfect form.

3. Wall slide exercise.

- Place your feet hip-width apart and lean on a wall as you stand.
- Ensure that the wall is in contact with your head, upper back, heels, and buttocks.
- Put your arms up against the wall with your palms facing forward and elbows bent at a 90-degree angle.
- Ensure that your elbows are at shoulder height and that your upper arms are parallel to the floor.
- Maintain a neutral spine throughout the exercise by contracting your core muscles.
- To avoid excessive back arching or rounding, keep your lower back forced up against the wall.
- Keep your elbows at a 90-degree angle as you slowly glide your arms up the wall.
- As you raise your arms, keep your wrists, elbows and shoulders in touch with the wall.
- Up until your hands are directly above your shoulders, keep sliding your arms up.
- Be careful not to shrug or let your shoulders roll forward.
- Pause for a little moment in the top position, making sure your shoulder blades are tightly clasped.
- Slide your arms back down the wall to the beginning position as you slowly reverse the motion.

**GROUP B: Thera band exercise**

1. Plantar flexion /inversion

**Flexion**:

- Sit down on a chair or a flat surface with your legs out in front of you.
- Loop one end of the TheraBand around the ball of your foot while holding the other end in your palms.
- Keep your foot relaxed and pointing up while the TheraBand provides resistance.
- Pointing your toes away from you, slowly

press your foot downward against the band's resistance.

- Hold this position for a few seconds, then gradually return to the beginning position.

**Inversion:**

- Sit down on a chair or a flat surface with your legs outstretched.
- TheraBand instructions state to fasten one end to a sturdy object, such a table leg, and then wrap the other end around the outside of your foot. other end around the outside of your foot.
- Hold the band firmly in place with your hand to keep it taut. Start by placing your foot in a calm, neutral position.
- Slowly shift your foot inside by pushing the bottom of your foot toward your body's midline while fighting the band's resistance.
- Hold the position with your body facing inward for a few seconds.
- then gradually let go to return to the beginning position.

2. Tibialis Posterior Strengthening:

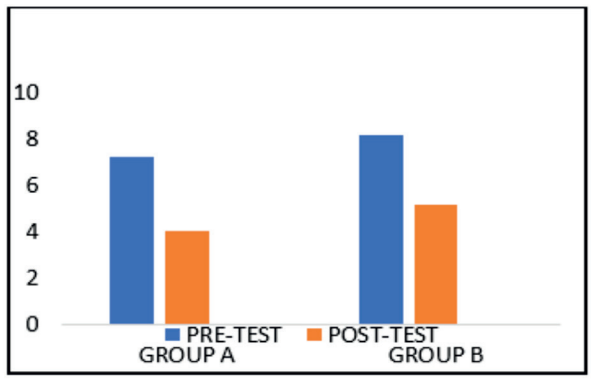
- Legs extended in front of you while seated on a chair or bench.
- The other end of the TheraBand should be wrapped around the top of your foot, just below the toes, and fastened to a strong object, such as a table leg.
- Make sure the band is fastened firmly.
- Ensure that your back is straight, and your core is active.
- Flex your foot slowly upward while pulling against the TheraBand's resistance.
- Only elevate the front of your foot while keeping your heel on the ground.
- The tibialis posterior muscle should be the object of this movement. Hold the flexed position for a few seconds before releasing gradually and going back to the beginning position.

3. Calf stretching in long sitting**:**

- Sit with your legs outstretched in front of you on the floor.
- While holding the opposite end of the TheraBand in your hands, wrap one end around the ball of your foot.
- To maintain proper posture, raise your shoulders and contract your abs.
- Pull the TheraBand gently towards you while slowly flexing your foot and pointing your toes towards your torso.
- Feel the stretch in your calf muscle and hold the stretch for 15 to 30 seconds. Relax the pressure a little bit to let your foot return to its neutral position.
- On each foot, carry out the stretch 2 to 4 times.

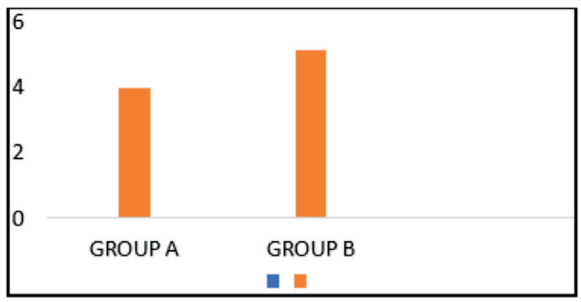
Throughout the stretch, keep in mind to breath deeply and relax your muscles.

**Data Analysis**



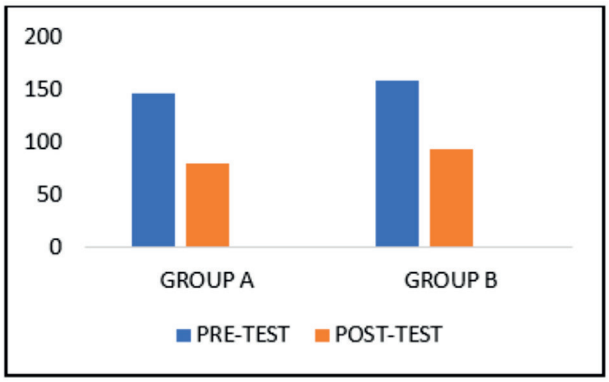

**GRAPH-1**

INTERPRETATION: **Graph-1** shows the Comparison of Pre-test and Post-test values of Group A and Group B using NPRS.



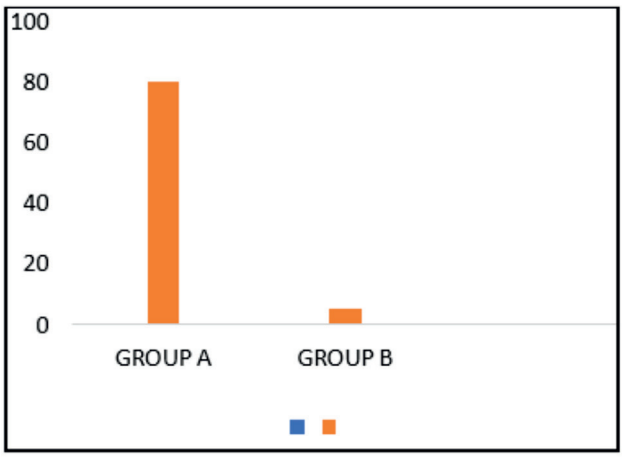

**GRAPH-2**

INTERPRETATION: **Graph-2** Comparison of post-test values of GROUP A and Group B using NPRS.




**GRAPH-3**

INTERPRETATION: **Graph-3** Comparison of Pre-test and Post-test values of Group A and Group B using FFI.




**GRAPH-4**

INTERPRETATION: **Graph-4** Comparison of Post-test values of Group A and Group B using FFI.

## Result

- The results of the study demonstrated significant improvements in pain reduction for individuals with flat foot who underwent either kinematic chain exercise or TheraBand exercises.
- The pre-test to post-test analysis revealed a substantial decrease in pain intensity, as assessed by the Numerical Pain Rating Scale (NPRS), for both groups.
- Furthermore, foot health is measured by Foot Functional Index (FFI) to measure foot health, after the interventions.
- Comparing the two intervention groups, Group A (kinematic chain exercise) exhibited a greater reduction in pain intensity and a more pronounced improvement in foot health compared to Group B (TheraBand Exercises).
- These findings suggest that kinematic chain exercise may be a more effective approach in alleviating pain and enhancing functional outcomes for individuals with flat foot.
- Overall, the study highlights the positive impact of both interventions on pain and foot health in individuals with flat foot, with kinematic chain exercise results.

## Discussion

The flat foot group exhibited a significantly decreased kinetic index without visual input. The more effective postural stability in the control group might be due to efficient compensatory strategies utilized without visual input to maintain one leg standing.

The management of flatfoot has been the subject of much research. Rao and Joseph asserted that wearing appropriate footwear could assist in arch normalization in their examination of the effects of footwear on the flatfoot. In the closed kinematic chain task, a significant difference in the accuracy of knee joint motion was observed between the flexible flatfoot and control groups.[21]

In addition, there was a significant difference in the accuracy of knee joint motion between the closed and kinematic chain task in the flexible flatfeet group. A comprehensive 2-week exercise program improved the longitudinal arch angle and navicular drop height among adults with flexible flatfoot more than active flexion of the foot and plantar flexion alone.

## Conclusion

The study's findings demonstrate that Kinematic Chain exercise is more effective than TheraBand exercise in reducing pain in subjects with flat foot in young adults. The results show that after the training, there are significant improvements in foot function, pain levels, and balance.

**Ethical clearance:** Taken from the institutional ethical committee. ISRB number-03/ 061/ 2022/ ISRB/ SR/ SCPT.

**Funding:** Funding

**Conflict of interest:** Nil

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Original Article

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# Effectiveness of Jumping Rope Exercise Verses Short Foot Exercise on Pain and Quality of Life for Subjects with Flat Foot

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**Abstract**

**Background:** Pes planus, commonly known as flat foot, is a deformity that leads to the collapse of the medial longitudinal arch and flattening of the foot against the ground. This study aims to compare the effectiveness of jumping rope exercise and short foot exercise on pain reduction and improvement in quality of life for patients with flatfoot.

**Purpose:** To find out the effect of Jumping rope exercise versus short foot exercise among individuals with flatfoot.

**Method:** A sample of 30 participants who met the inclusion and exclusion criteria were selected for the study. They were divided into two groups: the jumping rope exercise group with ultrasound (n=15) and the short foot exercise group with ultrasound (n=15). The interventions were administered five times a week for three weeks. The entire process was performed from November 2022 to April 2023.

**Outcome measure:** The navicular drop test (NDT) was used to measure the degree of foot pronation, the Numeric Pain Rating Scale (NPRS) was employed to assess pain levels, and the Foot Health Status Questionnaire (FHSQ) was utilized to evaluate participants' quality of life.

**Results:** The mean value of the jumping rope exercise group at the post-test was significantly higher than that of the short foot exercise group, with a p-value of <0.0001

**Conclusion:** Based on the findings, it can be concluded that jumping rope exercise with ultrasound therapy yields superior outcomes in managing Pes Planus compared to short foot exercise.

**Keywords:** Flatfoot exercise, Jumping rope, Pes Planus, Foot Health Status Questionnaire

## Introduction

The human foot has an extraordinarily complex architecture that allows it to execute a wide range of activities. It provides a stable basis for standing. The foot must be secure during push off and foot strike during gait These bones and the Ligaments that surround them and create the medial, lateral and longitudinal arch. The structure and dynamics of the foot arch are critical for the foot to execute functions such as shock absorption, transmission of body weight, and acting as a lever to drive the body forward during locomotion.[1]

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Classification: Flatfoot can be classified in to pathological and physiological pathological: Children with underlying disorders are more prone to develop pathological flatfoot, which is characterized by foot stiffness, tends to persist, and commonly leads in disability.[2]

Flat foot biomechanics include calcaneal drift, posterior tibial tendon, forefoot displacement, mid foot laxity. When functioning properly, the foot is an outstanding, adaptable, and effective aid in movement, whether walking, running, leaping, traveling uphill or downhill, or overcoming slippery surfaces.[3] Foot dysfunction is frequently manifested by the lack of normal foot function. As a result of the structural support, the form of the object changes. The loss of the medial longitudinal arch may be caused by a mismatch between the forces that operate to sustain and flatten the arch.[4]

The prevalence of flatfoot is relatively high (ranging from 21% to 57%) in the adult population, but decreases to around 5% to 14% when considering prevalence among adults and most prevalent cause of acquired flat feet is a combination of excessive strain on the arch and insufficient arch support.[5] The biomechanics of a normal arch when responding with a therapy that strengthens the arch's supporting structures or reduces the influences that flatten the arch. The arch-supporting muscles, particularly the posterior tibial tendon, play a decreased role in maintaining the arch after surgeries or after hindfoot fusions.[6] Re balancing the forces pressing on the arch can improve performance while minimizing the chance of deformity development in the future.[7-9]

The jump ropes or skipping ropes are the one which are easily available, affordable and which tend to improve the overall cardiorespiratory health and agility Improved strength can be tested to better the arch in patients with flat foot which in turn reduces the pain at the knee joint. [10-12]

## Aim

The aim of this study is to determine whether jumping rope exercise or short foot exercise have an effect on pain and quality of life in subjects with flatfoot.

## Methods

It was a comparative study conducted on 30 subjects with Flatfoot, age between 18-25 years. Convenient sampling with random allocation method was used in the study.

**Inclusion criteria:**

1. Both Genders
2. Age 18 To 25yrs
3. Subjects with Navicular Drop Test Positive
4. Jack's Test Positive

**Exclusion criteria:**

1. Recent Fracture In Lower Extremities
2. Neurological Disorder

**Outcome measures**

The navicular drop test (NDT) was used to measure the degree of foot pronation.

The Numeric Pain Rating Scale (NPRS) was employed to assess pain levels.

The Foot Health Status Questionnaire (FHSQ) was utilized to evaluate participants' quality of life.

**Procedure**

The finalized Subjects Were Randomly Allocated Into 2 Group; Group A (N=15) And Group B (N=15). The Experimental Group were Given Jumping Rope Exercises, While The Control Group were Given with Short Foot Exercises. Both Group are combined with Conventional Therapy such as stretches and ultrasound given to improve arch formation to reduce Pain and to Improve Quality of life. This study contain outcome measure such as Navicular Drop Test that can be used to access the arch, NPRS can be used to assess the pain and to quantify reduction in pain after treatment and finally Foot health status questionnaire (FHSQ) that can be used to assess and find out how quality of life was improved to the patient

**Group A: Jumping Rope Exercises**

Participants in Group A were assigned to jump rope; the leap was conducted barefoot and the individuals were instructed to jump on their toes. Session – 3 sessions each repetitions: 12 per day, rest

time: 5 seconds, hold time: 10 seconds, frequency: 5 days per week, duration: 3 weeks combined with conventional therapy and pain management of ankle discomfort with ultrasound 3mhz for 10 minutes 5 days per week

**Group B: Short Foot Exercises**

Participants were allocated to undertake a short foot workout with exercise. Session – two sessions each day, repetitions – 12 repeats per day Rest time is 5 seconds, hold time is 10 seconds, and the frequency is 5 days per week. Combined with pain treatment for ankle discomfort with ultrasound at 3 mhz for 10 minutes five days a week and conventional therapy.

**Both group A and group B are combined with conservative management for pain**

Gastrocnemius stretch: The individuals are advised to stand three feet away from a wall and place their right foot behind them, toes pointing front. Then they lean forward with their right knee straight and their heel on the ground.

Soleus stretch: Individuals should take a step back from a wall, place their foot behind it, and make sure their toes face front. Then they lean forward at the ankle, bending the right knee and keep the heel on the ground.

Heel Lifting: The individuals were told to lift their heels while maintaining their toes and forefoot on the ground.

Toe Lifting: To develop the lower leg muscles, the patients were advised to lift their toes and forefoot off the floor while maintaining their heels on the ground

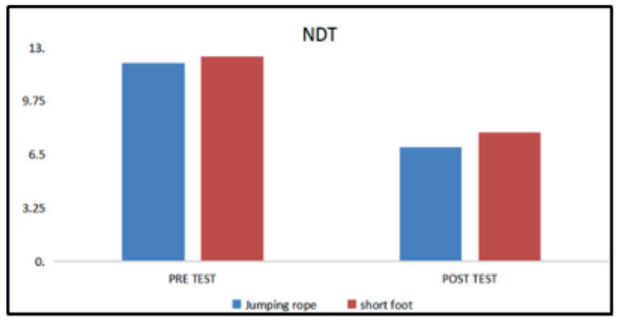
**Parameters for ultrasound therapy-**

Frequency – 3MHz, Duration – 10 minutes, Intensity – 1W/Cm2, Mode – continuous

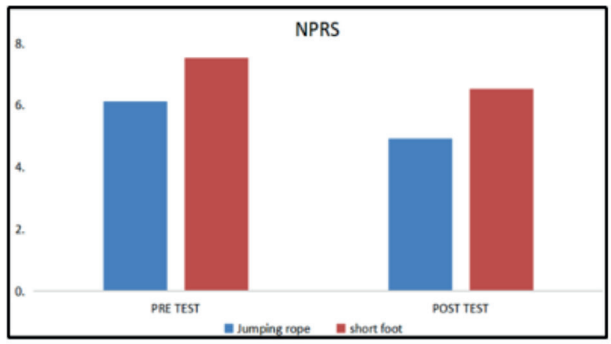
Procedure: This curriculum was mandated for all courses. A gel was utilized during the application to transmit ultrasonic waves between the transducer and the subject's skin. The therapy was given in longitudinal strokes along the arch using the direct touch approach (10 minutes; continuous mode; 5 sessions per week for 3 weeks)

**Data analysis**

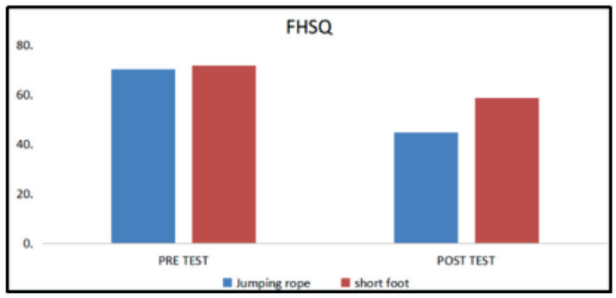
Pre-test and post-test values of Navicular Drop Test, Numerical Pain Rating Scale and Foot Health Staus Questionnaire are analyzed were analysed for flatfoot.




**Graph – 1** Comparison of pre-test and post-test values of Group A and Group B using NDT




**Graph – 2** Comparison of pre-test and post-test values of Group A and Group B using NPRS




**Graph – 3** Comparison of pre-test and post-test values of Group A and Group B using the Foot Health Status Questionnaire

## Results

All 30 subjects completed the study successfully pre-test and post-test values of NDT, NPRS, FHSQ were presented in the following graphs 1,2,3.

Statistical analysis shows there is a significant improvement from pre intervention to the post.

## Discussion

Pes planus is a rather common adult illness. Adult flat foot is a foot condition that arises at skeletal maturity and is distinguished by partial or entire loss (collapse) of the medial longitudinal arch. Foot alterations may result in variations to the needed plantar contact area in footprints.

Using this data, many researchers assessed arch height using footprints, and numerous criteria for identifying arch groups were presented.[13]In terms of the effect of jumping rope exercises on balance, the current study indicated that the Experimental group's (jumping rope exercise) improved arch and balance greatly after intervention. They said that 8 weeks of jumping rope and brief foot exercise training increased arch development, muscular strength of calf muscles, and it is the most essential muscle to maintain the arch and balance.[14]

Myer et al. stated That Jumping rope improved balance skills, and employed jumping rope activities, which are a sort of plyometric exercise.[15] Findings of Chaouachi et al were congruent with our findings when they said that Jumping rope training improved balance, jumping ability, and squat strength metrics.[16]

In the current experiment, ankle plantar flexion was the only gain in muscle strength (torque) necessary to create vertical-jump force in the land training group. The improvement in balance abilities following jumping rope exercise might be attributed to the quick stretch-shortening cycle, which combines center of gravity movements in both vertical and horizontal directions, potentially improving postural control and equilibrium.[17]

As per Dong-chul moon et al, apart from improving postural stability and muscular activation, brief foot training improved dynamic balance in flexible flatfoot individuals with excessively pronated feet.[18]Eunsang lee et al, Short foot exercises used for balance training function to increase ankle proprioception and develop intrinsic foot muscles support and improve dynamic standing balance.[19]In contrast to these two varieties of flexible flatfoot, Harris and Beath classified stiff flatfoot - stiff flatfoot is defined by a restriction in subtalar joint movement. When the individual's foot is dangling in the air while seated, as well as during toe-standing and the toe-raising test, the arch remains flat. On occasion, this type of flatfoot can cause discomfort and immobility. The improved proprioception and neuromuscular control as a result of jumping rope exercise helped with balance development.[20]

In flexible flatfoot, the medial longitudinal arch of the foot collapses to variable degrees during weight bearing. However, by standing on tiptoe (tiptoe test), the foot arch develops again. This arch may be seen when weight-bearing stresses on the feet are eased. If the foot is not bearing any weight and the medial longitudinal arch is not visible, the condition is known as stiff (fixed) flatfoot. Jack's test makes it simple to distinguish between these two circumstances.[21]

## Conclusion

In conclusion, this study provides empirical evidence supporting the efficacy of jumping rope exercise as a viable management strategy for individuals with flatfoot. The findings indicate significant improvements in pain levels and quality of life following the intervention. Jumping rope exercise demonstrates positive effects on arch formation, muscle tightness, range of motion, in the management of flatfoot.

**Ethical clearance:** Taken from the institutional ethical committee. ISRB number-03/ 062/ 2022/ ISRB/ SR/ SCPT

**Funding:** Self

**Conflict of interest:** Nil

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Original Article

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# Effects of Static Somatosensory Balance Training Versus Bosu Ball Training on Balance For Institutional Elderly Population

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**Abstract**

**Background:** As individuals age, balance becomes a critical aspect of daily tasks, involving the integration of sensory feedback for movement planning and execution. The aging process leads to gradual degeneration, increasing the risk of falls and associated mortality rates among seniors. Falls can result in debilitating injuries, signalling the onset of various health issues and potentially leading to a cycle of decline in physical function.

**Purpose:** To compare the effectiveness of static somatosensory physical activity for the state of equilibrium and bosu ball sessions on elderly individuals. These activities can help improve balance.They cannot really address fear or dread as those are psychological in nature.

**Materials and Methods**: The 30 subjects were obtained from Neo Education Social Awareness And Management Society (NESAM) Old Age Home between the ages of 60 and 70 were selected based on selection criteria and assigned to two groups. The inclusion criteria encompassed participants with scores between 35 and 45 on the Berg Balance Scale (BBS) and a score of four on the fall risk assessment questionnaire. Group A underwent 30-minute BOSU ball exercises. Group B received static somatosensory balance exercises. *Study period :* November 2022 to July 2023.

**Result:** The study's results revealed that both groups exhibited significant improvements in equilibrium, with a p-value < 0.001. However, the BOSU ball group showed more notable enhancements than the static somatosensory balance exercises group.

**Conclusion:** In conclusion, both BOSU ball sessions and static somatosensory sessions were effective in enhancing balance in elderly individuals. Nonetheless, BOSU ball exercises were found to be superior in improving equilibrium.

**Keywords:** Equilibrium, posture, control, geriatrics, old age home, collapse

## Introduction

A body is in an upright position when its centre of the force of gravity has been confined by its base of support. Balance is of two kinds- Dynamic Balance: When engaging in actions like walking or reaching, this balance is required to keep the point at which of the body's cog. Static Balance: When seated and

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standing quietly, the body must maintain this balance to keep the cog over the base.[1] Vestibular, Visual, and other somatosensory stimuli can be used to determine where the body is in space and where its centre of gravity is. The term "geriatric population" describes seniors 65 yrs. and over. Uneven balance is known to be more likely to occur in this age group.[2]

According to Carr and Shepherd (1998), Balance and action are inextricably linked to the environment in which it is carried out. The "foundation for all voluntary motor skills" is therefore balanced (Woollcott and mission 1996). In order to better adjust to the shifting Centre of gravity (COG), it is essential to be functionally aware of the Base of support (BOS).[3] Falls are one of the major problems for the elderly and one of the "geriatric diseases" (falls, confusion, incontinence, homeostasis and iatrogenic diseases) that contribute significantly to morbidity.[4] The most prevalent geriatric syndrome is thought to be falls.[5] Every year, about 35% of adults over 65 experience a fall. A person's confidence and independence are greatly affected by falling, which can also result in hospitalization, institutionalization, or even death).[6] Age-related structural changes indicate a significant decline in physical fitness.[7]

Falls are highly likely to occur when there are balance issues.[8,9] Falls represent one of a number of major challenges that the senior individuals face. Loss of independence, impairments, and an overall reduction in quality of life can follow a fall injury.[10] BOSU ball is a device created for balance training among athletes and other active people for leisure. A strong plastic base and an air-filled rubber sphere that is comparable to a Swiss ball split in half make up the BOSU's structure. The BOSU ball is intended to be used on either the dome or the platform. Any population can benefit from the equipment's use when it comes to rehabilitation following an injury or surgery.[11]

Only the body centre of mass (COM) moves during static balance, leaving the base of stability (BOS) immobile. Maintaining the Centre of Mass within the Base of Support, also referred to as the stability limit, is the goal of the balance task. The Berg balance scale (BBS), which assesses balance in elderly individuals. The scale, which is used to assess functional balance, consists of 14 accessible tasks representative of commonplace circumstances. Each category has a standard five-alternative scale with values between 0 to 4, and the maximum score that can be achieved is 56. The score is null if the patient requests aid in order to stand, and if the patient can stand unassisted, the score is 4. A score of less than 45 is regarded as indicative of impaired balance and a fall risk.[12]

## Aim

The study is intended to compare the effect of static somatosensory balance training and bosu ball training improving balance in elderly population.

## Methods

A sample size of 30 aged between 60- 80 years, were taken into consideration to assess balance and fear of fall. *Study period :* November 2022 to July 2023.

**Inclusion criteria:**

- Institutionalized elderly
- Male/Female between 60-80 years of age.
- Cognitively intact (MMSE>24)
- Berg Balance Scale 35-40.
- Able to walk independently at least 10 meters.
- At least 1 fall in the previous 6 months (not resulting from a violent blow; loss of consciousness, paralysis, or seizure).
- Independent in ambulation.

**Exclusion criteria:**

- Uncooperative patients.
- Patients with any history of neurological deficit or cerebellar dysfunction.
- Patients with a history of severe cardiac or pulmonary disease, terminal illness, dementia, medical unresponsive depression.
- The Subjects with visual problems or severe auditory problems.
- Elderly who used assisted walking devices or who were unable to walk independently at least 10 meters .

**Outcome measures:**

Assessment was performed at baseline (before starting of treatment) and after two weeks of study.

- Berg balance scale (BBS) to assess balance.
- Fall risk assessment questionnaire to assess individuals risk of experiencing a fall.

**Procedure**

Based on inclusion and exclusion criteria, the subjects were identified. They were provided with an explanation of the study. The included participants were randomly allocated to 2 groups; Group A underwent 30 minutes of bosu ball exercises (knee bend, one leg stand, unilateral heel raise, marching and split stance with torso rotation), with each set of exercises consisting of 5-8 repetitions and a 2-minute rest period. Static somatosensory balance exercises were given to Group B. For 30 minutes, Group B underwent static somatosensory balance exercises with 5-8 repetitions of each set and a 2-minute rest period between sets. For four weeks, the study was carried out five days per week.

**Group A: Bosu Ball Exercise**

At first, all of these sorts of activities were carried out with assistance.

Warm up: Exercises for arm, hip, and leg joint mobility are recommended as part of the warm-up.

1. A single heel lift

- Put one foot on the bosu ball.
- Repeat this motion 5-8 times by raising and lowering the heel that is on the floor.

2. March

- Stance atop the disc.
- March for 20 counts, then repeat 5–8 times.

3. Knee flexion

- Stance atop the disc.
- Kneel on both knees.
- Remain in place for 10 counts.
- It needs to be repeated 5–8 times.

4. Torso rotation while in a split stance

- Position one leg atop the ball.
- Repeat this motion 5-8 times while raising your arms around your trunk.

5. Stand on one leg

- Stance atop the disc.
- Lift a leg.
- For 10 counts, hold it.
- You should do it 5-8 times.

**Group B: Static Somatosensory Balance Exercise**

1. Under the Foot Roll

- Drop a little ball to the ground.
- Roll the ball under the foot in a circular motion while barefoot.
- Change feet and reverse the circling motion.
- Make sure your posture is upright while performing this exercise or any other exercise.

2. Exercise your toes out

- Roll a tiny ball from the big to the small toe while taking off your shoes to spread and stretch your toes.
- At all times, your heel should be in contact with the ground.
- This exercise will help you balance by making your toes more flexible and enhancing your foot somatosensory awareness.

3. Tandem position

- Putting themselves in an upright position next to a chair.
- Put both feet together in a straight line, with the toes of one foot nearly touching the heel of the other.
- Make sure your toes are pointing forward and that your feet are not spread out.
- Change your feet once the allotted time has passed.
- You can close your eyes and practice holding for the designated amount of time to make this exercise more difficult.

4. Standing on one leg with assistance

- Performed with hands on hips, eyes open.
- Time starts when the patient stands on one leg (with assistance if necessary), and it ends instantly when the patient's other foot touches the ground or when their hands leave their hips.
- Similar modifications are made, such as standing on one leg with the leg raised sideways and lifting the back off the ground.

5. Narrow base of support (with eyes closed)

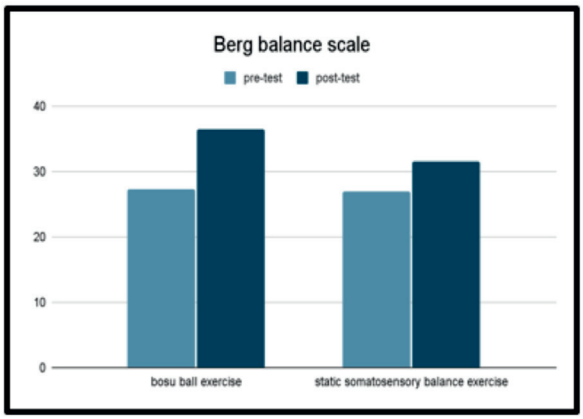
- Request that the subject close his or her eyes and stand straight up.

- As a safety measure, stand close by to prevent the person from falling over and hurting themselves.
- Swaying, occasionally and even toppling over are observed as positive signs.
- The patient's increased unsteadiness when their eyes are closed is the key characteristic.

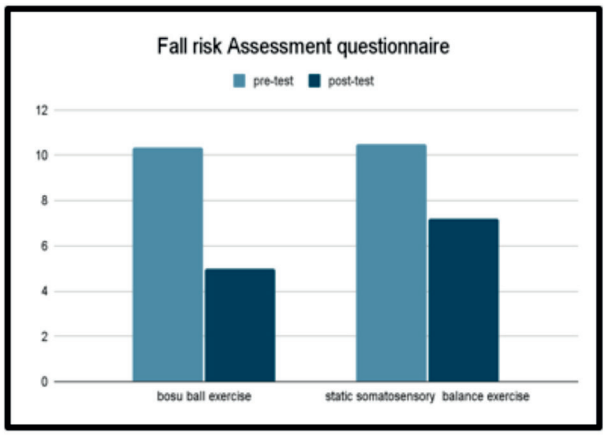
6. Changing to the sway's maximum range

- The performance-based on the length of stay of the subjects was found through demanding them to shift their weight around for as long as their bodies could in three distinct directions (forward, right, and left) while retaining a foundation of support.
- For practical and safety motives, we did not evaluate the performance-oriented length of stay in the reverse direction.

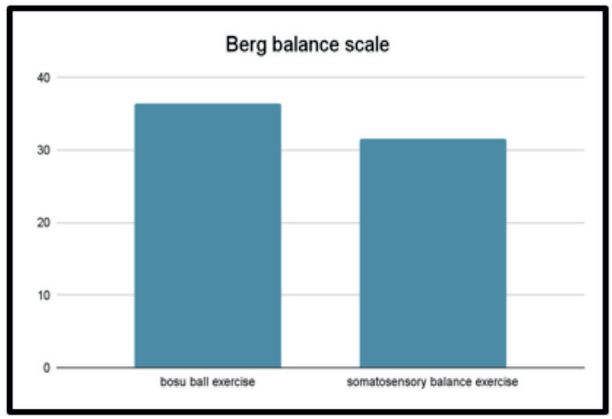
**Data Analysis**




**Graph No.1 Comparison of pre-test and post- test values of Group A and Group B using BBS.**




**Graph No. 2 Comparison of pre-test and post-test values of Group-A and Group-B using FRAQ.**




**Graph No.3 Comparison of post-test values of Group-A and Group-B using BBS.**




**Graph No. 4 Comparison of post-test values of Group A and Group B using FRAQ.**

## Result

A statistical comparison of quantitative data between the BOSU ball physical activity group and the static somatosensory balance physical activity group showed a statistically significant variance in values.

The results of bosu ball exercises using the Berg Balance Scale (BBS) and Fall Risk Assessment Questionnaire are compared using the Berg balance scale, the pre-test mean value was 38.0, and the post-test mean value was 45.73. Using the Fall risk assessment questionnaire, the pre-test and post-test mean values were 10.33 and 5.00, respectively. As a result, when the p-value is less than 0.0001, the results are regarded as statistically substantial.

The static somatosensory exercise's pre-test and post-test results using the Berg balance scale and

the Fall risk assessment questionnaire are compared using the Berg balance scale, the pre-test mean value was 37.86, and the post-test mean value was 41.13. Using the Fall risk assessment questionnaire, the pre-test and post-test means were 10.47 and 7.20, respectively. As a result, when the p-value is less than 0.0001, the results can be considered as statistically valid.

The post-test results of the BOSU ball exercise group and static somatosensory exercise groups are compared which shows that the mean values for the BOSU ball exercise group were 45.73 using the Berg balance scale and 5.00 using the Fall risk assessment questionnaire, while the mean values for the static somatosensory balance exercise group were 41.13 using the Berg balance scale and 7.20 using the Fall risk assessment questionnaire. As a result, when the p-value is less than 0.0001, the results are deemed statistically significant.

## Discussion

Evidence from numerous studies suggested that exercise can help older people with their balance.

According to Paterson et al., despite the fact it can restrict their capacities to perform ordinary everyday tasks, older adults remain capable of improving their joint elasticity through exercise.[13]

According to Rozzi et al., Balance exercises can improve balance and reduce sway conditions by restoring ankle equilibrium, which may also help the proprioceptive mechanisms that were ruined.[14]

Soderman et al., Investigated to determine whether stability board guidance could help prevent painful lower-extremity region injuries.[15]

According to Behm et al., Instead of focusing on building strength, a physio ball (BOSU) training program should aim to increase stability, balance, and proprioceptive abilities.[16]

Stanek et al., identified the center of pressure (COP) and the average sway acceleration. They discovered that, in terms of both COP and sway velocities, the BOSU ball appeared to be the most difficult.[17]

Pijnappels et al., conducted a study in which one leg becomes unbalanced while walking, the other leg is instantly lifted off the ground in an effort to avoid falling. This mechanism explains why there is a decline in the frequency of fear of falling.[18]

According to Hausdorff et al. (1997), Fallers in their senior years walk noticeably more slowly than non-fallers.[19] Wolfson et al. (1995) comparing the walking speed and duration of strides of fallers and non-fallers produced similar findings.[20]

Kronhed et al. (2001) found that participants who were performing activities involving balance transformed their one-legged stance scores and walked at a greater speed.[21] The fear of tumbling is a common worry among the elderly, particularly those who live in institutions. It is important to acknowledge that fear of falling is a complex issue influenced by various psychological and physical factors. Psychological factors such as anxiety, depression, and previous fall experiences can contribute to the development and persistence of fear of falling. Therefore, identifying effective interventions to address fear of falling is crucial for promoting overall well-being and independence among the institutional elderly population.

Limitations:

- No follow up was done.
- The duration of the study is short.

Recommendations:

- Future studies can be done with longer duration and periods.
- Follow up should be done.
- Future research is needed on subjects of other age group

## Conclusion

The study's findings demonstrate that BOSU ball exercise is more effective than static somatosensory balance training in reducing fear of fall in institutionalized elderly. The results show that after the training, posture, base of support, coordination, and balance significantly improved.

**Ethical Clearance:** Taken from institutional ethical committee 03/ 063/ 2022/ ISRB/ SR/ SCPT.

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Effect of Scapular Clock Exercise Versus Scapular PNF Exercise on Pain and ROM for Anterior Capsular Stiffness of Shoulder Joint

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**Abstract**

**Background:** Adhesive capsulitis is a also known as frozen shoulder. Adhesive Capsulitis is a condition that causes stiffness around the shoulder joint, excruciating agony, and limited shoulder range of motion. The onset of this sickness is extremely slow, and the process of regaining pain-free shoulder function is likewise gradual. Most diabetes patients are affected by it. For participants with anterior capsular stiffness, the goal of this study is to examine the effects of scapular PNF exercise with scapular clock exercise on pain and range of motion.

**Purpose:** The Purpose of the study is to determine the effectiveness of scapular clock exercise versus scapular PNF exercise in reducing pain and ROM for anterior capsular stiffness of shoulder joint.

**Materials and Methods:** A sample of 20 were taken according to selection criteria for this experimental study which was divided into two groups, scapular clock exercise with IFT (n=10) and scapular PNF exercise with IFT (n=10) were given. Interventions were given as 6 sessions a week is given and continued for 4 weeks. The pre-test and post-test values were taken. The values were tabulated and statistically evaluated. Study period: November 2022 to apirl 2023

**Result:** The result revealed that the mean of scapular PNF exercise at the post-test was found to be higher than the mean value of scapular clock exercise with a p-value of <0.0001.

**Conclusion:** The study shows that scapular PNF exercise with IFT had shown higher positive outcome in managing anterior capsular stiffness of shoulder joint.

**Keywords:** Adhesive capsulitis, shoulder restriction, anterior capsular stiffness, scapular PNF exercise, scapular clock exercise, NPRS, ROM.

## Introduction

A musculoskeletal condition known as frozen shoulder, or shoulder adhesive capsulitis, causes pain and functional impairment1, especially in external rotation.**2**

The subscapularis muscle is directly underneath the thickest part of the anterior glenohumeral joint capsule, which was measured for thickness and aberrant signal intensity.[3] One of the most important morphological indicators of adhesive capsulitis is a thickened inferior glenohumeral ligament (IGHL)

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(AC). According to earlier research, the anterior band of inferior glenohumeral ligament thickness (AIGHLT) and shoulder capsular contracture, luxio erecta humeri, and AC.[4]

The shoulder's capsular scar tissue identifies its etiology. Similar to other fibrotic musculoskeletal conditions, such as Dupuytren's contracture[5], Hyperthyroidism, diabetes, and prior cervical spine surgery[6], trauma, thyroid disease and female sex are risk factor.[7]

There is no impingement test has a 100% sensitivity or specificity.[8]

The inflammatory, freezing, frozen, and thawing phases of adhesive capsulitis development are the four distinct phases. The patient may experience sudden, intense pain at the end of their range of motion as well as while at rest during Stage 1, last for around three months.

Sleep disturbances occur during this stage. The second phase, or freezing period, might continue from three to nine months. When their range of motion in the forward, internal, and exterior rotation planes is restricted, they may experience discomfort more frequently at night. The third stage, often referred to as the frozen period, might go on for nine to fifteen months. The patient may still experience discomfort at their limits and may have a limited ROM. Stage 4, the discomfort may lessen as movement quality gradually improves. [9]

Adhesive capsulitis is a debilitating condition which causes the capsule of the gleno humeral joint to thicken and contract progressively. Adhesive capsulitis is the leading cause of pain at the shoulder joint in middle aged and elderly persons. It is also more prevalent in the 40-70 years age group and it is estimated that 2-3% of the general population affected with this pathology (19) 3% of the general population is affected with this pathology.[10]

## Aim

The Aim of the study is to determine the effectiveness of scapular clock exercise versus scapular PNF exercise in reducing pain and ROM for anterior capsular stiffness of shoulder joint.

## Material and Method

It was an experimental study conducted on 20 subjects with anterior capsular stiffness of shoulder joint, aged between 40-59 years of both genders was taken from Dynamics physio rehab centre, Chennai. Convenient sampling with random allocation was used in this study.

**Inclusion criteria:**

- Patient who referred by orthopedician,
- PA shoulder (stage 2), Patient with unilateral involvement
- Both genders of age between 40-59 yrs,
- Subjects with positive Dugas test.

**Exclusion criteria:**

- Previous history of shoulder manipulation under anesthesia, diabetic patient.
- Diabetic patient
- OA of shoulder or acromioclavicular joint,
- Metastatis or post traumatic shoulder or shoulder dislocation patient in past 3months, recent fracture.
- Intraarticular cortico-steroid injection in affected limb.

**Outcome measures:**

Assessment was performed at baseline (before starting of treatment) and after four weeks of study.

Numeric Pain Rating Scale (NPRS).[17]

Shoulder range of motion [18]

**Procedure**

Participants were included considering the inclusion and exclusion criteria. Procedure was explained to the participant & participants were then asked to sign the consent form. Assessment of all the included participants was done according to the assessment form. Participants were randomly divided into two groups i.e group 'A' and 'B'. Assessment was performed at baseline and after 4 weeks of study for both (GROUP -A&B) IFT is used.

Study period: November 2022 to apirl 2023

**Interferential therapy procedure:**

This program was prescribed for all subjects. patient in a comfortable position.

During the placement, a gel was used for the vibrations to transfer to the subject's surface area. Pad electrodes are placed accurately at the treatment area and two pairs of electrodes are positioned alternately so, that the crossing point of two currents is over or within the treatment area. (Frequency=90, Spectrum frequency=50, Duration= 15 minutes, 5 sessions per week)

**Group A: scapular clock exercise**:

Scapular clock exercise

- 3' o clock position
- 6' o clock position
- 9' o clock position
- 12' o clock position

Kneeling on a Swiss ball with the elbow fully extended and pointed at the 3, 6, 9 and 12 o'clock positions are among the scapular clock exercises, in all mentioned positions. 3'o clock scapula is protracted, 6'o clock-the scapula is depressed & 9'o clock-the scapula is retracted, 12' o clock-shoulder is elevated.

The stretch was maintained for 15 secs.

Repetition:3set*10reps,Duration:6session/week for 4 weeks)

**Group-B: scapular PNF exercise:**

- flexion-abduction-internal rotation
- extension-adduction-external rotation
- anterior depression and posterior elevation.

Positioning: Start by positioning the person in a comfortable and relaxed sitting position. Make sure their shoulders are relaxed and their back is straight.

**Flexion -abduction-internal rotation:**

Position: Flexion, abduction and internal rotation. Instruct the patient to elevate the hand in flexion-aduction-internal rotation, meanwhile motion resistant has to be given in downward direction. The stretch was maintained for 15 secs.

Repetition:3set*10reps,Duration:6session/week for 4 weeks)

**Extension-adduction-external rotation:**

Position: Extension, adduction, external rotation. In this position, Patient has to lift the affected hand at the back in extension- adduction-external rotation, meanwhile motion resistance has to be given against the patient stretch. The stretch was maintained for 15 secs.

Repetition:3set*10reps,Duration:6session/week for 4 weeks)

**Anterior depression:**

Position: Side lying with involved side up.

While Patient raise their scapula, restrict the movement by giving resistance in opposing direction. The stretch was maintained for 15 secs.

Repetition:3set*10reps,Duration:6session/week for 4 weeks)

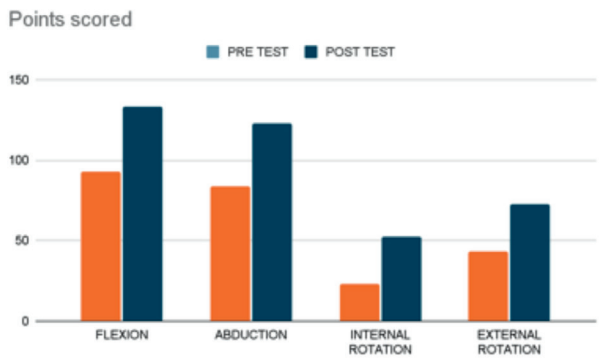
**Posterior elevation:**

Position: Side lying with involved side up.

While Patient depresses, their scapula restricts the movement by giving resistance in opposing direction. The stretch was maintained for 15 secs.

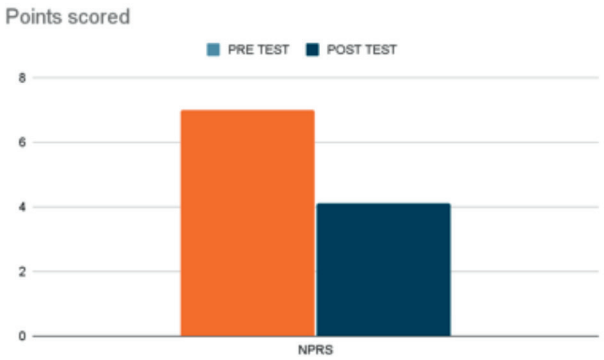
Repetition:3set*10reps,Duration:6 session/week for 4 weeks)

**Data analysis**



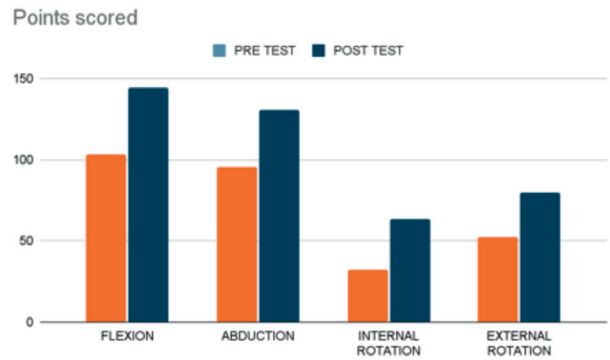

**GRAPH-1 Comparison of pre and post-test values of Group-A using ROM.**

INTERPRETATION: Graph No.1 shows that the values are extremely statistically significant.



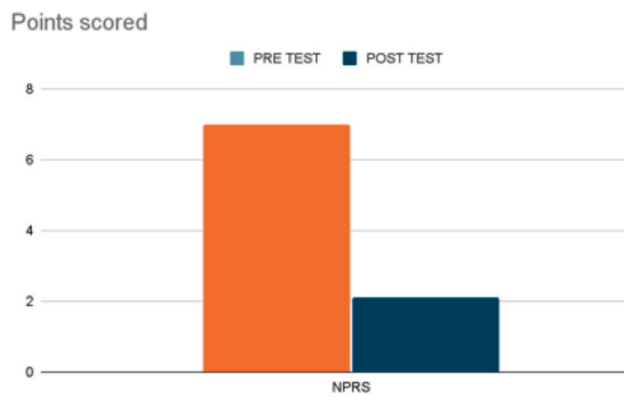

**GRAPH-2 Comparison of pre and post-test values of Group-A using NPRS.**

INTERPRETATION: Graph No.2 shows that the values are extremely statistically significant.



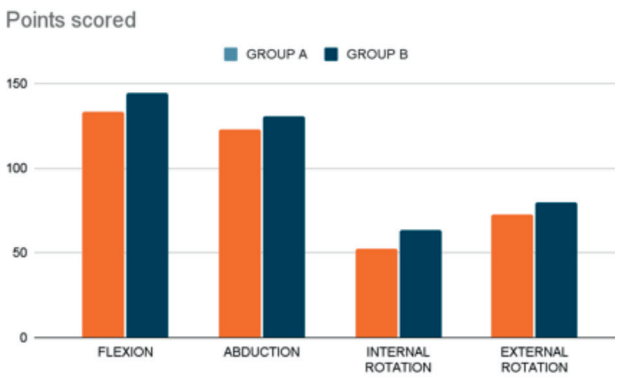

**GRAPH-3 Comparison of pre and post-test values of Group-B using ROM**

INTERPRETATION: Graph No.3 shows that the values are extremely statistically significant.



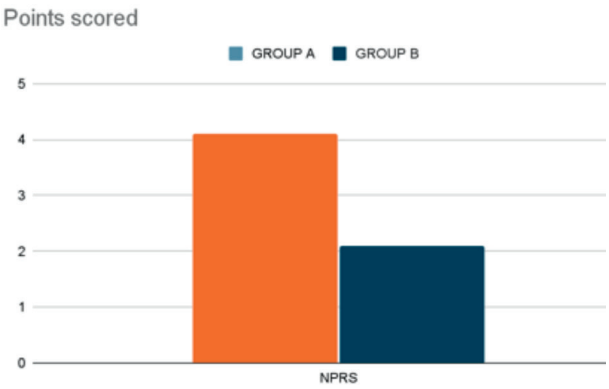

**GRAPH-4 Comparison of pre and post-test values of Group-B using NPRS.**

INTERPRETATION: Graph No.4 shows that the values are extremely statistically significant.




**GRAPH-5 Comparison of pre and post-test values of Group-A and B using ROM.**

INTERPRETATION: Graph No.5 shows that the values are extremely statistically significant.




**GRAPH-6 Comparison of pre and post-test values of Group-A and B using NPRS.**

INTERPRETATION: Graph No.1 shows that the values are extremely statistically significant.

## Result

In result, significant improvement in both ROM and NPRS of post-test values for both groups. The Values of ROM of Group-A were flexion 133.10(+2.60), abduction 123.10(+3.00), internal rotation 52.60(+0.67), external rotation 72.80(+1.99) whereas values ROM of Group-B were flexion 144.10(+6.14), abduction 130.40(+4.55), internal rotation 63.20(+2.39), external rotation 79.50(+2.64), and NPRS values of Group-A were 4.10(+0.88) and value of Group-B were 2.10(+0.88).

According to GRAPH-1 shows, comparison of pre-test and post-test of ROM in Group A (Scapular clock exercise) the values of ROM significantly increased

from flexion 93.00(+2.71), abduction 83.80(+2.53), internal rotation 23.40(+0.69), external rotation 43.00(+2.21) to flexion 133.10(+2.60), abduction 123.10(+3.00), internal rotation 52.60(+0.67), external rotation 72.80(+1.99).

According to GRAPH-2 shows, comparison of pre-test and post-test of NPRS values significantly decreased from 7.00(+1.49) to 4.10(+0.88) in Group-A.

According to GRAPH-3 shows, comparison of pre-test and post-test of ROM in Group-B, the values of ROM significantly increased from flexion 103.50(+3.03), abduction 95.50(+2.8), internal rotation 32.20(+2.15) external rotation 52.40(+1.51) to in flexion 144.10(+0.14), abduction 130.40(+4.55), internal rotation 63.20(+2.39), external rotation 79.50(+2.64)

According to GRAPH-4 shows, comparison of pre-test and post-test of NPRS in Group-B, values were decreased from 7.00(+7.40) to 2.10(+1.17)

According to GRAPH-5 shows, comparison of post-test of ROM in Group-A and B, the values of ROM of Group-A were flexion 133.10(+2.60), abduction 123.10(+3.00), internal rotation 52.60(+0.67), external rotation 72.80(+1.99) whereas values ROM of Group-B were flexion 144.10(+6.14), abduction 130.40(+4.55), internal rotation 63.20(+2.39), external rotation 79.50(+2.64).

According to GRAPH-6 shows, comparison of post-test of NPRS in Group-A and B,values of Group-A were 4.10(+0.88) and value of Group-B were 2.10(+0.88).

As a result of both groups, the results are statistically significant with a p value of 0.0001

This suggests that group B (scapular PNF exercise) performed considerably better than group A (Scapular clock exercise). This strongly suggests that scapular PNF exercise has a positive effect on reducing pain and improvement in shoulder ROM.

## Discussion

The purpose of the study is to find the effects of Scapular PNF along with IFT in subjects with anterior capsular stiffness. Research studies also state that scapular PNF exercise has significant improvements in patients with adhesive capsulitis.

In this study, 20 subjects were assigned, 10 were in Group A and 10 in Group B. Group A received scapular clock exercise along with IFT 6 sessions/week and Group B received Scapular PNF exercise 6 sessions/week for a duration of 4 weeks. The outcome measures were NPRS and ROM performed at baseline and after 4 weeks of study. According to Graph no. 1 and 2, scapular clock exercise is effective in reducing the pain and improving ROM. According to Graph no.3 and 4 scapular PNF exercise is effective in reducing the pain and improving ROM the present study shows improvement. According to Graph no.5 and 6, comparison of post-test values of both groups the present study shows improvement in both the groups i.e., scapular PNF exercise is more effective in reducing the pain and improving ROM than scapular clock exercise.

Joshi YS, Shridhar S, (2020) had concluded that participants with adhesive capsulitis, in terms of lowering pain, abduction, flexion, external and internal rotation ROM, LSST, and SPADI, scapular PNF and Maitland glenohumeral mobilization were more effective treatments (p 0.05). [11]

Tedla JS, Sangadala DR (2019) had concluded that PNF group outperforms in terms of lowering pain and disability, boosting ROM, and enhancing function. The meta-analysis also revealed a substantial impact size, demonstrating that the PNF outperforms traditional physical therapy in terms of reducing pain, boosting external rotation, and improving range of motion (ROM) in abduction.[12]

Mogahed HG, Mohamed NA (2020) had concluded that Increasing shoulder flexion and abduction range of motion, improving shoulder function, and reducing discomfort in post-mastectomy adhesive capsulitis were all achieved with the combination of cyriax soft tissue release and scapular proprioceptive neuromuscular facilitation, which were both important, efficient, and affordable techniques.[13]

When compared to the posterior capsule, the anterior capsule in patients with shoulder stiffness exhibits higher fibrogenic processes, according to genetic study of the shoulder capsule.[14]

A patient with adhesive capsulitis was found to benefit from Proprioceptive Neuromuscular Facilitation together with scapular stability exercises. [15]

The scapular PNF approach was found to be more effective than traditional physiotherapy alone with exercises in lowering pain and enhancing dynamic scapular stability in participants with adhesive capsulitis.[16]

On the basis of the study's findings, suggestions can be made for the clinical care of anterior capsular stiffness of shoulder joint. Clinicians should think about including scapular PNF exercise along with IFT in the treatment plan for patients with anterior capsular stiffness of shoulder joint if it is discovered that they are more helpful at reducing pain and improving ROM than scapular clock exercise. In order to ascertain these interventions' long-term effects on pain management and functional improvement in people with anterior capsular stiffness of shoulder joint, future research should examine the long-term effects of these interventions beyond the 3-month follow-up period.

## Conclusion

In conclusion, this study provides evidence supporting the effectiveness of scapular PNF exercise as a management strategy for anterior capsular stiffness of Shoulder joint. The findings demonstrate significant improvements in shoulder ROM, pain levels following the intervention. These positive outcomes align with recent research emphasizing the benefits of ROM on shoulder function. Scapular PNF exercises show potential for strengthening of shoulder muscles and improves range of motion. Further research and long-term follow-up studies are necessary to validate these results and assess the long-lasting effects of scapular PNF exercise in the management of anterior capsular stiffness of Shoulder joint.

**Ethical Clearance**: Taken from institutional ethical committee. ISRB number-03/ 064/ 2022/ ISRB/ SR / SCPT

**Funding:** Self-funding

**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# Effectiveness of Kendall Exercise for Forward Head Posture among IT Workers

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**Abstract**

**Background:** Forward head posture(FHP), or anterior head syndrome, is a condition where the head is positioned in front of the body's center of gravity. In this posture, the head is tilted forward and extended beyond its normal alignment with the neck and spine. In a neutral position, the ear canal should align vertically with the shoulder, hip, and ankle. However, individuals with forward head posture have their head protruding forward, causing misalignment. This condition is becoming increasingly common due to lifestyle factors such as sedentary activities, excessive screen time, and poor posture habits. It's important to address forward head posture to prevent further complications. Corrective measures may include postural exercises, ergonomic adjustments in workstations, and adopting proper posture habits in daily activities.

**Purpose:** To determine the effectiveness of "Kendall's exercise" among IT workers with FHP.

**Materials and Methods:** A total of 50 subjects were selected according to inclusion and exclusion criteria and consent was obtained from participants. Cranio-vertebral angle and the Neck Disability Index were assessed as pre and post-test.

**Results:** The statistical examination of the forward head revealed a statistical significance between the pre and post intervention.

**Conclusion:** The study concluded that "Kendall's exercise" had improved forward head posture among IT workers, these exercises may be useful in correcting the forward-facing posture.

**Key Word:** neck pain, CV angle, cervical range, neck posture.

## Introduction

FHP is defined as "any one position in which the external meatus of the auditory canal is situated proximal to the plumb line via the shoulder".[1] When the joint is moved, the articular capsule rotates and glides unevenly, resulting in these restrictions. Additionally, it was noted that prolonged FHP could lead since there are fewer filaments and a shortening of the muscle fibres, both of which could influence the ability of the muscles to contract.[2,3] FHP is characterized by greater flexion of the upper thoracic and lower cervical spine. Shortening of the sternocleidomastoid, posterior cervical extensor, upper trapezius, and elevator scapulae muscles are all linked to it.[4]

The forward-facing head posture, often known as the turtle neck posture, is one of the detrimental effects of working on a computer on the body's

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skeletal system. This is because staring at a monitor that is below eye level for a prolonged period of time to maintain equilibrium when the head leans forward leads to thethe lower cervical vertebrae's anterior curvature increasing, as does the upper thoracic vertebrae's posterior curvature.[5-8] IT professionals are at a higher risk of acquiring musculoskeletal diseases due to forward head posture.[9, 10]

The Kendall exercise, a general treatment method, emphasizes on the posture and vertebral alignment in the FHP. In order to treat FHP, which is an instance of muscle imbalance, Kendall exercise is often employed as a form of physical therapy. It induces appropriate neck alignment by typically using building techniques for two muscles: "deep the cervical flexors and scapular retractors and neck extension muscles and pectoralis".[11]

## Aim

To determine the effectiveness of Kendall's exercise in increasing the cranial-vertebral angle among IT workers with forward head posture.

## Material and Method

A convenient sampling technique was used to select 50 participants from a total of 100 for this Quasi-experimental study at MC Engineers, 50 were selected out of the remaining candidates using Craniovertebral angle below 48-50. Study period: October 2022 to June 2023.

**Inclusion criteria:**

1. Both gender
2. neck pain with rounded shoulder
3. CV Angle below 48 – 50 degree
4. System based workers.
5. Working hour for more than (8 – 12 hours)

**Exclusion criteria:**

1. Cervical trauma
2. Surgical interventions in the cervical region
3. Spondylosis
4. Ankylosing spondylitis

**Outcome Measures:**

Assessment was performed at baseline (before starting of treatment) and after four weeks of study.

1. Craniovertebral angle: The angle less than 48 -50° angle denotes a forward head position.
2. Neck Disability Index (NDI): It is used to assess neck disability. It has ten items that assess neck pain intensity and the degree of ability to manage ADL [12]

**Procedure**

Participants received an explanation of the procedure's safety and efficiency. Informed consent was requested and received, along with a subject information paper. Subjects were chosen based on inclusion and exclusion criteria, and participants' concerns were collected. Craniovertebral angle and Neck Disability Index Questionnaire was assessed as a pre-test measurement and the same was assessed as post-test after four weeks of intervention.

**Group A: Kendall Exercise Training Group**

Kendall's exercises are also known as "Muscle Testing and Function with Posture and Pain" exercises. These exercises are commonly used in physical therapy and rehabilitation to assess and improve muscle strength, flexibility, and function.

Duration: Four weeks duration for five times per week, 12 repetitions, each lasting 30 seconds.

The exercise techniques used by Kendall were as follows:

1. Stretching of the Cervical Extensors:

By sitting with the head down and putting both hands across the occipital area, the cervical extensors can be stretched by adopting a flex neck position.[13]

While standing or sitting, you can perform this stretch. Sitting down allows for a larger stretch. Advice stretching while seated as a result. Make cautious not to slouch your shoulders during the stretch to prevent it from working. Additionally, maintain a straight neck (do not curve). Reach down as far as you can on the chest, touching the chin. By stretching, you can find relief and relaxation, which significantly reduces hunching. Furthermore, maintaining appropriate posture necessitates that the muscles of the neck extension stay relaxed, which can assist lessen muscle tension and strain.

Strengthening of the Deep Cervical Flexors:

With the head raised and the body flat on the back, and holding that position for 2 to 8 seconds.[13]

3. Strengthening the Shoulder Retraction:

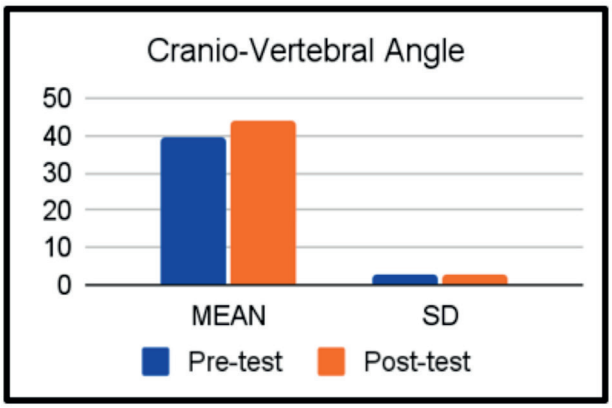
The shoulder blades can be brought closer together while standing by encircling a TheraBand and pulling the band back as far as it will go with both hands.[13]

4. Stretching the Pectoralis Muscle:

Placing the hands on the occipital region, unilaterally abducting the arms, and bilaterally turning externally the arms.

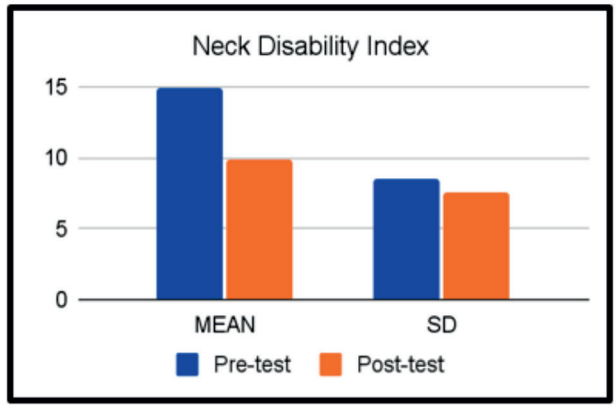
Gentle, not jerky or abrupt pulling is required. It ought to flow easily. Avoid stretching muscles that are frozen. After a warm-up, right after getting out of the shower, or at the conclusion of a workout, stretching is a good idea. Never stretch frozen muscles; instead, start with a brief cardio warm-up. Change the posture of your arms if you see that your shoulder joint is being stretched more than the chest muscles, which is the intended result. Always maintain a straight spine. Breathe correctly by inhaling through your nose and exhaling through your mouth. Hold the stretch until only slight discomfort remains, not until there is noticeable pain.[13]

**Data Analysis**




**Graph No. 1**

Interpretation: Graph No.1 shows that the values are extremely statistically significant.




**Graph No. 2**

Interpretation: Graph No.2 shows that the values are extremely statistically significant

## Result

The mean pre and post-test of Craniovertebral angle (CV angle) was 39.42(2.52) and 43.92(2.56) respectively showing improvement in head posture respectively. Whereas the t value is 22.0006 and p value is <0.0001.SD pre and post-test of CV angle is 2.52 and 2.56 respectively. Graph-1 shows both CV angles were of statistical significance using conventional norms.

The mean of pre and post-test of NDI questionnaire was 14.92(8.47) and 9.96(7.57) respectively Graph-2 showing improvement in head posture respectively. Whereas the t value was 26.4861 and p value was <0.0001. SD pre and post value was 8.47 and 7.57 respectively. The NDI survey contains Statistical significance using conventional standards.

## Discussion

In this study, subjects who underwent Forward head posture were screened for craniovertebral angle using a modified universal goniometer and NDI questionnaire. In previous study subjects whoever has the angle below 50 is considered as Forward head posture as D H Watson et al., Cephalalgia.[14] Similarly in this study also subjects who have an angle below 50 are included. A statistical analysis of the pre and post-tests measurements were Calculated. The results obtained from the study have shown that both the groups have statistically significant improvement. Also, on comparing the pre and post results, the progressive exercise showed more improvement Among IT workers with forward head posture.

In early study concluded that increased computer use brought on by scientific, technological, and industrial advancements, many people nowadays suffer from FHP and develop musculoskeletal irregularities and pain Preservation therapies including traction, stimulation with electricity, and heat therapy as well as therapeutic exercises like Kendall's skeletal muscle endurance and flexibility exercises and McKenzie's postural exercise, have all been used in physical therapy to treat FHP and improve posture[15] Similarly in this study subjects were treated using Kendall's exercise had better improvement for forward head posture among IT workers.

The results from the Kendall exercise group suggest that neck stability has improved. Kendall's workout regimen is based on the idea that exercises for alignment will rectify an unsteady forward head posture, albeit this also entails stretching the chest muscles in addition to the shoulder retractors and deep neck flexors should be strengthened. Despite having features that are similar to those of computers, televisions, and music-related devices, cell phones' small screens make it challenging to use them when standing up straight. The position of the head when using a computer or smartphone, which for an extended period of time prevents the spine's natural curvature from being maintained. The prevalence of neck and shoulder musculoskeletal issues rises as a result among smartphone users. As a result, persons who are susceptible to developing postural deformities as a result of poor posture habits and everyday living patterns should emphasize the value of exercise and good training. This study's objective was to ascertain whether participants' improved forward head position was influenced by the modified cervical exercise's level of momentum. This study suggested Kendall exercises for enhancing forward head posture.

In early study Harman demonstrated the effects of Kendall's exercise programme in a study involving treatment and control groups that had forward-leaning posture and a control group with forward head posture and concluded that Kendall's exercise had better improvement for forward head posture similarly we used this technique to correct that posture.[16]

In previous studies Kendall FP et al., 1993 states that Kendall's exercise program's basic premise is that alignment exercises can help correct an unsteady forward head posture, but this also requires stretching the chest muscles in addition to strengthening the deep neck flexors and shoulder retractors. Kendall exercise is frequently utilized as physical therapy to treat FHP, a disorder marked by muscle imbalance. It generally employs techniques for stretching and strengthening two muscles (deep cervical flexors and retractors of the scapula) and two other muscles (neck extensor muscles and pectorals) in order to bring about optimal neck alignment.[1]

In a previous study, Diab AA et al. (2012 concluded: It has been proven to improve neck stability and postural control. The cervical muscles are developed with the Kendall exercise, a stretching exercise.[17] Similarly, in this study, Kendall exercises were done by stretching and strengthening the deep neck muscles, showing improvement among IT workers.

Additionally, in a prior work by Wang CH et al., the other study showed that the head, shoulder, and upper-body parts were more aligned securely after six weeks of doing the stretching practice upon the chest muscle and shoulders retraction muscles.[18] Exercises to the cranial cervical flexors improved the nervous system's command for the longus colli along with longus capitis, 2 inner neck flexible skeletal muscles, and diminished the rate of unease in individuals with persistent neck pain. This study's conclusion was consistent with earlier research that found that craniocervical flexor training decreased pain intensity in people with persistent neck pain.[19-23] Controlling head motion and maintaining cervical spine stability are the main goals of the longus colli and longus capitis muscles resulting in improved FHP in people with neck discomfort.

The findings of the present study may support the notion that craniocervical flexor training is crucial for patients with persistent mechanical neck discomfort who want to improve their CV angle. The deep cervical flexor exercise-training group exhibited significantly higher levels of neck-flexor muscle strength. This outcome is in line with the findings of a prior study, in which participants underwent 6 weeks of craniocervical flexor training.[24] Deep cervical flexor

strength was found to be lower in patients with neck pain. The longus colli and longus capitis, among other deep cervical muscles, are crucial for maintaining cervical spine stability. Therefore, it is important to emphasize deep cervical muscle activity.[25]

Additionally, a study by Park incorporated cervical with pectoral muscle training with extension and flexibility bands found that the exercise had a good effect on the CVA.[26] Similarly in this study subjects who were trained using Kendall's exercise program the deeper neck flexible muscles & scapular retractor muscles are often strengthened, and the pectoralis muscle & cervical muscles that extend are stretched, to achieve appropriate neck alignment. Kendall exercises can therefore assist to enhance core stability, which can enhance performance and straighten out your forward head posture.

## Conclusion

The study's conclusions imply that patients with forward head posture who engaged in Kendall's exercise might quickly improve and correct the faulty posture. Since FHP is a condition of muscle imbalance, Physical rehabilitation for Kendall usually takes place through exercise.

**Ethical Clearance:** Taken from institutional ethical committee.ISRB Number:03/ 065/ 2022/ ISRB/ SR/ SCPT.

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Original Article

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# Effectiveness of High Load Plantar Fascia Resistance Training among Athletes with Plantar Fasciitis

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**Abstract**

**Background:** Plantar fasciitis is a common condition characterized by pain and inflammation in the plantar fascia, a thick band of tissue that runs along the bottom of the feet, connecting the heel to the toes. It is particularly prevalent among athletes who engage in activities that involve repetitive impact, such as running, jumping. Athletes with plantar fasciitis often undergo a structured rehabilitation program that incorporates high load resistance training alongside other interventions such as stretching, massage, orthotic devices, and modifications in training and footwear.

**Purpose:** To compare the effectiveness of High Load Plantar Fascia Resistance Training with ultrasound and Intrinsic Muscle strengthening with ultrasound among athletes with Plantar Fasciitis.

**Materials and Methods:** Total of 60 subjects were selected from Sri Sai Ortho General Clinic based on the selection criteria and randomly divided into two groups; High load plantar fascia resistance training (HLST) with ultrasound (n=30) and Intrinsic muscle strengthening with ultrasound (n=30). The subjects were assessed for pain intensity using NPRS and using LEFS, for pre and post-test values. The interventions were given for 2 weeks. Study period : November 2022 to March 2023

**Result:** The result of the study revealed that both exercises are effective but (HLST) with ultrasound was more effective and significant in terms of decreasing pain and improving functional mobility.

**Conclusion:** Hence the study concludes that HLST was more effective in managing plantar fasciitis in terms of both relieving pain as well as functional mobility among athletes with plantar fasciitis.

**Keywords:** Heel pain, Resistance training, Intrinsic foot muscle, disability Scale.

## Introduction

The strong, fibrous band that runs from the calcaneus and extends distally to the phalanges is called the plantar fascia, and plantar fasciitis is an inflammation of this band.[1] It affects both elderly and athletic populations and is assumed to be brought on by chronic overload from either lifestyle choices or exercises.[2]

It makes up to 8% of all injuries related to running among runners, making it one of the most

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frequent injuries. Long-term running, which results in biomechanical overuse and minute tears at the calcaneus seems to be the cause of PF.[3]

The origin and insertion of the IFM are located inside the feet. During walking and other strenuous exercises, the foot intrinsic muscles actively resist the arch bending. They essentially provide the foot's arch with active support, this is notably evident during the propulsion phase of walking, running, and jumping.[4]

In each phase of gait it provides support, helps to store and release energy. The intrinsic Muscles are the primary source of the basic stability that is necessary for all actions.[5]

The heel strikes the ground as one is walking. The tibia rotates inward and the foot pronates immediately after this contact, both the arch and the plantar fascia are stretched. As a result, the foot can absorb shock and account for differences in the walking surface.[6]

Risk factors include- a sudden increase in running volume or intensity, running on hard surfaces, tight calf muscle, and prolonged standing or walking. [7] Other risk factors are shortening of the Achilles tendon, and weakness of the plantar flexor and inappropriate footwear.[8]

Symptoms include stabbing pain in the heel at the base of foot, pain worsens in the morning when taking the first few steps. Standing for a long time can also increase the pain. [9,10]

Athletes may experience a typical kind of morning discomfort that manifests itself due to more intense exercise. They may experience foot stiffness, pain and swelling in the heel. [11]

Physiotherapy treatment like radiation therapy, stretching, ESWT, Cryotherapy, ultrasound, lasers, and tapes are used, as well as surgical techniques like partial or complete plantar fascia release.[12,13,14]

Therapeutic Ultrasound uses high-frequency acoustic energy to create thermal or non-thermal effects and helps in reduction of pain.[15]

Some studies have shown that intrinsic foot exercise routine helped recreational long-distance runners improve their forward running propulsive forces and enhance the volume of the foot's intrinsic muscle.[16]

Studies have shown that a basic progressive exercise routine followed every other day produces better results than plantar-specific. Hence the high-load strength training may help subjects with plantar fasciitis experience quicker pain relief and functional benefits.[17]

Thus, the purpose of the study was to compare the effects of High load strength training with ultrasound and Intrinsic muscle strengthening with ultrasound among athletes with Plantar fasciitis.

## Aim

The goal is to address both the underlying causes of plantar fasciitis and the associated biomechanical factors that contribute to the condition.

## Material and Method

Total of 60 subject**s** were selected based on the selection criteria and randomly divided into two groups; High load plantar fascia resistance training (HLST) with ultrasound (n=30) and Intrinsic muscle strengthening with ultrasound (n=30). The subjects were assessed for pain intensity using NPRS and using LEFS, for pre and post-test values.Study period : November 2022 to March 2023

**Inclusion Criteria**

- Age between 25-44 years
- Both gender
- Heel pain in the morning.
- No history of rest pain in heel
- Palpable pain over the medial tubercle of the proximal fascia

**Exclusion Criteria**

- History of systemic disease
- Rheumatoid arthritis
- Osteoporosis
- Diabetes mellitus
- Bursitis in and around the ankle joint

**Outcome Measures**

Assessment was performed at baseline (before starting of treatment) and after two weeks of study.

- Numerical Pain Rating Scale (NPRS)
- Lower Extremity Functional Scale (LEFS)

**Procedure**

Subjects were selected based on the selection criteria, the subjects were explained about the safety and simplicity of the study and informed consent was obtained. As a pre-test measurement the baseline for pain and functional mobility using NPRS and Lower extremity functional scale were used respectively and the same as post-test measurements were measured after 2 weeks of intervention.

**High Load Plantar Fascia Resistance Training With Ultrasound : (HLST Group)**

The subject was first treated with Ultrasound therapy and then the HLST exercises were initiated.

**Ultrasound Protocol:** The subjects was positioned in prone lying. Using ultrasound on the skin in a circular motion for approximately 10 minutes, per session for two weeks, with a frequency of 1MHz with 1W/cm2 in a pulsed mode with a 1:4 ratio of duty cycle was applied over the plantar fascia.

**HLST Exercises:**

Patient position: Standing

**Procedure:**

Set up instruction:

Step 1: The towel should be rolled into a cylinder about 2 cm in diameter; the size should be adjusted to fit your particular foot size.

Step 2: The injured foot toes should be put on the towel about 5 cm away from the foot stool edge as a result of which can enclose the cylinder.

Step 3: Make sure the corner of the foot stool is at the midpoint of the foot; Placing a chair provides support which reduces the risk of fall.

**Instruction:**

Step 1: Carry out a heel rise in concentric phase for at least 5 seconds while (moving up), isometric phase for 3 seconds (pause at the top of exercise), followed by eccentric phase for 5 seconds (moving down)

Step 2: Raise the heel of the other leg up in the air, if it is possible. Heel lifts can be performed with both feet simultaneously if this is impossible or if both legs are injured.

Week 1 (1-7 days): Perform 3 sets of 12 repetitions using body weight, perform as many repetitions as you can at the beginning of the program.

Week 2 (8-14 days): lowering the repetitions to 10 and increasing the set to 4, by utilizing a backpack filled with books.

**Intrinsic Muscle Strengthening With Ultrasound: (IMS Group)**

The subject was first treated with Ultrasound therapy and then the IMS exercises were initiated.

Strengthening exercises for the Intrinsic Muscle:

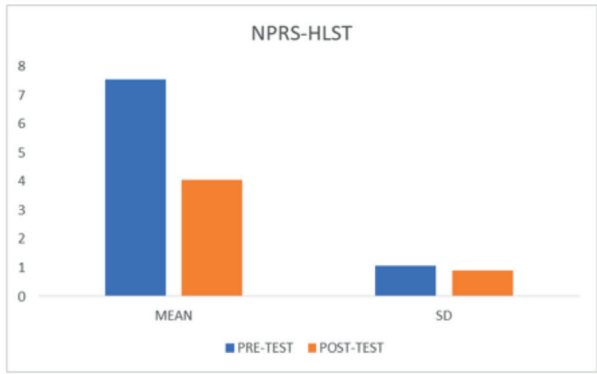
**Active Ankle Exercises:** Subjects position: Supine lying. Procedure: Active involvement of the subjects, performs ankle movements such as Plantar Flexion, Dorsiflexion, Eversion and Inversion 3 sets, 10 repetition for two weeks.

**Towel Curl Up:** Subjects position: Sitting in the chair. Procedure: Place the feet flat on the end of the towel, when placing the heel on the ground by curling the towel within the toes for ten minutes per day for two weeks.

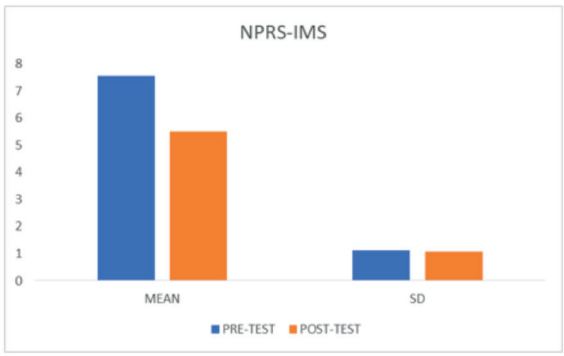
**Achilles Tendon Stretching:** Subjects position: Walk standing position. Procedure: Place the hands at eye level, against the wall. Keeping the leg back that you want to stretch. Point your toes straight ahead while keeping your back heel on the ground. Actively bend the other leg knee towards the wall, the leg which is behind is kept straight. Bend forward towards the wall, till a stretch is felt in the calf muscle. Perform 5 sets and hold each stretch for 1 min, for two weeks.

**Tennis Ball- Plantar Fascia Stretch:** Subjects position: Sitting in a chair. Procedure: Tennis ball is used to stretch the plantar fascia. Place the tennis ball under the arch of the affected foot. Roll the ball from heel to toe. Perform it for 10 minutes per day for two weeks.

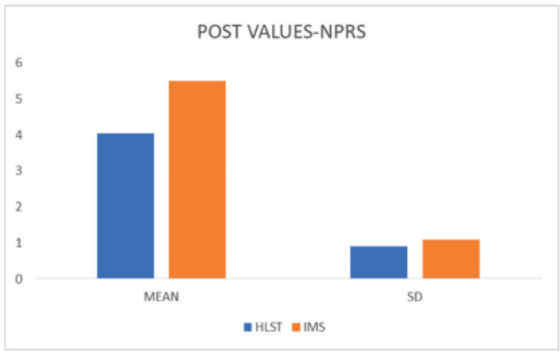
**Data Analysis**



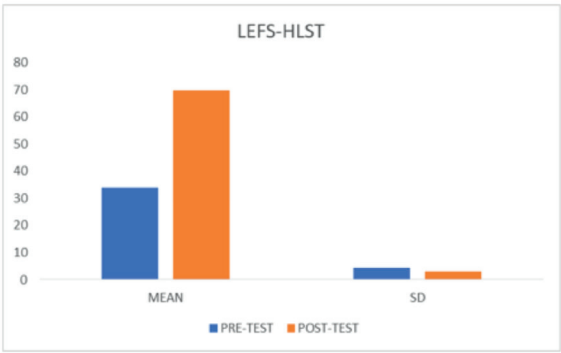

**Graph - 1 Pre-test and Post-test values of NPRS of HLST**



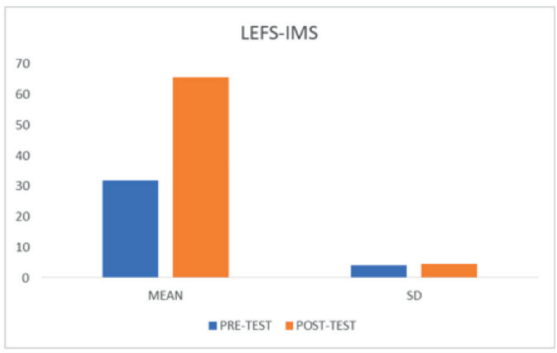

**Graph - 2 Pre-test and Post-test values of NPRS of IMS**



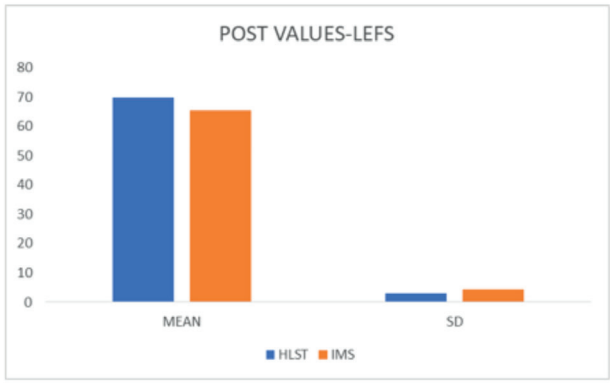

**Graph - 3 Post-test values of HLST-IMS of NPRS**




**Graph - 4 Pre-test and Post-test values of LEFS -HLST**




**Graph - 5 Pre-test and Post-test values of LEFS – IMS**




**Graph-6 Post-test values of HLST-IMS of LEFS**

## Result

In HLST group pre-intervention mean of NPRS was 7.53 and LEFS was 33.90. After treating the subject with HLST with ultrasound, the mean value of NPRS and LEFS is 4.03 and 69.73, which shows statistically significant differences between the groups.

In IMS group pre-intervention mean of NPRS was 7.53 and LEFS was 31.70. After treating the subject with IMS with ultrasound, the mean value of NPRS and LEFS is 5.50 and 65.40, which shows statistically significant differences between the groups.

Based on the statistical analysis, both groups showed improvement in NPRS and LEFS. However, subjects in HLST groups who received HLST with ultrasound showed better improvement in NPRS and LEFS than the subjects in the IMS groups who received IMS with ultrasound.

## Discussion

The current study compares the efficacy of HLST with ultrasound and IMS with ultrasound among athletes with plantar fasciitis. Additionally, the focus is to evaluate the efficiency in reducing pain and improving functional outcome. Before and after treatment, the outcomes were evaluated using the NPRS and LEFS. When the responses from the two groups were compared, the result showed a significant difference in High load plantar fascia resistance training with ultrasound group's than the Intrinsic muscle strengthening with ultrasound group.

Douglas L. Miller.et,al.states that ultrasound can have an impact not just through thermal but also

through non heating mechanisms such as mechanical stress, gas body activation. Physiotherapy treatment, for instance, the use of misdirected heating can be controlled to treat highly absorbent tissues like bone or tendon without causing damage.[18]

Valma J Robertson,et al.states that the therapeutic uses of ultrasound in Physical Therapy Based on Heating, the first clinical use of ultrasound for physical therapy dates back to the 1950s and is frequently referred to as simply "therapeutic ultrasound."[19] L Machet,et al.states that Physical therapist, applies coupling gel to the handheld transducer and move it around the area of pain in circular motion to treat diseases like inflammation of tendon and bursa in shoulder. Which increases circulation and hastens recovery. [20] Rathleff MS,et al. shows that for individuals with plantar fasciitis, this is the first randomized experiment to contrast high-load strength training with plantar-specific stretching. The subjects with HLST was related with a bigger improvement in FFI. [21] Lynn,et al. states that, it is not able to determine the degree to which strengthening therapies that enhance IFM may assist symptom less or at-risk groups for Plantar Fasciitis/heel discomfort. [22] Daeyeol Kim,et al. states that a similar increase in muscle growth with LL and HL and maximum strength readings increased somewhat after high load. [23] Brittany R. Counts,et al. states that muscle contractions alone could activate the muscle enough to stimulate growth of the muscle like High Load training. [24] Scott K. Lynn,et al.stated that training the IFM had no effect on the results of the navicular height and static balancing tests. [25] Therefore, our study states the HLST is effective for managing Plantar fasciitis symptoms.

## Conclusion

Hence the study concludes that both exercises are effective but (HLST) with Ultrasound was more effectual and significant in terms of decreasing pain and improving functional mobility, in managing plantar fasciitis.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. ISRB number-03/066/2022/ISRB/SR/SCPT.

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**Conflict of interest:** The authors state that there is no conflict of interest**.**

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Original Article

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# Effectiveness of Nordic Exercises in Subjects with Hamstring Strain

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**Abstract**

**Background:** Hamstring strains are the most prevalent muscle injuries reported in sport with a prevalence rate between 6% and 29% of all injuries reported. The symptoms of hamstring strains include pain, swelling, tenderness, bruising in the back of the thigh. There is an inadequacy of studies to support the efficacy of Nordic Exercise for hamstring strain.

**Purpose:** To determine the effectiveness of Nordic exercise among subjects with hamstring strain.

**Materials and Methods:** A Convenient sample of 80 subjects with hamstring strain were sorted out by the selection criteria and were randomly assigned into Nordic group and control group. The Nordic group was treated with Nordic exercises, while the Control group was treated with stretching and strengthening exercises on an odd-even randomization. The pre-test and post-test were obtained through "Functional assessment scale for acute hamstring injuries" (FASH).The entire study process was conducted from November 2022 to March 2023.

**Result:** The study revealed that the Nordic exercise group showed reduction in hamstring strain and FASH score than the conventional group. The mean pre-test value for Nordic group was 57.00 and post-test value was 11.73, while the mean pre-test value for Control group was 52.61 and post-test value was 7.40. As a result, both groups have a significant increase in FASH.

**Conclusion:** The study concluded that the Nordic exercises are more effective when compared to stretching and strengthening exercises for reduction of hamstring strain and increased functional activities.

**Key Words:** Hamstring strain, muscle injury, eccentric training and FASH.

## Introduction

The most habitual muscle pathology in sports is the hamstring strains. According to epidemiology studies, around 6% to 29% among injuries disclosed were found to be hamstring- related.[1,2] The prevalence of hamstring strains and re-injuries has not seen to be reduced over the past three decades. Within a few weeks of the injury, most of the athletic population are able to return to sport. Rehabilitation professionals must be knowledgeable with the causative factor and processes of hamstring injuries in order to execute a complete functional assessment and proceed weight bearing to the injured area in a safe and efficient manner. According to recent research, there are two types of hamstring strains; as first occurs during

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high-intensity activities while the other occurs during stretching exercises performed at their maximum range of motion.[3] In addition to the higher frequency of injuries, the protracted length of clinical features, inadequate relieving outcomes, and a significant risk of recurrent injury prevalence of 12-31% all contribute to aggravation with hamstring strains.[3-4] The main functions of the hamstrings are knee flexion and lengthen the hip. It is frequently assumed that the factor contributing to hamstring's propensity for strain is that it is biarticular in development, crossing over two joints and being stretched at many points.[5-10] Breakdown of the muscle-tendon junction, which typically takes place at the anterior musculotendinous junction, characterizes a muscular strain injury typically, when the muscle is stretched or passively lengthened.[11-14] Schache et al. in his research studied the bio-mechanical measures for the pre- and post-sprinting-related hamstring injury utilizing movement and ground reaction force data which revealed that, asymmetries exist prior injury and the biomechanical changes that occur due to the injury leg, when the damage most likely occur prior to the foot strike during a sprinting movement that results in an eccentric muscle action where the "biceps femoris" stretched over the hip and knee.[15] It has been demonstrated that the Nordic hamstring exercises (NHE), also known as Nordic curl, is a useful tool for increasing eccentric hamstring strength. Adopting the NHE in routine training decreased the incidence rates of hamstring injuries by 65% to 70%, with a notably preventative effect on minimizing recurrent injuries, according to previous research on male professional soccer players. The exercise attempts to stop falling forward while kneeling which indirectly causes rise in the eccentric torque output of hamstring muscle during the eccentric phase, according to a preliminary finding by a team of researchers from the Oslo Sports Trauma Research Centre (OSTRC).[17] Most of the time, the hamstrings are engaged throughout its late swing phase or the beginning of stance phase. The risk of hamstring strain is highest throughout the late swing or late stance stages of a sprint because those times are when the hamstring muscles flex eccentrically to limit knee and hip extension. Risk of future strain injuries might be due to hamstring weakness, hence strengthening exercises, particularly eccentric knee movements, should be used.[16-20] According to Yu et al., the musculo-tendinous junction throughout the terminal stance phase and the muscle's belly through the late swing phase maybe they are the most prone locations for hamstring strain.[21-23] Having enough flexibility is a crucial component of physical fitness. Many athletic teams focus on improving or maintaining flexibility, primarily via the use of different stretching. Numerous investigations, notably all of those examined in this work, have demonstrated at least a brief improvement in range of motion and increasing flexibility when hamstrings are stretched.[24,25] Thus, an attempt is made in this study to determine the effect of Nordic exercises on hamstring strain.

## Aim

To evaluate the effect of Nordic exercise among subjects with hamstring strain.

## Material and Method

A Convenient sample of 80 subjects with hamstring strain were selected from Prism Health Care and were sorted-out by the selection criteria and were randomly assigned into the Nordic group and control group. The Nordic group treated with Nordic exercises, while the Control group treated with stretching and strengthening exercises on an odd-even randomization. The study conducted for eight weeks, the pre-test and post-test values were obtained through "Functional assessment for acute hamstring injuries" (FASH). Study period : November 2022 to March 2023.

**Inclusion Criteria**

- Male and Female players.
- Age between 21 and 35 years.
- Being an active player of any sport.
- No Previous injury of the hamstring at least for 6 months.

**Exclusion Criteria**

- Recurrent episodes of strain.
- Recent H/O hamstring strain or last 6 months.
- H/O knee injuries, surgeries, hip and back pain.
- Musculoskeletal, respiratory or cardiovascular conditions.

- Uses of nutritional supplements steroids.
- Physical therapy treatment for strain.

**Outcome Measures**

Assessment was performed at before and after the treatment.

- Functional assessment for acute hamstring injuries (FASH).

**Procedure**

Subjects who were willing to take part in the study were sort-out based on the selection criteria and informed consent was obtained after explaining about the process of study and the safety of the procedure. A total of 80 subjects were recruited and using the odd even ratio were divided into Nordic Hamstring Exercise (NHE) group (n=40) treated with Nordic exercises and Control group (n=40) treated with Strengthening and Stretching exercises for the Hamstring. The pre-test value was measured using the FASH and the same was recorded as post-test after eight weeks of intervention.

**Nordic Hamstring Exercises Group:**

Subjects in this group were instructed to follow the Nordic Exercises along with Stretching exercises. The session started with 5 mins of warm-up and 5 mins of cool down phase.

**Procedure:** The subject was asked to kneel on both knees with pad below and secure the ankles with Nord stick and instruct them to tighten the hamstrings, glutes and abs to hold up the position. Keep your back straight and slowly lean forward till you reach the floor at the same time squeeze your hamstrings and glutes hard to maximize contraction per repetition.

**Treatment Protocol:**

No of Sets: 3

No of Repetitions: 10

Rest period: 10 seconds

Sessions: 3 sessions per week for 8 weeks.

**Stretching and Strengthening Exercises Group:**

Subjects in this group were instructed to follow the Strengthening and Stretching exercises for the Hamstring. The session started with 5 mins of warm-up and 5 mins of cool down phase.

**Stretching Exercises:**

**1. Sitting Hamstring Stretch:**

**Procedure:** Subjects instructed to sit on the floor in long sitting with one leg bent at knee and foot facing inward and extend the stretchable leg and bent forward at the waist. Instruct the subjects to bend forward and touch the toe to feel a stretch.

**2. Standing Hamstring Stretch:**

**Procedure:** The subjects received instructions in accordance. They were instructed to stand straight with their backs straight, put one leg in front of them with the foot flexed and the heel pushed into the ground, then ask them to lean forward and lay their hands on the straight leg.

Treatment Protocol:

No of Sets:3

No of Repetitions:10

Hold period:30 seconds

Rest period:10 seconds

Sessions:5 sessions per week for 8 weeks.

**Strengthening Exercises:**

**1. Romanian Deadlift:**

**Procedure:** The subjects were instructed to stand with their feet hip-width apart, knees slightly bent, and arms at their sides while maintaining a flat back and holding the barbell in both the hand. They were then instructed to slightly drop the weight along their shins, squeeze their butt while keeping the weight near to your shin.

**2. Weighted Glute Bridge:**

**Procedure:** The subjects were instructed to lie on their back with their knees bent, holding a dumbbell in each hand, rest it under their hip, and contract their glutes and abs while naturally pushing through their heels and lifting their hip.

**3. Sumo Squat:**

**Procedure:** The subject was instructed to stand with their feet wider and their toes pointed slightly outward. They were then instructed to grip a weight with both hands, and instruct them to perform squatting.

**Treatment Protocol:**

No of Sets:3.

No of Repetitions:10.

Hold period:30 seconds.

Rest period:10 seconds.

Sessions:5 sessions per week for 8 weeks.

**Data Analysis**

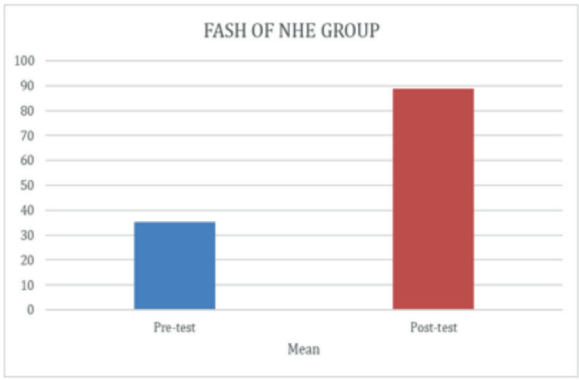



**Fig-1 Pre and Post-test values of NHE for FASH**

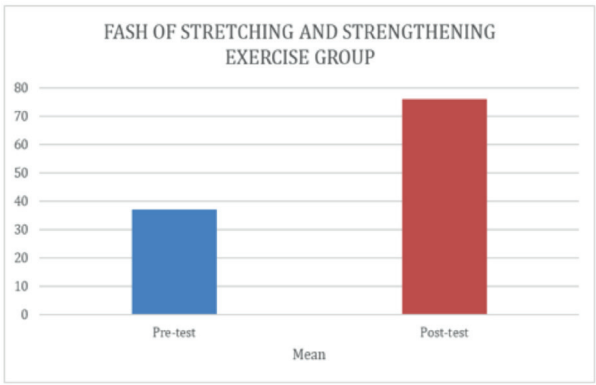



**Fig-2 Pre and Post-test values of Stretching and Strengthening exercise group for FASH**

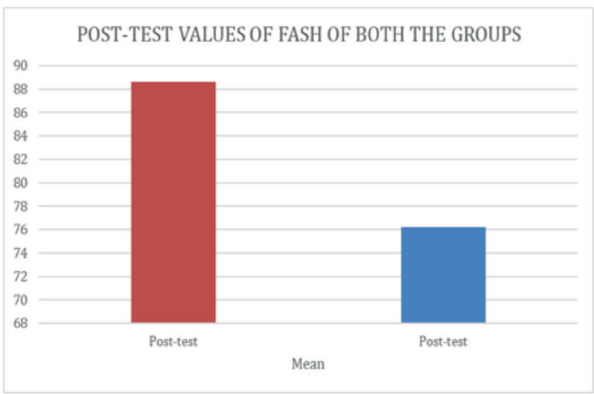



**Fig-3 Comparison between the post-test values of both the groups for FASH**

## Result

Statistical analysis made with quantitative data indicated statistically significant differences in the values of NHE and Control group. The statistical analysis of both the groups, post-test values (mean ± SD) for FASH 88.60 ± 8.76 and 76.18 ± 11.84 respectively with t-value of 12.42 and the p-value was less than 0.0001 were considered statistically significant.

## Discussion

By describing the incidence of acute hamstring injuries in various sports and the general population, as well as the challenges associated with returning to sports without suffering performance-related setbacks and a high risk of recurrence of injuries, this study aims to highlight the scale and extent of the problem. Because hamstring injuries are most common among athletes and the general public.[25] Male athletes are more likely than female athletes to experience hamstring strain, according to several studies.[26] Acute hamstring strains have been discovered to occur more frequently in field sports than in court sports, during competitions as opposed to practices, and during the preseason as opposed to the regular season and post season.[27] Exercise improves various factors of our body like cardiorespiratory fitness, mental health and helps in maintaining the level of various diseases like type-2 diabetes and many more. Exercise plays a major role in our daily living.[28] This study mainly focuses on the effectiveness of Nordic exercises versus stretching and strengthening exercises. According to Decoster LC et al (2005), only 21.4% (6/28) of the studies had a methodological quality score between 6 and 8, indicating a generally poor level of quality. Therefore, it was challenging to definitively name the top hamstring stretching technique. Instead, it appears there is support evidence in a variety of stretching methods, positions, and durations that increase range of motion in the hamstrings.[23] According to Guex K et al (2013), preventing hamstring strain injuries requires more than just strength and contractions, or a combination of both the activity.[22] This study shows more effectiveness with Nordic exercises based on statistical values than strengthening and stretching exercises. Although both the groups show almost the same result and values.

## Conclusion

According to the findings, the Nordic exercises were more effective than stretching and strengthening exercises. It was concluded that Nordic exercise had a substantial clinical and statistical effect rather than using electrical modalities on treating Hamstring strain. As a result, it is suggested that this procedure be used in clinical practice to reduce hamstring strain. **Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number- 03/ 067/ 2022/ ISRB/ SR/ SCPT).

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**Conflict of Interest:** Nil.

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Original Article

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# Efficacy of Flexibility Exercise for Subjects with Achilles Tendinitis- Quasi-Experimental Study

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**Abstract**

**Background:** Achilles tendinitis is a habitual overuse injury, particularly in the field of sports which may involve lunging and jumping activities. This study focuses on how well brief flexibility exercises help subjects with Achilles Tendinitis and improves their functional activity and decreases the pain.

**Purpose:** The Purpose of the study is to determine the effect of flexibility exercise in reducing pain and in improving functional activity among subjects with Achilles tendinitis.

**Materials and Methods:** This is a Quasi-Experimental study where subjects with Achilles Tendinopathy were selected on the basis of the selection criteria. The subjects were briefed about the procedure and informed consent was acquired. Pre-test scores for pain and functional ability were recorded using NPRS and VISA, the same as post-test values after 4 weeks of intervention. The entire process was performed from November 2022 to March 2023.

**Result:** From the test values according to the VISA and NPRS it results that flexibility exercise for Achilles tendinitis helps in reducing pain and it gives the best result in improving functional activity.

**Conclusion:** According to the data gathered, flexibility training for four weeks with twelve sessions enhances physical activity and reduces discomfort in patients with Achilles tendinopathy.

**Keywords:** Achilles tendon, VISA, pain, functional activity

## Introduction

Achilles tendinitis (AT) is an illness marked by discomfort, pain, puffiness, and decreased action of the Achilles tendon. The tissue that joins the calf musculature posterior to the lower leg to the calcaneus. The tendon can become inflamed from overuse. Achilles tendonitis most frequently affects runners who have abruptly increased their run length or intensity. Middle-aged people who only participate in weekend sports like basketball or tennis are also prone to this. Most occurrences of Achilles tendinopathy can be managed with straight forward home sessions like treatment while under the guidance of the therapist. Personal-care techniques are a typical requirement for the cessation of recurring episodes. Achilles tendon ruptures can result from more severe occurrences of the condition and could

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need to be repaired surgically. Mostly, the prevalent causative factor of heel pain in the posterior aspect, and athletic population are at the highest risk, with an Achilles Tendinitis frequency of 11 percent to 18 percent. While runners are the most prone to acquire Achilles Tendinitis, it can also affect other athletes and those who are sedentary.[1] It is the degeneration or failure to heal as a result of repeated loading without adequate recovery. Tendinitis should not be used since it comprises inflammatory response, which may be present in the tendon that is wounded. There is diffuse increase in thickness, loss of collagen, an increase in proteoglycans, and seizing up of tissue order at the tissue level.[2] Overuse tendinopathy is a non-inflammatory condition characterized by a failing healing tendon reaction. Treatment for Achilles tendinopathy can be difficult as symptoms may continue despite conservative and surgical surgery.[3] Mechanical loading induced by eccentric strengthening can promote tendon repair. Although treatment programmes for Achilles tendinitis include flexibility exercise, eccentric exercise had improvement in pain, discomfort and outcome, the relieving rate and have shown that functional utility improvements are leisure, taking up to 4–5 yrs. The prevalence of Achilles tendinitis is up to 9% in runners and 30% in physically inactive individuals.[4] The non-operative treatment of chronic Achilles tendon insertion tendinopathy is understudied. The motive of the study was to establish the effectiveness of eccentric loading and flexibility to leg exclusively in subjects with insertional Achilles tendinitis, following the recent demonstration of their effectiveness in patients with Achilles tendinitis.[5] The Achilles tendon tear injury is the most prevalent sports-related injury among the adult population. Despite the rising prevalence, no consensus exists on the optimum treatment strategy, because both operational and nonoperative therapies have their own set of pros and disadvantages.[6] Running is a popular type of exercise, but it puts athletes at risk for a number of injuries specific to running. The majority of running injuries are caused by overuse and can be treated conservatively. The most prevalent form of treatment for tendinopathies in the hamstring, Achilles, and patellar tendons is flexibility exercise, stretching and eccentric exercise.[7] Achilles tendinitis is a usual wear and tear condition that causes significant discomfort and a decreased grade of daily living. The pathophysiology of Achilles tendinopathy is governed by several biomechanical and anatomical features, making selecting the best treatment strategy difficult.[8] The best way to treat an Achilles tendon rupture after surgery is yet uncertain. Over the last two decades, there has been a tendency toward less strict immobilization, quicker weight-bearing, and faster postoperative functional rehabilitation.[9] Tendinopathies cause severe morbidity, and there are currently just a few scientifically established therapeutic options. The tendons of the Achilles and Patellar are among the most fragile, and overuse lesions of the lower limbs are common. Achilles tendon pathologies can be treated conservatively with optimal results and functional outcomes, but surgery should be considered if this method fails.[10] Eccentric exercise may produce better results.[11] Achilles tendinopathies are common injuries that occur after sports activity, with men being more susceptible than women.[12] Blood flow restriction training has been demonstrated to be sound and effectual in building strength and stamina in healthy fit inhabitants, and it is currently being researched for application in post-injury intervention plan. BFR induces strength and hypertrophy gains at significantly lesser loads to the previous approaches, permitting subjects to commence rehabilitation considerably earlier.[13] Currently there is no agreement on the post-operative therapy for acute Achilles tendon rupture. There is debate over ROM and the quantity of weight- bearing or immobilisation required. Recent research has found that initial, functional resistance rehabilitation is beneficial in both conventional and surgical intervention.[14] The assessment methodologies and eccentric overload treatment procedure employed in this study can be advised to individuals with chronic Achilles tendon pain.[15] Tendinopathy, the medical term for discomfort in the Achilles tendon and the functional limits it causes, is widespread and places a heavy burden on society. For the general adult population, the prevalence figure of Achilles tendinitis is 2.35/1000 person-years.[16] Another possibility is that a significant effect may be the length of rear foot eversion. The length of eversion, however, hasn't gotten much attention in the biomechanics literature.[17] The two most popular stretching methods on the sports field are static and ballistic stretching. A relaxed muscle is slowly and carefully lengthened during static stretching. A rhythmic bouncing motion known as a ballistic stretch lengthens a muscle by utilising the swinging

body segment's momentum.[18] With the exception of eccentric training, which is the widely used regimen, no therapy is universally acknowledged for treating the common musculoskeletal condition Achilles tendinitis.[19] According to anatomical location, there are two basic types of Achilles tendinitis.[20]

## Aim

The aim of the study is to determine the effect of flexibility exercise with subjects with Achilles tendinitis.

## Material and Method

This is a Quasi-Experimental study where 30 subjects with Achilles Tendinitis were selected on the basis of the selection criteria from a private hospital from Chennai. Pre-test scores for pain and functional ability were recorded using NPRS and VISA, the same as post-test values after 4 weeks of intervention.

**Study period:** from November 2022 to March 2023.

**Inclusion Criteria**

- Both male and females
- 18-70 years of age
- Thompson test positive (The patient lies prone with his foot over the end of the table. Alternatively, the patient could lie prone with his knee flexed to 90°. The examiner squeezes the calf muscles, specifically the gastrocnemius - soleus complex, with his hand Squeezing the calf should cause contraction of the Achilles tendon, resulting in plantar flexion. If the Achilles tendon is completely ruptured, there will not be any apparent plantar flexion.).
- Pain present for ≥4 weeks
- Positive Achilles palpation test
- Decreased plantar flexion endurance test vs contralateral leg
- Isometric heel raise test

**Exclusion Criteria**

- Vascular or sensory disturbances in lower leg
- Inflammatory conditions of the lower limb
- Subjects with Lymphedema
- Subjects with peripheral vascular or arterial disease
- Subjects with DVT.

**Outcome Measures**

Assessment was done at initial and at the end of the study using

**VISA:** The Victorian Institute for Sport Assessment is seen as a valid and reliable self-reported scale for disorders related to Achilles Tendinitis (VISA). It is used to investigate the functional severity of chronic Achilles tendinitis in patients. It's a simple self-reported survey that assesses clinical features and their impact on physical activeness. VISA comprises 8 questions that covered 3 domains of pain (questions 1-3), function (questions 4-6), and activity (questions 7) and Questions 1 to 7 are scored out of 10, and question 8 carries a maximum of 30. Scores are totalled to give a total out of 10 with lower scores indicating greater disability [(21)]. **NPRS:** Numerical pain rating scale is used as the primary source of outcome for this study design. The Scale described the severity of pain by encircling on a horizontal segmented line from 0 (no pain) to 10 (worst pain).

**Procedure**

The study was conducted as a Quasi experimental study at SIMATS. The sample was collected at PHYSIO360 CLINIC. The assessment was accepted by the Institutional Board of Review of Saveetha College Physiotherapy. A total of 30 subjects were randomly selected based on selection criteria and informed consent was obtained after explaining the safety and simplicity of the study. The subjects of age between 18-70 yrs of both genders with pain > 4 and with positive Achilles palpation test and decreased plantar flexion endurance test were included in the study and subjects with vascular or sensory disturbances in lower limb, inflammatory conditions, any bleeding or clotting conditions, peripheral vascular or arterial disease, pregnant or may be pregnant were excluded from the study. Pre-test values for functional ability and pain were recorded by VISA questionnaire and NPRS respectively. The subjects were trained with flexibility exercise that involves exercise programs including concentric and eccentric exercises regimen to the triceps surae, tibialis posterior, hip and foot intrinsic were also given. The treatment was given

on alternate days for 4 weeks, a total of 12 sessions. Following the training session, the post-test values were recorded using the same outcome measure and the significant difference was noted.

**Study Period:** from November 2022 to March 2023.

**Treatment Protocol**

No of Sets: 3

No of Repetitions: 10

Rest period: 10 seconds

Sessions: 3 sessions per week for 4 weeks.

**Flexibility Exercises**

1. Zig-Zag Hops:

Jump on one foot in an alternating diagonal (zig zag) pattern across each side of a line. Subject is asked to Jump and land on the forefoot while keeping the other foot elevated. Aim for minimal ground contact time and minimal knee flexion.

**1. Double Leg Hop**

Subjects are asked to stand with feet kept together and keep arms straight out in front of the subject. Then they were asked to jump upwards and forward as far as they could. As soon as they land, jump again. Repeat the motion for the desired number of repetitions.

**2. Dynamic Step Ups**

Place a step-up stool. Stand facing the platform with the feet hip-width apart. Step up with an alternate leg. Repeat the motion for the desired number of repetitions.

**3. Achilles Hops**

Take a stool, place one leg on it and hold a weight of 2kgs using an ipsilateral hand. Place the injured leg one step backwards so that the Achilles tendon stretches and then the subject is asked to hop continuously for one minute.

**4. Calf Raise**

To do a calf raises subjects are used to stand with your feet about shoulder-width apart. And then they were asked to let arms hang straight below the shoulders. Rise up onto the toes, and then slowly return to the starting position.

**5. Floating Heel Weight Pass**

Take a stool, place one leg on it and hold a weight of 2 kgs using your hand. Place the injured leg one step backwards so that the Achilles tendon stretches and then the subject is asked to transfer the weight from one hand to another hand.

**6. Heel Drops**

Stand with the feet about 10cms apart with hands lightly resting on a counter or chair in front of the subject. Slowly raise heels off the floor while keeping knees straight.

**Data Analysis**

The collected data was tabulated and analyzed using descriptive and inferential statistics. To all parameters mean and standard deviation (SD) was used. Paired t-test was used to analyze significant changes within the groups and Unpaired t-test for between group analysis. Man Whitney test was used for nonparametric analysis.

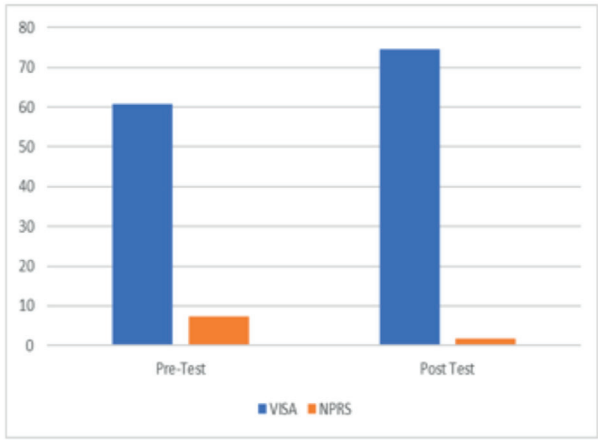



**Fig-1: Pre and Post Test mean values for VISA and NPRS**

## Result

All 30 subjects completed the study successfully pre-test and post-test values of NPRS and VISA were presented in the Fig 1. From the quantitative examination evaluated using the statistical data, it was noted that an exceptional contrast among the pre-test values and post-test values were observed. Hence from the test values according to the VISA

and NPRS it results that Manual therapy for Achilles Tendinopathy helps in reducing pain and it gives the best result in improving functional activity.

## Discussion

This study mainly focused on improvement of pain and functional ability by flexibility exercise for the patient with Achilles tendinopathy. Interestingly, we found a significant increase in the mean by obtaining the difference in the pre and post-test values. Therefore, after giving exercises there is a lot of improvement in the patient. McCormack JR et al first reported eccentric exercise and flexibility exercise was seen to be more advantageous and beneficial to eccentric exercise.[1] Rompe JD et al applied eccentric stack exercise and showed very less positive outcome to low-energy exercise in subjects with long term tendon pathology of the insertion of the Achilles Tendon at a 4-month follow-up.[6] Vescio A et al from his study said that a lot of conventional modes of management have been found, but no treatment was welcomed, other than eccentric training, which is commonly used.[19] Valkering KP said that mass-bearing after Achilles rupture encourages the healing process. Cause-and-effect relationships cannot be established because of poor control group and the non-experimental study design, and other factors like thrust and non-joint thrust mobilisation might be in charge of the patient's improvement. Each patient's pain and function did, however, improve right away after joint treatment, indicating that they at least experienced fast alleviation.[14] Patients also reported satisfactory results at relieving at 12 weeks and follow up. Comparisons of manual therapies are less trustworthy since thrust adjustment may have a different therapeutic effect than eight minutes of high-grade mobility. Manual treatment is still a patient-specific approach that necessitates expert clinical judgement, though. Three patients' therapy included eccentric exercise in addition to joint manipulation and mobilisation. Tenderness and discomfort levels, PPT measurements, and raising single leg heel ability were immediately improved after mobilisation and adjustments. Developments were consistently observed and noted over the duration of treatment, and also during the nine-month follow-up. The data suggest that additional study into the function of flexibility exercise regimen in the intervention plan of Achilles tendinitis is required. Muh Khaidir in his study concluded that there was a difference between body flexibility level in pre and post-test after giving concentric exercise. Edman G in a study concluded that Functional load-bearing mobilization improved healing results of Achilles tendon rupture. Also, initial ankle ROM was enhanced without Achilles tendon elongation and without changing long-term outcome.[14] Henning langberg concluded that a VISA score lesser than 24 is rarely obtained in Achilles tendinitis. Only few subjects with AT acquire an equivalent VISA score when seen to uninjured healthy individuals post treatment. The VISA is a valid tool when assessing AT patients.[21]

## Conclusion

The motive of the study is to evaluate and assess the effects of flexibility exercises in subjects with Achilles tendinitis. According to the data gathered, flexibility training for four weeks enhances physical activity and reduces discomfort in patients with Achilles tendinopathy. Therefore, flexibility exercises are suggested to lessen pain, discomfort, and increase functional motility, which will improve their welfare, academic performance, and ADL. ISRB approval: This research work has been approved by the ISRB committee.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/068/2022/ISRB/SR/SCPT).

**Funding:** This study is a self-funded study.

**Conflict of Interest:** Nil.

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Original Article

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# High Impact Exercise Training Versus Low Impact Exercise Training on Functional Outcome in Subjects with Knee Osteoarthritis: Experimental Study

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**Abstract**

**Background:** Exercise or physical exercise is suggested for subjects with arthritic knee to improve their pain and functional condition. These therapies, whose success is dependent on a few components, are commonly ignored. Therefore, the proper intensity or load needs to be specified. Depending on the therapy aim exercise intensity might be high or low.

**Purpose:** This study aims to modulate the patient's pain and the secondary outcome was to improve functionality by evaluating high-impact exercise training with low-impact exercise training in subjects with symptomatic knee OA.

**Materials and Methods:** Subjects with OA Knee were selected based on selection criteria. All subjects were assigned to either of the groups; high-impact exercise and low-impact exercise by odd even randomization method. The pre-test values for pain and functional outcome are taken using NPRS and WOMAC questionnaire and the same were recorded for post-test after 8 weeks of intervention. The entire process was performed from November 2022 to March 2023.

**Result:** The statistical analysis reveals a lowering in the pain intensity and notable enhancement in functionality on high-impact exercise training when compared with low-impact exercise training in subjects with arthritic knee.

**Conclusion:** The study's findings indicate that high-impact exercise training affects subjects with knee osteoarthritis by decreasing pain and improving function.

**Keywords:** Exercise training, chronic OA, high impact, low impact

## Introduction

Osteoarthritis (OA) is a widespread illness that causes pain, functional restrictions, increased consumption of healthcare, and significant societal expenses.[1] Knee, a complex synovial joint, with bone components, infrapatellar pad, cartilage, ligaments and synovium. Synovial fluid lubricates the cartilage. The regular usage and excessive stress on this joint cause painful OA. OA disease assessment is sluggish and can gradually evolve; worsening the

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illness's severity and symptoms.[2] Clinical signs are discomfort, stiffness, reduced ROM, quadriceps muscle weakness, and changes in proprioception. In persons over the age of 40, the prevalence of self-reported knee pain is between 20% and 28%, with nearly 50% claiming impairment as a result of their knee pain. Women have a considerably higher frequency and incidence of illness in these joints than males.[3-5] Musculoskeletal, anatomical, biological, and ecological variables all have a part in onset and maturation of arthritic knee.[6] Slow deterioration of cartilage in OA comes along with chondrocyte loss. Sensory nerve terminations in vascular channels innervate cartilage in articulations and trigger tibiofemoral discomfort.[7] Bearing too much weight on the knee may compromise the functionality of the knee joint.[8] "The Kellgren-Lawrence radiographic system grades OA into 5 stages from 0 to 4, describing OA by the detection of an osteophyte (2 Grade), and major grades by the presumed sequential manifestation of reducing joint space or sclerosis, deformity, and cysts.[9] " Rehabilitation and physiotherapy were frequently recommended to relieve pain and increase mobility.[10] Exercise can help individuals with knee OA reduce pain, increase function, and improve their psychological status.[11] Exercise is regarded as primary non-pharmacological therapy and is recommended by international recommendations for the treatment of OA patients. Exercises assist individuals improve their function and general health and are safer than pharmacological therapy,[12] while treatment recommendations encourage strengthening exercise with specified proper intensity or load to be considered [13] which either could be high or low. High-impact exercise training can be characterized as the extra period or strength necessary emphasizing more on pain alleviation, increased joint function, and joint stability. [10,14] Several new clinical trials have recently indicated that a more rigorous exercise program aimed at improving muscular strength may be better for those with osteoarthritis. The primary goal is to regulate pain and the secondary objective was to improve functionality by using high-impact exercise training. In comparison to fewer repetitions, a high volume of repetitions appears to manage pain and enhance function. Theoretically, high-repetition, high-impact exercise activates the descending pain regulating system, lowering the sensitization. As a result, as the pain subsides, functionality improves. [15,16] Thus an attempt is made in this study to analyze the effect of High impact and Low impact exercises training in subjects with OA Knee.

## Aim

To evaluate the effect of High-Impact exercise training versus Low-Impact exercise training in subjects with OA knee.

## Material and Method

Samples of 30 subjects were selected, aged between 45-65 years from Sri Thirumala Physiotherapy and Pain Relief Clinic. Convenient sampling with odd even randomization was used in this study.

**Study Period:** from November 2022 to March 2023

**Inclusion Criteria**

- Both gender
- Age between 45 to 65 years
- Unilateral medial tibiofemoral OA
- People with neutral to moderate varus alignment
- BMI of ≥ 20 kg m2 and ≤ 45 kg m2
- No strength training/ previous physical therapy in the past 6 months
- Arthritic knee with pain for the past 3 months
- Grade 2 osteoarthritis based on Kellgren and Lawrence classification

**Exclusion Criteria**

- Musculoskeletal injuries/deformities of the lower limb
- Knee arthroplasty
- Radiological End stage knee osteoarthritis (KL=4)
- Pain ≤ 2
- Associated Symptomatic patellofemoral OA
- Lateral tibiofemoral OA
- Rheumatoid arthritis
- Osteoporosis
- Recent fractures of the lower limb
- Patellofemoral pain syndrome

**Outcome Measures**

Assessment was performed before and after the treatment.

- Numerical Pain Rating Scale (NPRS)
- Western Ontario and Mcmaster Universities Osteoarthritis Index (WOMAC)

**Procedure**

Subjects participating in the study were briefly explained about the study and informed consent was obtained. The subjects were assigned either to High-impact exercise training group (HIET) and the Low-Impact exercise training group (LIET) by an odd even randomization method. The pre-test values for pain and functional outcome were recorded using the NPRS and WOMAC questionnaire and the same were recorded for post-test after 8 weeks of intervention.

**High-Impact Exercise Training Group (HIET)**

**Global aerobic exercise**

Ask the subject to perform stationary cycling. This helps to utilize the body and stimulate pain systems. They are done three times per treatment regimen for 20+10+10 minutes respectively.

**Semi-global exercise**

1. **Closed chain squat** - The subject is to be in a standing position. The TRX band is held with hands to deload the body and perform squats. The goal is to activate the knee joint in a kinetic chain.
2. **Closed chain squat with weights -** The above exercise is progressed without the TRX band. The subject holds dumbbells (2kg) in each hand and is made to squat.
3. **Step up** - Place one foot on the stepper and step up holding the TRX band. The later is progressed by stepping up from the stepper without the support.
4. **Step down** - Place one foot on the stepper and step down holding the TRX band. The latter is progressed by stepping down from the stepper without support.

**Local open chain exercise**

1. **Deloaded knee extension** - Ask the subject to sit in a chair facing the ladder and place feet flat on the floor. The theraband is tied to the ankle of one leg and the other end is tied to the ladder from above. Now, active knee flexion is followed by deloaded knee extension. The goal is to dynamically activate the knee joint.
2. **Knee extension** - Ask the subject to sit in a chair facing opposite to the ladder and place feet flat on the floor. The theraband is tied to the ankle of one leg and the other end is tied to the ladder from below. Now, active knee extension is followed by knee flexion. These local exercises are performed for 3-5 minutes × 1 set per regimen.

**Low-Impact Exercise Training Group (LIET)**

1. Global aerobic exercise: Stationary cycling
2. Semi-global exercise: Closed chain squat
3. Semi-global exercise: Closed chain step up
4. Semi-global exercise: Closed chain step down
5. Local open chain exercise: Knee extension

**Treatment protocol**

The treatment exercise was on alternate days for 8 weeks. The subjects in HIET performed with 30 repetitions of 3 sets each and LIET Low-impact exercise training performed with 10 repetitions of 2 sets each.

**Data Analysis**

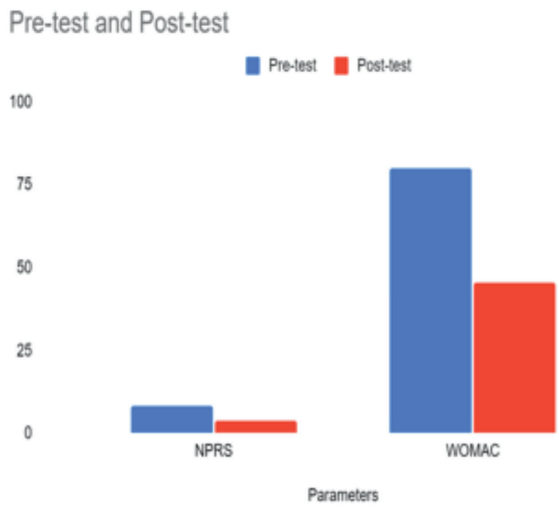



**Fig - 1 Pre and Post-test values of HIET**

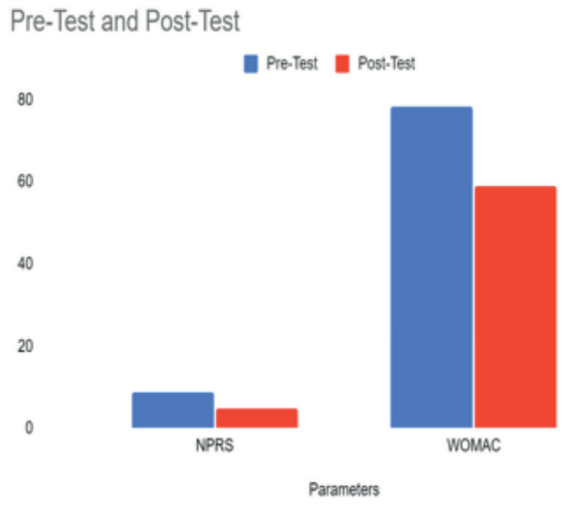



**Fig - 2 Pre and Post-test values of LIET**

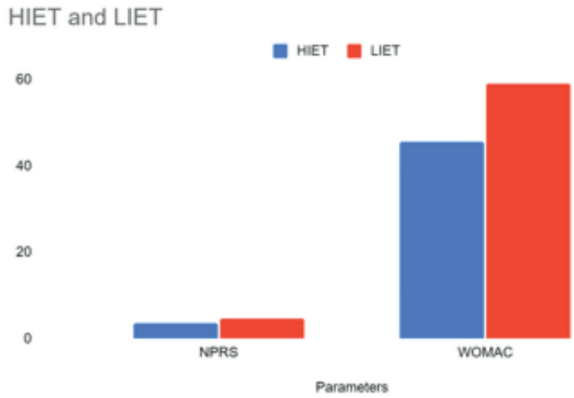



**Fig - 3 Post-test values of HIET & LIET**

## Result

As needed descriptive statistics, mean and SD were calculated. All p values were considered as statistically significant using paired t-test. The statistical analysis compares the post-test mean values of NPRS with 3.67 and 4.67 in HIET and LIET respectively and post-test mean values of WOMAC with 45.67 and 58.93 in HIET and LIET respectively. As a result of statistical analysis, the p value shows high-impact and low-impact exercise training are effective, however the effect of high-impact exercise training was found to be slightly higher and showed significant effect of pain and function outcome when compared with LIET in subjects with knee OA.

## Discussion

This present analysis aims towards evaluating the practicality of high-impact exercise training in arthritic knee patients. It has been classified as a pathological issue established by loss of cartilage in the articular region inside synovial joints, as well as bone hypertrophy and capsule thickening.[17] According to appearing data by Torstensen et al., (2018), pain of arthritis in the knee is caused by distal and centralized nervous system sensitization. MET "medical exercise therapy" is built on a bio-psycho-social paradigm since the workouts are self-paced, pain-free, or near pain-free.[18] Carlino et al., (2014) study supports the Tailoring of exercise regimen to the subject's clinical context along with their desires and requirements. It also backed this study's supervised program where those sessions helped the patient feel protected, increasing the anticipated benefit from the regime and diminishing the possibility of nocebo effects.[19] It has also been noted that programs that demand considerable engagement by the side of patient, such as being at their own pace, are more inclined to display significant compliance than exercise regimens that entail an organized exercise plan, from the study of Williams et al., (2008). This highlights the rate of low dropout.[20] As a water-based exercise, MET (medial exercise therapy) employs the notion of deloading. However, aquatic activities don't appear to be better than land-based workouts, indicating additional study into the effects of dose-response exercise therapy. In a recent systematic analysis of research conducted by Regnaux JP et al., (2015) only five comparative studies of high- and low-intensity were included. It also validated the effect of including the WOMAC as an end indicator in our study by revealing increased physical function.[14,21] Using the NPRS and WOMAC the outcome measure will be assessed for pain and physical function. Our finding suggests that using high-impact exercise training resulted in a significant improvement in knee OA after the post-test. Furthermore, this therapy has been shown to be beneficial in adults with OA knee.

## Conclusion

The finding from this study implicated the advantage of high-impact exercise training over low-impact exercise training to enhance physical function and alleviate pain in adults with OA knee.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has

provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/069/2022/ISRB/SR/SCPT). **Funding:** This study is a self-funded study.

**Conflict of Interest:** Nil

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Original Article

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# Efficacy of Positional Release Therapy Versus Deep Transverse Frictional Massage on Quadratus Lumborum Strain among IT Workers

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**Abstract**

**Background:** The study was designed to inspect the effectiveness of Positional Release Therapy (PRT) and Deep Transverse Frictional Massage (DTFM) on Quadratus Lumborum Strain.

**Purpose:** The purpose of this study is to compare the efficacy of Positional Release and Deep Transverse Frictional Massage for Quadratus Lumborum.

**Materials and Methods:** Sixty subjects with Trigger Points in quadratus lumborum muscle were divided randomly into two equal groups. Group "PRT" received Positional Release Therapy five times/week while Group "DTFM" received Deep Transverse Frictional Massage five times/week for two weeks. Numeric Pain Rating Scale (NPRS), Universal Goniometer were used to evaluate subjects at two intervals (Pre-Treatment and Post-Treatment).The entire process was performed from November 2022 to March 2023.

**Result:** The results of the study revealed that both the interventions were effective but in terms of superiority PRT gave a significant result than DTFM.

**Conclusion:** Based on the study results, it was concluded that PRT was found to be more effective for the treatment of Quadratus Lumborum strain.

**Key Words:** NPRS, Goniometer, Low back pain, Lumbar range of motion.

## Introduction

The Quadratus Lumborum muscle group is important in regular body function. These muscle groups consist of number of small muscles found deep to lower back muscle mass. Quadratus Lumborum (QL) is thought to assist, lengthen the lumbar spine and promote flexion, lateral flexion and extension of spine.[1,2,3] To support the trunk and maintain body mechanics, a prolonged contraction of QL is necessary during walking, sitting, lying, and other functional tasks. Chronic low back pain prevalence was 4.2% in individuals aged between 24 and 40 years old.[4] However, various occupations are subjected to varying working environments, and the nature of the job has an impact on the employees' health.[5] Sitting still may cause soft tissues to shorten, which therefore reduces the range of motion for the joints.[6]

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Positional Release Therapy is a manual treatment that restores the muscles typical resting tone. This method comprises passive body alignment, which is intended to produce both short-term and long-term decreases in soreness at trigger points as well as pain relief for musculoskeletal disorders. The position of comfort is maintained while using the tender point as a reference. The muscle is typically in this posture, which causes the least amount of discomfort. The joint is passively and slowly brought back to the neutral position after being kept in the position for 90 seconds. Both the intrafusal and extrafusal fibres of the muscle shorten as a result of the prolonged muscular contraction. These adjustments have led to a notable increase in function and ROM as well as a decrease in pain. The subjects are set up in positions that closely resemble the places where the hypertonic muscle originates and inserts.

Maintaining mobility within the ligament, tendon, and muscle soft tissue structures and preventing adherent scar formation are the goals of deep transverse friction massage.[7] Its mechanical action leads in hyperaemia, which increases the area's blood flow.[8] However, transverse friction treatment must be viewed as a sort of counterirritation that produces the necessary analgesia.[9] When sufficient physical pressure is applied directly to the musculo-tendinous junction, Golgi tendon organs are stimulated and muscle tension is reduced.

## Aim

To compare the efficiency of Positional Release and Deep Transverse Frictional Massage for Quadratus Lumborum strain.

## Material and Method

This study was conducted with 60 subjects with quadratus lumborum Trigger Points, age between 25-45 yrs was taken from Panruti Islamic Baithumal Trust and hospital. Convenient sampling with the random allocation method was used in the study. The randomization was done using the odd-even method. Study period: November 2022 to March 2023.

**Inclusion Criteria**

- Both genders.
- Age group 25 - 45 yrs.
- Subjects who had pain in the lumbar region and at Quadratus Lumborum attachments.
- Subjects whose pain lasts no longer than six weeks.
- Palpable trigger point in QL muscle.
- IT workers with shift hour more than 12 hrs.

**Exclusion Criteria**

- Spinal canal stenosis.
- Spondylolysthesis.
- Spinal Fracture.
- Disc prolapse.
- Rheumatoid arthritis.
- Malignancy.

**Outcome Measures**

Assessment was performed at baseline (before starting of treatment) and after two weeks of study.

- Numerical Pain Rating Scale (NPRS).
- Universal Goniometer.

**Procedure**

Subjects who were screened for selection criteria were involved in the study and informed consent was obtained. Subjects were recruited from Panruti Islamic Baithumal Trust hospital was selected. Totally 60 subjects were selected and they were randomly divided into PRT group (n=30) were treated with Positional release technique while the DTFM group (n=30) were treated with Deep friction massage for QL strain. The randomization was done. Pre and post treatment score for pain, ROM were assessed using NPRS, Universal Goniometer. The duration for the study intervention was 5 sessions per week for 2 weeks and the post-test values were recorded and statistically evaluated.

**Positional Release Therapy Group (PRT):**

Positional Release Therapy (PRT) is a gentle manual therapy technique used to alleviate pain, reduce muscle tension, and restore normal muscle function.

**Position of the Subject:** The subject was comfortably positioned in prone.

**Tender Point Identification:** The therapist identifies the tender points within the QL by

palpating the affected area by applying pressure by using thumb and index finger. Then the subject was asked to flex laterally in the direction of trigger point side.

**Gentle Passive Positioning:** The therapist then gently positions the patient's body in a way that minimizes strain and tension on the identified tender points. The goal is to find a position of ease, where the muscle is relaxed and the tenderness is reduced.

**Procedure:** The therapist supported the subject's affected leg on his or her thigh while standing on the side of the subject by placing one knee on the table. The position was then fine-tuned by extending, abducting at a 45° angle, and gently rotating the subject's hip internally. This position was held for 90 seconds, and 60 seconds rest was given between each repetition.

**Monitoring Response:** During positioning, the therapist closely monitors the subject's response, noting any changes in pain levels, muscle tension, or tissue texture. The goal is to achieve a reduction in tenderness and muscle hyper tonicity.

**Release and Return**: After the designated time, the therapist slowly and carefully guides the subject out of the position, allowing the muscle to gradually return to a neutral or slightly stretched position.

**Deep Transverse Frictional Massage (DTFM)**:

Deep Transverse Friction Massage (DTFM) is a manual therapy technique commonly used to address soft tissue injuries and promote healing.

**Position of the Subject:** The subject was comfortably positioned in prone.

**Locating The Target Area:** The therapist located the specific area of the QL muscle that is affected by the strain which was typically done through palpation.

**Procedure:** The treatment procedure was started after the therapist palpated the trigger point on the Quadratus Lumborum while the muscle was relaxed and shortened. Then the frictional massage was applied over the tender point of the muscle and the skin and finger of the therapist should move as one to prevent blister formation.

**Application Of Friction:** The therapist applied deep pressure with the fingers, knuckles, or thumbs, perpendicular to the direction of the muscle fibre creating a transverse or crosswise movement. The therapist performed short, oscillating movements across the muscle fibres depending on patient's tolerance.

**Pressure Adjustment:** The therapist adjusted the pressure of the friction strokes based on the subject's comfort and tolerance. Any sensations of discomfort or pain during the treatment was communicated so that the therapist can adjust the technique accordingly. As the treatment progresses, the therapist gradually increased the intensity and depth of the friction strokes within the tolerance level. This helps to effectively address the affected tissues and encourage healing.

**Data Analysis**

The collected data was tabulated and analysed for pain & Lumbar ROM for both PRT Group and DTFM Group. Pre and Post-test values was evaluated. To all parameters mean and standard deviation was calculated. Paired t-test was used to analyse significant changes within the group. Unpaired t-test was used to analyse significant changes in between two groups.

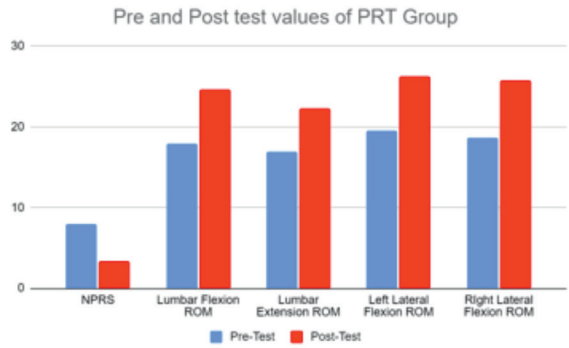



**Fig-1 Comparison of pre and post- test values of PRT Group.**

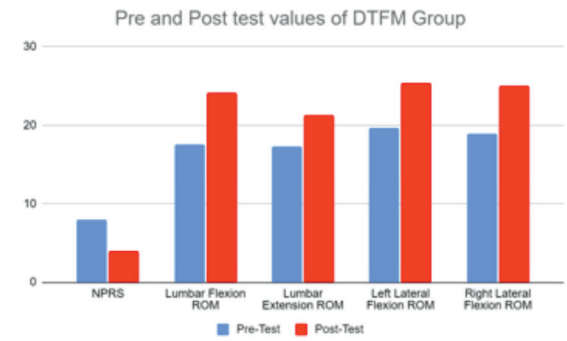



**Fig-2 Comparison of pre and post- test values of DTFM Group.**

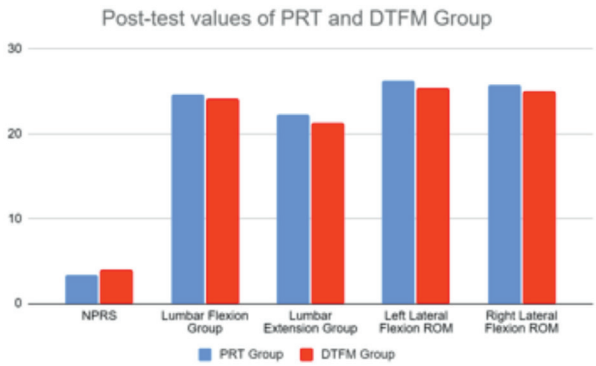



**Fig-3 Comparison of post test values of PRT and DTFM group.**

## Result

- There were statistically significant differences between PRT group and DTFM group as a result of the statistical analysis done on the quantitative data. The post-test mean value of NPRS score PRT group was 3.33 and DTFM group was 3.97. The findings were statistically significant, with the p values of 0.0283. This shows that NPRS scores in PRT group were comparatively more than DTFM group.
- The post-test mean value for Lumbar flexion in PRT group was 24.63 and in DTFM group were 24.20. The findings were statistically significant, with the p value of 0.0318. The post-test mean value for Lumbar extension in PRT group was 22.27 and in DTFM group were 21.30. The findings were statistically significant, with the p value of 0.0161. The post-test mean value for Lumbar left Lateral flexion in PRT group was 26.30 and in DTFM group were 25.37. The findings were statistically significant, with the p value of 0. 0071. The post-test mean value for Lumbar right Lateral flexion in PRT group was 25.70 and in DTFM group was 25.07. The findings were statistically significant, with the p value of 0.0389.
- This shows that Lumbar ROM in PRT group were comparatively more than DTFM group. As per the result PRT was more effective than DTFM in decreasing pain and improving ROM.

## Discussion

The goal of the study was to compare the efficacy of PRT and DTFM in subjects with Quadratus Lumborum strain. In this study, 60 subjects were assigned, 30 were in Group PRT and 30 in Group DTFM. Group PRT received Positional Release Therapy 5 sessions/week and Group DTFM received Deep Transverse Frictional Massage 5 session/ week for a duration of 2 weeks. Simons claims that localised pressure may ease discomfort by balancing the impacted trigger point's sarcomere length.[10] Positional release technique is frequently with the shortened position of the targeted used muscle to treat painful regions. Positional release technique may lessen pain since the A fibres are activated. Positional Release Therapy (PRT), also known as Strain Counterstrain or Tender Point Therapy. It is a non-invasive manual therapy technique that can be used as a conservative treatment option for various musculoskeletal conditions. One of the primary benefits of PRT is pain relief. By identifying and releasing tender points or areas of muscle tension. By placing the body in a position that minimizes strain on tender points, PRT allows the involved muscles to relax and reduces excessive muscle contractions. By reducing muscle tension and promoting relaxation, PRT can improve range of motion. Tender points and muscle tension often limit joint mobility and movement. PRT helps release these restrictions, allowing for greater joint range of motion. PRT can facilitate tissue healing and recovery by reducing tension in the affected muscles and promoting improved blood flow to the area. By identifying and releasing tender points, PRT helps restore balance and proper functioning of muscles. Mohammed et al concluded that conventional exercises, positional release technique showed promise in alleviating pain, enhancing lumbar range of motion, and reducing the functional impairment limitation in individuals with mechanical low back pain.[11] Bailey and Dick suggested a nociceptive hypothesis that the positional release mechanism used by PRT can lessen tissue damage in malfunctioning muscle.[12] They claimed that putting patients in a comfortable position could help the injured tissues relax. Deep Transverse Friction Massage (DTFM) is a manual therapy technique that offers several important benefits and plays a significant role in musculoskeletal rehabilitation. DTFM helps promote tissue healing by increasing blood circulation to the affected area. The friction applied to the soft tissues stimulates the formation of

new blood vessels, improving oxygen and nutrient delivery to the injured tissue. The friction applied during the massage stimulates sensory nerves, which can inhibit pain signals and provide temporary relief. The friction applied transversely to the muscle fibers aids in the realignment and organization of the tissue fibers, allowing for improved muscle contraction, joint mobility, and overall functional performance. DTFM helps improve joint mobility by releasing tight or shortened muscles and fascia. It is often combined with other therapeutic techniques such as exercise, stretching, and strengthening exercises to maximize the benefits. It offers a conservative treatment option for musculoskeletal conditions, minimizing the risks associated with more invasive procedures. The importance of DTFM and PRT lies in its ability to promote tissue healing, reduce scar tissue, relieve pain, restore tissue function, enhance range of motion, and complement rehabilitation efforts. It is a valuable tool in the hands for healthcare professionals, providing numerous benefits for individuals with musculoskeletal injuries and conditions.

## Conclusion

According to this study PRT was found to be more effective than DTFM in decreasing pain and improving ROM in subjects with trigger point in Quadratus Lumborum strain.

**Ethical Clearance:** Taken from Institutional ethical committee 03/070/2022/ISRB/SR/SCPT.

**Funding**: Self.

**Conflict of Interest:** Nil.

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Original Article

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# Effectiveness of Foot Intensive Exercise Training for Subjects with Chronic Ankle Sprain: Experimental Study

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**Abstract**

**Background:** This study was developed to determine the effectiveness of Foot Intensive Exercise Training among subjects with Chronic Ankle Sprain.

**Purpose:** To determine the effect of Foot Intensive Exercise Training and Proprioception Exercise Training in subjects with Chronic Ankle Sprain.

**Materials and Methods:** Thirty subjects with Chronic Ankle Sprain were divided randomly into two equal groups. "Foot Intensive Exercise Group" received plyometric exercises while the Control Group received proprioception exercises on alternate days for 6 weeks. Cumberland Ankle Instability Tool (CAIT) and Y-Balance Test were used to evaluate subjects at two intervals (Pre-Treatment and Post-Treatment). The entire process was performed from November 2022 to March 2023.

**Result:** Statistical analysis of Cumberland Ankle Instability Tool and Y-Balance Test post values revealed constantly significant differences, with the p value of <0.0001.

**Conclusion:** Foot Intensive Exercise is effective and increases functional ankle stability and decreases episodes of giving away in subjects with chronic ankle sprain.

**Key Words:** CAIT, plyometric training, ankle stability, proprioception, balance.

## Introduction

The ankle joint brings about the lower limb and the foot close together. The varying degrees of motion occurs between 500 dorsiflexion and 900 plantarflexion. Talus bone gives maximal postural control in dorsiflexion and minimal postural control in plantar flexion.[1] The most habitual injuries seen in orthopedics among dancers and sports players, is ankle sprain.[2] Of all the athletic injuries the involvement of ankle takes up to 40% in average.[3] Habitually injury by persons who take part in court, ground and indoor sports would be the acute ankle sprain (lateral), which may lead to CAI (Chronic Ankle Sprain) in the longer run.[4] Depending upon the anatomical position, the ligament around the joint may be put into 3 groups: lateral, medial ligaments (deltoid ligament), and the ligament in the tibiofibular junction of tibia and fibula at the junction

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of distal epiphysis. In plantar flexed and inversed force, the largest impact is on the ATL (anterior talofibular ligament). In this mechanism and position the ligament develops increased vulnerability to injury and strain. With more applied force, the calcaneofibular ligament, and the posterior ligament is prone to be injured.[5]

Injuries like abrasions, lacerations and fractures are unavoidable due to aggressive play, but the rest may be prevented with proper intervention methods.[6] Internal rotation is one of the causes at the ankle joint of inversion ankle sprain, involving a slight inversion in the joint during touchdown. To prevent this, players should touch down with the ankle in neutral position, while performing sideward cutting motions.[7] It has been reported that previous injuries, balance deficit, ankle dorsiflexion loss are strong predictors of recurrent sprain in ankle in persons with FAI.[8] Most of the injuries occurring to players are sprains which puts them in a long-term risk of instability, prolonged symptoms and also includes reinjury.[9] The most commonly and effectively used measure of dynamic stability and risk of injury is the Star Excursion Balance test (SEBT). Another most frequently used modified version of measure is the Y Balance test which is also often used.[10] The Y balance test is seen to have a strong association with hip abduction strength.[11] The Cumberland Ankle Instability Tool (CAIT) is a reliable 30-point 9-item scale, widely used to measure the degree and severity of Functional Ankle Instability. CAIT's supremacy is that it does not require much of the subject's burden and its increasing reliability to objectify chronic ankle instability.[12]

The sprained or injured ankle can cause the receptors in the joint to be subjected to damage and alteration in the motor control in the longer run-in which individuals report sensorimotor impairments following a history of ankle sprain that further corresponds to FAI or giving away.[13] Ankle sprain may reduce neural-muscular control causing a deficit in proprioception. Proprioceptive training is a time and cost-efficient treatment which is a neurological action in which the body gets sensory stimulus or input from the surrounding environment and interprets the received information to bring about a motor response.[14] Proprioception is important in regulating the system to keep the ankle in neutral. This system subconsciously controls ankle movements and position in which, when a player is not able to comprehend their ankle position it is most likely to easily deviate from its neutral position. Plyometric training on the other hand is an extensively used intervention to enhance performance in the general athletic population. It is seen to be in the final stages of rehabilitation of various injuries involving the lower limb, especially ankle sprains. Previous studies show that Foot Intensive Exercise boosts proprioception, agility, and strength in individuals with past history of lateral ankle sprain.[15]

## Aim

To evaluate the effectiveness of Foot Intensive Exercise Training among subjects with Chronic Ankle Sprain.

## Material and Method

It was an experimental study conducted on 30 subjects with Chronic Ankle Sprain. The sample was collected at Kirubai Physio & Rehabilitation Centre, based on the inclusion and exclusion criteria. Participants received an extensive overview of the method and a formal consent form was acquired.

**Study Period:** from November 2022 to March 2023.

### Inclusion Criteria

- Both male and female
- Aged between 18 to 30
- History of two or more ankle sprain
- Recurrent episodes of giving away
- CAIT score < 24

### Exclusion Criteria

- Ankle sprain occurred within the past 3 months
- Recent fracture of the lower limb
- Surgeries of Ankle joint
- Deformity of the Ankle and Foot

### Outcome Measures

Assessment was performed before and after the treatment.

- Cumberland Ankle Instability Tool (CAIT)
- Y-Balance Test

**Procedure**

Participants were included considering the inclusion and exclusion criteria. Procedure was explained to the participant and participants were then asked to sign the consent form. Assessment of all the included participants was recorded using CAIT and Y-Balance Test. Participants were randomly divided into two groups; Foot Intensive Exercise Group and the Control Group. The assessment was performed after 6 weeks of intervention.

**Foot Intensive Exercise Group**

Repetitions: 5-10 reps;2-4 sets/session.

**1. Ankle Jumps**

- Subjects were asked to stand upright with legs closed and keep hands placed on the waist.
- Then the subjects are asked to Jump straight up forward only by extending the ankle while avoiding bending the knees.

**2. Squat Jumps**

- Subjects are asked to stand with feet slightly wider than hip and asked to lower the body to squat down.
- Then the subjects were asked to jump while lifting their arms overhead as they jump engaging the abs and Upon landing, they are asked to back down to the squatting position.

**3. Hopping for a Distance**

- Subjects were asked to stand upright with a single leg and then hop to a distance.
- They were asked to start with a shorter distance and speed and then progress gradually.
- Perform with both left and right foot separately.

**4. Diagonal Hop**

- Subjects were asked to stand with feet shoulder width apart.
- Take a step diagonally forward to the right with the right foot.
- Then hop diagonally to the left landing on the left foot.
- Focus on proper landing.
- Again, start with a shorter distance and speed and progress gradually.

**Control Group(Proprioception exercise)**

Repetitions:30 seconds – 1 minute hold;

3-4 sets/session

**1. Heel to Toe Stand (Tandem Stance)**

- Subjects were asked to place hands on the hip and bring the heel of one foot touching the toes of the other foot in a straight line.
- Then they were asked to hold the position for 15 to 30 seconds. Subjects were asked to have a rest and repeat thrice and repeat for the opposite leg.
- Slowly progress by lifting both arms overhead, increasing hold time and by closing eyes.

**2. Single Leg Stand**

- Place hands on the hip.
- Subjects were asked to stand with balance on a single leg keeping the other leg slightly lifted off the floor.
- Hold this position for 20 to 30 seconds. Progress slowly by increasing the duration, standing on a pillow and closing eyes.

**3. Ball Catching with single leg stance**

- Subjects were asked to stand on a single leg.
- The person is thrown first gently that aims close to the body and slowly progresses to throwing harder and aiming slightly further off the body.
- Balance and catch the ball. This is continued for 30 seconds to 1 minute and performed up to 2 to 3 sets per session.
- Difficulty can be improved based on the ability to balance by standing on a pillow.

**4. Star Excursion Exercise**

- Subjects were asked to stand in the center of the star with hands placed on the hips where tape is placed on the floor on a star pattern separated by a 450 angle.

- Balancing with one leg, start touching the line in front as much as you can and return to the starting point allowing the suspended leg to touch the ground.
- Reach each line clockwise. Then repeat anticlockwise.
- 3 sets can be performed by alternating the legs.

**Data Analysis**

Using tabular and inferential statistics, the gathered data was evaluated. The mean and standard deviation (SD) were utilized for all parameters. The statistically significant differences between pre-test and post-test measures were examined using a paired t-test. When utilizing the unpaired t-test to look at significant changes in the experimental group, the significance level of p 0.0001 was determined to be statistically significant.

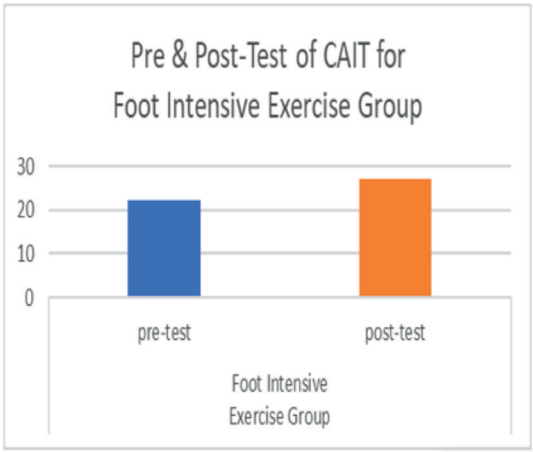



**Fig-1 Pre-test and post-test values of CAIT for Foot Intensive Exercise Group**

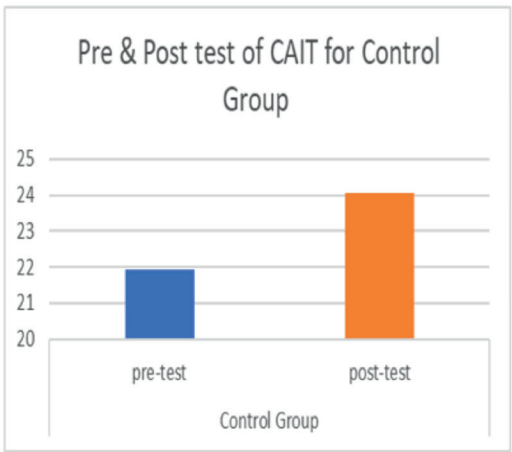



**Fig-2 Pre-test and post-test values of CAIT for Control Group**

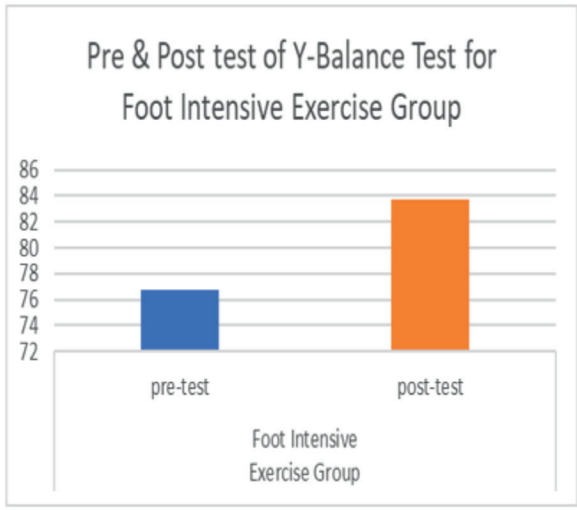



**Fig-3 Pre-test and post-test of Y-Balance Test for Foot Intensive Exercise Group**

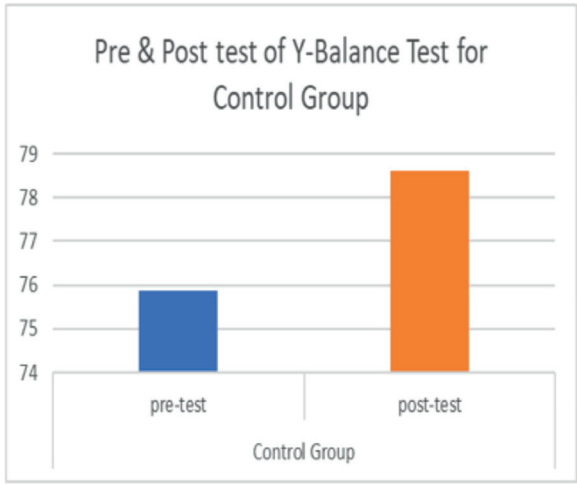



**Fig-4 Pre-test and post-test of Y-Balance Test for Control Group**

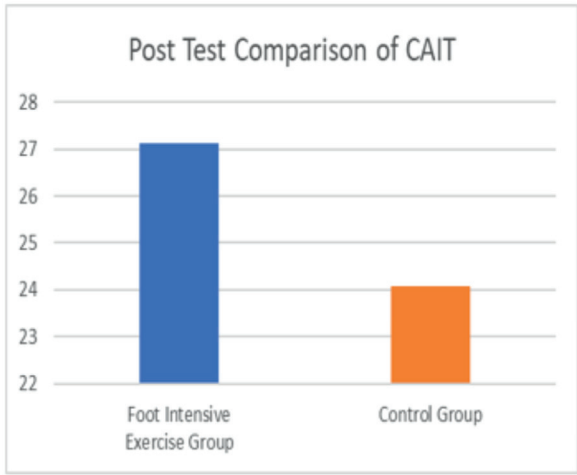



**Fig-5 Post-test Comparison of CAIT for both groups**

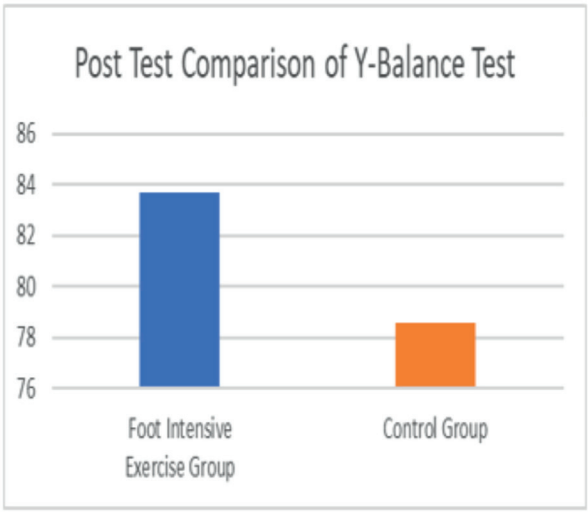



**Fig-6 Post-test Comparison of Y-Balance Test for both groups**

## Result

As needed descriptive statistics, mean and SD were calculated. All p values were considered as statistically significant using paired t-test.The statistical analysis compares the post-test mean values of CAIT with 27.13 and 24.07 in Foot Intensive Exercise Training and Control Group respectively and post-test mean values of Y-Balance Test with 83.67 and 78.6 in Foot Intensive Exercise Training and Control Group respectively.

As a result of statistical analysis, the p value shows that both Foot Intensive Exercise group and Control Group are effective, however the values of Foot Intensive Exercise group were found to be slightly higher and showed significant effect of pain and functional outcome in subjects with chronic ankle sprain.

## Discussion

The motive of the study was to find the efficacy of foot intensive rehabilitation for individuals with chronic ankle sprain by comparing the efficacy of foot intensive exercise and proprioception training. Ankle sprains are recurrent or common amongst active individuals and athletes. A larger population who have experienced ankle sprains have various symptoms which comprise episodes of giving away, pain, re-injury, affected proprioception leading to chronic ankle instability. Recurrent ankle sprains may develop into CAI or early osteoarthritis. 8Ankle sprains have seemed to occur during the foot loading and unloading. Sprains are marked by internal twisting while the tibiotalar joint in plantarflexion. Beginning a physical therapy session early is important to reduce and control pain, to maintain and also improve ROM.[15]

Previous study has shown that a 6-week intervention comprising core stability, gluteal strengthening, and proprioception training have improved dynamic balance in the athletic population. Neuromuscular training program and single limb proprioceptive regimen reduces the evidence of ankle injury by 30% to 45%. This gives quality management post ankle sprains in decreasing the risk of acquiring chronic ankle instability.[16] A study showed a reduction in recurrent injuries by increasing the exercise session volume. A study also showed that subjects that received four training sessions were found to be superior to the subjects that received two training sessions. Rehabilitation program shows reduction in the risk of re-injury or reoccurring ankle sprain by 40% when compared to the Standard of Care (SOC). McKeon et al said that focused dynamic postural control training regimen sessions resulted in 20% to 60% relative reduction in risk for lateral ankle sprain, mostly in the athletic population having continuous history of ankle sprain. It also showed that neuromuscular training has shown success in the reduction in the risk of ankle sprain.[17] Paterno et al. showed that a neuromuscular program which comprises dynamic stability and plyometric training showed improvement in postural sway in anteroposterior direction whilst moving. Furthermore, Salezadeh et al. reported that a combined session of strength training, stability, and plyometric training have shown to improve anteroposterior balance. strengthening muscle around the ankle joint improves proprioception and kinesthetic feedback which has promising improvements in stability and postural control.[18,24]

McKeon and Wikstrom et al have shown improvement in single leg balance in subjects with CAI with plantar massage and also showed activation of the cutaneous plantar receptors. Joint mobilization with or without movement, manipulation improves dorsiflexion, ankle strength and balance. Manual

therapy as treatment protocol will have increased regulation or activation of the somatosensory receptors which in turn will reduce pain, enhance stability, dynamic balance and function of the ankle. [19,20] Studies report that functional stability of the ankle is related to loss in dynamic postural control and also shows that this is the reason for the etiology of ankle re-injury.[21] Furthermore, Mattacola and Dwyer concluded that the Ankle stability Exercise program which incorporates a series of strengthening and proprioception exercises for the ankle has enhanced dynamic balance. Hence dynamic balance control was shown significant improvement in ankle stability exercise.[22] Plyometric exercise regimen uses a short-stretching concept to desensitize the Golgi tendon organs, allowing the elastic components of the muscles to tolerate stretching more efficiently. Plyometric training involves repetitive jump landings that maximize hamstring activation, resulting in higher knee and hip joint flexion.[23] Preceding to plyometric training, Voigt et al. (1998) made an observation which shows greater soleus H-reflex during hopping exercise, which is attributed to more automatic control techniques which is being used during jumping sessions and less voluntary activation. Because of this, Plyometric training on a large scale may improve spinal reflex activity rather than voluntary activation, in contrast to pneumatic power training.[25]

## Conclusion

The aim of this study was to evaluate the effectiveness of Foot Intensive Exercise over proprioception training in subjects with chronic ankle sprain. From the collected data it has been proved that Foot Intensive Exercise is effective and increases functional ankle stability and decreases episodes of giving away in subjects with chronic ankle sprain.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/071/2022/ISRB/SR/SCPT).

**Funding:** This study is a self-funded study.

**Conflict of Interest:** Nil

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Original Article

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# Effect of Task Oriented Exercise with Wrist Flexibility Training among Badminton Players to Improve Wrist Mobility and to Prevent Wrist Injury: Comparative Study

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**Abstract**

**Background:** This study was conducted explicitly on the efficacy of task-oriented exercises paired with wrist flexibility training on enhancing wrist mobility and reducing wrist injuries in badminton players.

**Purpose:** The purpose of this study was to see how a structured intervention integrating task- oriented exercises and wrist flexibility training benefited wrist mobility and injury prevention in badminton players.

**Materials and Methods:** A randomized controlled trial design was used, with a sample of 70 intermediate- level badminton players participating. The participants were split into two groups: conventional and intervention. The intervention group participated in a four-week programme that included task-oriented workouts with badminton movements and targeted wrist flexibility training. The typical group continued with their regular training schedule, with no wrist mobility modification. Validated metrics - ROM and Quick DASH score - were used to assess wrist mobility and function.(Study period : September 2022-May 2023)

**Result:** Preliminary research found that the intervention group had significantly better wrist mobility than the control group. They also demonstrated enhanced ROM, flexibility, and functional performance of the wrist joint, as well as a significant decrease in wrist injury occurrence.

**Conclusion:** These data indicate that combining task-oriented exercises with wrist flexibility training in badminton players can successfully improve wrist mobility and lower the incidence of wrist injuries.

**Key words:** Badminton players, Task oriented-exercises, Wrist flexibility training, wrist mobility, wrist injury.

## Introduction

All ages can participate at an elite level in the well-liked sport of badminton. Aerobic power, agility, strength, explosive power, speed, flexibility, balance, and coordination are the key physical attributes needed by a badminton player to be proficient in the sport. [1, 2] The game is characterized by fast racket and shuttlecock play, with elite-level matches including shuttles hit at speeds surpassing 250 km/h. In Olympic level badminton matches over the last few decades, decreased effective playing time and rising shot frequency show that the game

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has gotten faster.[3-6] Improved control of jumping, sprinting to smash, and lunging has been linked directly to the capacity to sustain dynamic balance [7] across a variety of sports. Badminton has received minimal sports medicine attention while being one of the most widely practiced sports in the world. The few available studies on badminton injuries indicate that it is a relatively low-risk sport compared to others and that overuse injuries predominate.[8-9] Even though the injury typically lasts a long time, just a few days of work are lost. Anatomically, injuries mostly affect the foot and ankle. The two most frequent wounds are tennis elbow and achilles tendinitis. Rarely occurring, Achilles tendon rupture often affects senior leisure athletes. Men are proven to have a higher injury risk than women when exposure time is taken into account, and average players have a higher damage risk than elite players.[10] The proportional risk of injury is higher during training than during competition, in contrast to many other sports. The following preventive strategies are suggested based on the proposed mechanisms causing damage and injury, the established injury tendency of badminton, and the proposed sources of damage and processes. A higher heel with shock absorption and a stiffer, anatomically appropriate heel counter for badminton shoes; B changes to the impact between individual shoe-soles and playing surfaces; and C particular badminton training, such as conditioning and stretching of the triceps surae and the muscles responsible for the internal and external rotation of the shoulder and elbow throughout badminton strokes.[11-16] Badminton is a fast-paced and dynamic activity that puts a lot of strain on the upper extremities, especially the wrist joint. Wrist mobility is critical in badminton for producing power, performing precise strokes, and sustaining overall performance. However, because badminton actions are repeated and strong, players are more likely to get wrist ailments such as sprains, strains, and overuse injuries. Various training methods have been investigated to address the relevance of wrist mobility and avoid wrist injuries in badminton players. Task-oriented exercise and wrist flexibility training have received attention as viable techniques to increase wrist mobility and reduce the risk of injury. Wrist flexibility training focuses on improving the range of motion and flexibility of the wrist joint, whereas task-oriented exercise entails practicing specific badminton actions or drills that imitate game-like conditions. The goal of this study was to look at the effects of task-oriented exercise combined with wrist flexibility training on badminton players.

## Aim

The aim of incorporating Task oriented exercise with wrist flexibility training among badminton players is two-fold: To improve wrist mobility and to prevent wrist injury.

## Material and Method

It was a comparative study conducted during September 2022 - May 2023 on 70 subjects, aged 15-35. Random sampling technique was used in the study.

### Inclusion Criteria

1. Age :15-35
2. Both male and female
3. Skill level: Intermediate level players

### Exclusion Criteria

1. Players with early stages of recent wrist injury.
2. Players with any chronic conditions like severe arthritis, uncontrolled hypertension or any CVS conditions.
3. Recent wrist surgery.

### Outcome Measures

The assessment was performed at baseline (before starting treatment) and after four weeks of study. ROM and Quick DASH score were used to evaluate wrist mobility and total wrist function.

### Procedure

In this study, seventy players with ages ranging from 15 to 35 were chosen as a sample from the Aadukalam Multi-Sports facility and training center in Chennai based on inclusion criteria and exclusion criteria. Following that, there were two groups created from the subjects, both Groups A and B. Group -A as convention group and group-B as intervention group. In each group, there were 35 players. Wrist range of motion (ROM), and a Quick DASH score were used to evaluate wrist mobility and total wrist function at

baseline and after the intervention.

Group-A (Conventional group)

In Group A the participants of intermediate level were asked to perform their normal routine which included specified allocated time for Stretching before running, warm up, aerobic exercises which includes running and skipping, practice matches or doubles drill and cool down. An exercise Protocol was made, and the participants had to follow it 5 times a week for 1 ½ hours.

Group-B (Intervention group)

In Group B the participants of intermediate level are given task-oriented exercise and wrist flexibility training for 4 weeks, 5 days a week except Saturday and Sunday. Exercises lasted 30 minutes per day, were performed three times for 30 seconds each, and required 10 to 20 seconds of rest in between each session. A quick warm-up (10 minutes) was performed before the exercises begin. A cool-down phase of 10 minutes should be included after the task-oriented exercise and wrist flexibility training routine. This time should include static stretching exercises to target major muscle groups, particularly the shoulders, arms, wrist, hips, and lower body, as well as relaxing postures. Wrist flexibility training includes wrist flexor and extensor movement using racket, wrist circles using racket and resistance band exercises whereas task oriented exercises includes shuttle pick up, smash follow through , net shot practice and wall tapping.

**Data Analysis**

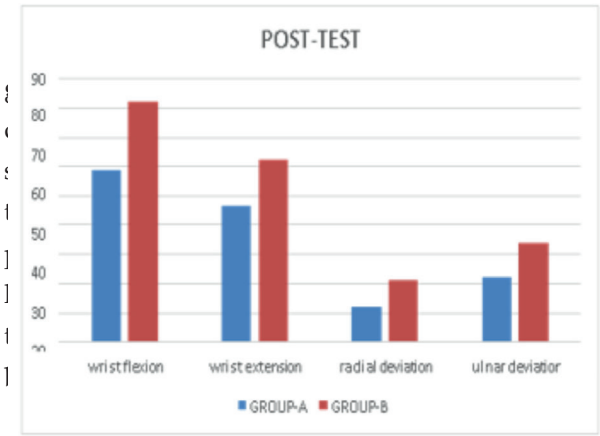



**Fig-1 Comparison of post-test values using ROM for Group-A and Group-B.**

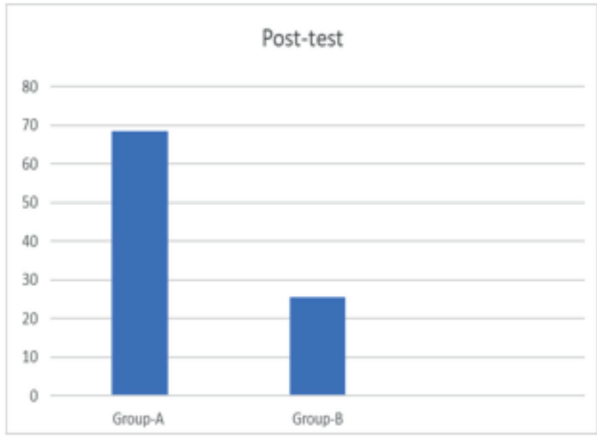



**Fig-2 Comparison of post-test values using Quick DASH score for Group-A and Group-B.**

## Result

Statistical analysis of data revealed a statistically significant difference in values between the convention group and the group that received task-oriented exercise with wrist flexibility training. Statistics, both descriptive and interferential, were used to tabulate and analyze the data that had been obtained. Fig 1 represents the comparison of posttest values using ROM. Fig 2 represents the comparison of posttest values using quick DASH score. The mean and standard deviation (SD) for each parameter were computed. In order to examine the effectiveness of the treatment measures between the group's pre- and post-training, Unpaired t-test and Paired t-test were utilized.

## Discussion

The purpose of this study is to discover and compare the effect of task-oriented exercise versus wrist flexibility training on wrist mobility and injury prevention in badminton players.Wrist flexibility training combined with task-oriented exercises that imitate certain badminton actions can provide a holistic strategy to improving wrist mobility and reducing injuries. Task-oriented exercises imitate the functional demands of badminton by requiring players to undertake motions that mimic the actions performed during gaming. The needs of badminton

players are further targeted by including wrist flexibility training. The wrist joint's range of motion, joint stability, and muscle flexibility and strength are the main goals of this training. The risk of overuse injuries can be reduced, muscle imbalances can be reduced, and wrist mobility can be improved by performing certain stretching and strengthening exercises. When task-oriented exercises are paired with wrist flexibility training, badminton players can improve wrist mobility and reduce their risk of wrist injuries. Players who took part in organized therapies reported having more range of motion, more flexibility, and better wrist movement control. These enhancements led to improved shot execution, a greater diversity of shots, and a lower risk of wrist-related injuries. Rahul modi et al., concluded that although badminton is a non-contact sport, there is a significant risk of injuries. This prevalence of injuries is much higher than commonly assumed, and is almost similar to the incidence of injuries in other racquet sports such as tennis and squash. The majority of badminton injuries are secondary to overuse and are a result of excessive cumulative loads. Badminton coaches and trainers should note these observations and consider an alteration in the training workload of badminton players to allow the body to recover, and break the repetitive cycle leading to overuse injuries.[17] Stewart kerr et al., concluded that in one third of the injuries a player had lasting limitations or pain. A concerning number of players reported stress fractures and it may be a serious underestimated problem in badminton.[18]

## Conclusion

According to this research, task-oriented exercise and wrist flexibility training can be an efficient strategy for enhancing wrist mobility and reducing wrist injuries in badminton players. According to the studies, this intervention may result in benefits including enhanced wrist mobility, a wider range of motion, a lower risk of injury and an overall performance among badminton players.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/072/2022/ISRB/SR/SCPT).

**Funding:** This study is a self-funded study.

**Conflict of Interest:** The authors state that there is no conflict of interest.

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Original Article

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# Effect of Isometric Strengthening Exercise Combined with Interferential Current on Pain among Patients with Knee Osteoarthritis: Experimental Study

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**Abstract**

**Background:** Osteoarthritis, a degenerative disease, is the gradual breakdown of the articular cartilage in the joint. Knee osteoarthritis is more prevalent in women than men which causes pain and discomforts. The intention of this study is to find out the effect of isometric strengthening exercises combined with interferential therapy on pain in patients with knee osteoarthritis.

**Purpose:** To find out the effect of isometric strengthening exercises combined with interferential therapy in the management of knee osteoarthritis patients.

**Materials and Methods:** Thirty individuals aged above 45 years of both genders with mild or moderate osteoarthritis participated in the study. The individuals were assigned in single groups. They received interferential therapy and performed isometric strengthening exercises for 4 weeks. Pain, Active range of motion (AROM), Passive range of motion (PROM) and functional state of the subjects were evaluated by Numerical Pain Rating Scale (NPRS), universal goniometer and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), respectively. The entire process was performed from November 2022 to March 2023.

**Result:** The interventional group showed a considerable difference in each criterion (NPRS, AROM, PROM, and WOMAC). Isometric exercise and IFT was found to be effective in reducing pain in knee osteoarthritis.

**Conclusion:** At the commencement of the four-week intervention plan, isometric exercise and interferential therapy showed a marked outcome on pain and functional state of subjects with osteoarthritis in the knee.

**Key Words:** knee osteoarthritis, isometric strengthening exercise, interferential therapy, pain.

## Introduction

Arthritis is described as the joint's inflammation which is characterized by pain, swelling and restricted joint motion. Osteoarthritis (OA) is a degenerative disease. It is usually the consequence of erosion and gradual degradation of joint cartilage. It affects every articular surface, most usually the knees and hips. The most significant issue for an OA patient is pain, which must be treated while function is kept at a level consistent with habit. [1,2] There are

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three compartments in the knee namely:(i) medial tibiofemoral compartment; (ii) lateral tibiofemoral compartment and (iii) patellofemoral compartment. These compartments join to form a modified hinge joint that permits bending of knee, lengthen and rotate leg. Surplus weight could affect the efficiency of the knee articular surface. The diagnosis of OA-knee is initiated by clinical survey and verified by x-rays. The knee Osteoarthritis can be redivided into 5 degrees of grades: Grades 0-4 in which; 0 is denoted as normal - normal knee health,1 as minor-minor growth in bone spur and without experiencing any pain or discomfort and, 2 as mild - greater bony spur growth and symptoms arises at this stage, 3 as moderate- pain during movement and greater joint stiffness and 4 as severe osteoarthritis – joint space reduced, high levels of pain and discomfort, cartilage damaged and synovial fluid will be reduced. [3] Muscle weakness is a major risk factor in knee osteoarthritis. It has been proposed that weakened shock-absorbing and weight-bearing muscles may weaken joints and cause structural destruction to joint cartilage and subchondral bone which poses a risk for developing knee OA. Quadriceps weakness has been linked to worse self-declared assessments of function and impairment. The quad helps the knee joint absorb shock, therefore when this muscle group is weak, the body is put under more physical strain, which puts more pressure on the knee.[4,5] Exercise has been demonstrated to be important for maintaining function and may even help people with OA of weight bearing joints feel discomfort. Isometric exercise may be the best option out of the three because it is suitable for patients, simple to learn, and safe to conduct at home with little to no equipment needed. Additionally, isometric exercise results in the least amount of bone loss and intra-articular pressure and inflammation. [6]

IFT is a typical physiotherapeutic pain management treatment method. It's distinguished by the interference of two medium frequency currents, which merge to create a new medium-frequency current whose amplitude is regulated at low frequency, resulting in lower resistance to skin and allowing profound infiltration into tissue. IFT is useful in the treatment of many pain syndromes, according to several research.[7] In order to get past the skin's impedance, it uses pulsed or sinusoidal currents with a kilohertz carrier frequency to send currents to deep tissues. When 2 medium-frequency currents are supplied out of phase, they can get in the way with one another in the tissues where they cross. This interference leads to the generation of a low-frequency current. It has been asserted that this amplitude-modulated frequency (AMF) is the primary analgesic element of IFC.[8]

## Aim

To investigate the effect of isometric strengthening exercises combined with interferential therapy on pain among patients with knee osteoarthritis.

## Material and Method

This research is a Quasi Experimental study. The study was conducted with a sample of 30 participants. The participants were selected from Physio 360 clinic, according to inclusion and exclusion criteria. Participants received an extensive overview of the method, and a formal informed consent form was acquired.The materials used are towel and IFT (Interferential Therapy).

**Study Period:** from November 2022 to March 2023.

**Inclusion Criteria**

- Both male and females
- Aged 45 years and above
- Patients with mild and moderate osteoarthritis

**Exclusion Criteria**

- Patients with severe osteoarthritis
- lower limb fracture
- patients with other rheumatoid disease

**Outcome Measures**

Assessment was performed before and after four weeks of intervention. The examination of hip and knee osteoarthritis uses the WOMAC. It gauges function, stiffness, and pain as three distinct dimensions. NPRS is a unidimensional tool for the assessment of pain. NPRS is used to focus on patients and individuals with chronic back, knee, and hip pain.

**Procedure**

The study was conducted as a randomized study. The sample was collected at Physio 360 clinic. A total of 30 subjects were randomly selected based on the selection criteria and informed consent was acquired after explaining the safety and simplicity of the study. The subjects of age 45 years and above of both genders with knee osteoarthritis were obtained for the study. Pre-test values were recorded using the WOMAC questionnaire and NPRS scale. The subjects were assigned in a single group and given isometric strengthening exercises combined with interferential current for an interval of four weeks, five days per week, 5 repetitions and 3 sets. Following the training session, the post-test values were again recorded using the same outcome measure and significant differences were noted.

**Quadriceps Strengthening Exercise**

- subjects were asked to lie on their back with extended knee
- roll a towel and place under the thigh (above knee)
- the subjects were then asked to push the knee into the towel to tighten quadriceps
- hold for 10 seconds.
- Repeat 5 times and 3 sets.

**Straight Leg Raise**

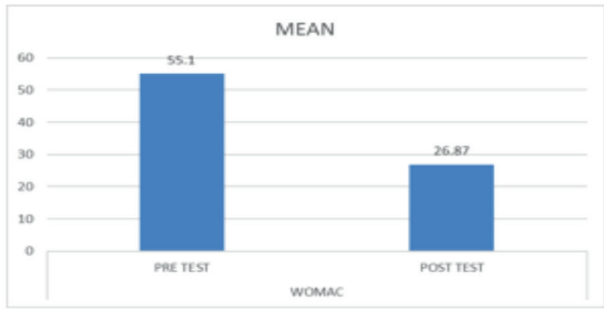
- subjects were asked to lie on their back with extended knee
- Slowly Raise the involved leg without bending the knee
- Hold for 10 seconds
- Repeat 5 times and 3 sets

**IFT**

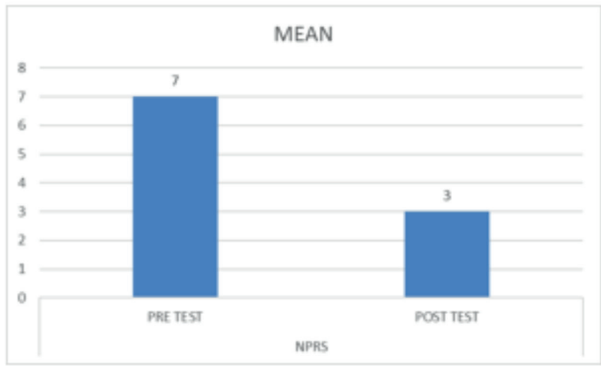
- Four padded electrodes are applied with ultrasound gel placed around the involved knee and fastened with straps. The electrodes are aligned diagonally.
- A base is set at 90 Hz and spectrum at 50 Hz with a frequency of 80-100 Hz. Program fixed at 20 and a trapezoidal pattern is used.
- The subjects described experiencing a tingling sensation unescorted by inducing muscular spasm, the current intensity was adjusted.
- Throughout treatment, subjects were asked to inform if any adjustments were required to change the current intensity to maintain a potent but optimal degree of stimulation.
- Each session of treatment was given for 12 minutes.
- Ift was given before the exercise session.

**Data Analysis**

Descriptive and inferential statistics were used to analyze the study's data. Standard deviation (SD) and mean were applied to all parameters. The significant variations in outcome measure were examined using a paired t-test.




**Graph-1 Pre-Test and Post-Test using WOMAC**




**Graph-2 Pre-Test and Post-Test using NPRS**

## Result

A statistical report of quantitative data established a statistically significant difference in values in the intervention group. Subjects of 30 members with knee osteoarthritis are assessed for pre- and post-tests using the NPRS scale and WOMAC questionnaire.

Graph 1 represents the comparison of the pre-tests and post -tests values of isometric strengthening exercise and IFT using the WOMAC questionnaire.

The mean value of the pre-test is 55.1 and the post test is 26.87.Graph 2 represents the comparison of the pre-tests and post -tests values of isometric strengthening exercise and IFT using NPRS scale. The mean value of pre-test is 7 and the post-test is 3.As a result, the findings are considered statistically significant when the p-value is <0.0001.

This shows that the isometric strengthening exercise combined with IFT gives beneficial results to reduce pain.

## Discussion

The motive of this study is to show the efficacy of isometric strengthening exercise and interferential therapy in reducing pain for subjects with knee OA. Knee OA rates are increasing due to aging and obesity problems which are less prevalent in men than women. The symptoms of pain, stiffness and other discomforts may lead to disability. Therefore, focusing on exercise and physiotherapy treatment is an important way to prevent disability. The Effects of isometric strengthening exercise have been studied by Chinelo N. Onwunzo (2021), who took effort to analyze the reduction of pain in knee osteoarthritis. The author found that the intervention showed greater outcome on pain intensity, discomfort, ROM and functional capacity among the subjects.[1] In addition to strengthening exercise, interferential therapy also has beneficial effects on knee osteoarthritis. Meltem Gundog et al (2012) concluded that the research demonstrated that an intervention for knee arthritis was effective, yielding favorable results in terms of pain reduction and improved disability outcomes. 8 Rufus A. Adedoyin et al (2005) conducted a randomized control trial on knee osteoarthritis to find out the effects of IFT current and TENS. The subjects improved significantly over a period of 4 weeks, but there were no additional effects of interferential current or transcutaneous electrical nerve stimulation on pain and function outcome. With the consideration of the results, we made an attempt to combine the strengthening exercise with the interferential therapy to show improvement in the functional state and reduce pain in the subjects with knee osteoarthritis.[7]

According to Jun Iwanoto study on effectiveness of exercise for knee osteoarthritis, there will be improvement of functional state and pain on performing aerobic and strengthening exercise.[9] In the findings of Aline Mizusaki Imoto, neuromuscular electrical stimulation was effective in reducing pain, function and ADL for knee osteoarthritis. One hundred subjects were randomly taken into two groups and evaluated for pain, function and ADL activities. Then he concluded that the neuromuscular electrical stimulation when included in the rehab protocol for knee osteoarthritis, is effective for improving pain, function and ADL.[5] Effectiveness and safety of strengthening, aerobic and coordination exercise have been studied by Heike A Bischoff, who took effort to find the effectiveness of strengthening, aerobic and coordination exercise in regard to pain and function with knee osteoarthritis. From the assessment, the interventions were effective and gave better pain relief.[4] In 2014 Mohammad H Ebrahimzadeh et al in his study concluded that WOMAC is a routinely used tool for estimating patients with knee OA. He concluded that the WOMAC index is a valid and reliable instrument for knee osteoarthritis. From the assessments the interventions are given and the questionnaire is used to estimate the scores of pains, stiffness and functional state.[11]

With the conclusion of all the above-mentioned studies, we designed a protocol involving isometric strengthening exercise along with interferential therapy for the patients with mild and moderate knee osteoarthritis to reduce pain and improve functional state. With this attempt, the pre- and post- tests measures of both groups were analyzed and tabulated in the result column. Thus, the results concluded that isometric exercise combined with interferential therapy is effective in reducing pain, discomfort and disability in patients with knee OA. The subjects who had profound knee osteoarthritis were not included in the recruitment of participants, which was the best way to enhance the sample size. Future studies may concentrate on the long-term impact of these interventions, as this study only did a four-week follow-up. The present study concluded that isometric strengthening exercise combined with interferential therapy were effective for knee osteoarthritis patients. However, the WOMAC score and NPRS score indicated a substantial change in the post-tests analysis for the interventional group. The interventional group which received isometric

exercise combined with interferential therapy had more significant changes.

## Conclusion

The aim of the study is to evaluate the effect of isometric exercise training combined with IFT on pain in patients with knee osteoarthritis. The research work concluded that isometric exercise combined with IFT was found to be more effective and reduces pain in knee osteoarthritis patients.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/073/2022/ISRB/SR/SCPT).

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**Conflict of interest:** The authors state that there is no conflict of interest**.**

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Original Article

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# Comparing the Effect of Proprioceptive Neuromuscular Facilitation (PNF) Exercise and Focused Regimen Program to Assess Balance and Quality of Life for Acute Stroke Rehabilitation

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**Abstract**

**Background:** Stroke is a leading cause of long-term disability worldwide, resulting in significant physical impairments, including hemiparesis and loss of motor control. Rehabilitation plays a crucial role in aiding stroke patients' recovery, and various approaches have been used to improve their functional abilities. Two widely practiced methods are Proprioceptive Neuromuscular Facilitation (PNF) exercises and focused regimen programs.

**Purpose**: To compare the effectiveness of PNF exercises and focused regimen programs in improving motor function, mobility and quality of life in stroke patients.

**Materials and Methods:** The total of 30 subjects with acute stroke were taken from Saicharan physio Center-Arakkonam. The subjects are selected based on inclusion and exclusion criteria The intervention was given for 6 weeks. The entire process was performed from November 2022 to February 2023.

**Result:** According to the statistical analysis, PNF exercises revealed significant in improving both balance and quality of life measures for acute stroke patients compared to focused regimen program.

**Conclusion:** This study finally concluded that the PNF exercises has a high impact in improving both balance and may enhance neuroplasticity.

**Keywords**: PNF Exercise, Focused regimen program, Berg balance scale.

## Introduction

The most frequent cause of death and disability in India is stroke, a neurological condition. Hemiplegia or hemiparesis, which result in partial paralysis of one side of the body, greatly restricts the ability of stroke survivors to live independently and participate in social activities. In addition to difficulty speaking or comprehending speech, vision issues, difficulty walking, dizziness, and loss of balance, a stroke can suddenly paralyze or numb one side of the face, arm, or leg.[1]

In addition to affecting limb function, stroke also impairs trunk function. Clinical observations of ambulatory stroke patients reveal issues with balance, coordination, and performing activities like getting out of bed or standing up from a chair.

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A recent clinical trial suggests that poor balance and reduced quality of life in post-stroke cases are linked to weakness in the trunk muscles. Therefore, it is crucial to strengthen the trunk muscles to improve balance and mobility in stroke patients.[2,3]

Rehabilitation plays a vital role in promoting recovery and optimizing functional outcomes for stroke patients. Different approaches have been employed in stroke rehabilitation, including Proprioceptive Neuromuscular Facilitation (PNF) exercises and focused regimen programs. These approaches aim to enhance motor function, mobility, and overall standard of living in stroke survivors.[4,5] But, there is a scarcity of comprehensive evidence comparing the effectiveness of PNF exercises and focused regimen programs in stroke rehabilitation. Physiotherapy treatments after stroke can be categorized into approaches based on neurophysiological, motor learning, or orthopaedic principles.[6]

The focused regimen exercise program is a structured and intensive intervention designed to target specific motor tasks and functional goals in stroke rehabilitation. This approach places emphasis on task-oriented training, progressive resistance exercises, and targeted strengthening activities to improve balance control, stability, and functional mobility.[7]

The Strength training of the afflicted lower limb combined with task-oriented training appears to help physiotherapy intervention for postural control dysfunctions after stroke. The findings suggest that lower limb strengthening activities may be beneficial for stroke patients who have muscle weakness. Lower limb muscle group strengthening activities appear to contribute to increased strength and activity without increasing spasticity and should be included in intervention regimens.[8]

Task-specific training focuses on practicing activities relevant to the individuals' goals, such as reaching, grasping, and walking. Progressive resistance training involves gradually increasing resistance to challenge the muscles and promote strength gains. Functional activities aim to improve overall mobility, balance, and coordination, enabling stroke survivors to perform daily tasks more independently and efficiently. [9] The primary outcome measure for assessing the effectiveness of these interventions will be balance, as it plays a vital role in enabling stroke survivors to regain independence in daily activities. The Berg Balance Scale, a widely utilized tool for evaluating balance and mobility, will be used to calculate balance performance before and after the interventions. Quality of life will be the secondary outcome measure, taking into account the physical, psychological, and social difficulties faced by stroke survivors.[10]

## Aim

To evaluate the comparing the effect of proprioceptive neuromuscular facilitation (PNF) exercise and focused regimen program to assess balance and quality of life for acute stroke rehabilitation.

## Material and Method

The total of 30 subjects with acute stroke were taken from Saicharan physio Center-Arakkonam. The subjects are selected based on inclusion and exclusion criteria The intervention was given for 6 weeks.The entire process was performe from November 2022 to February 2023.

**Inclusion Criteria**

- Subjects who had been diagnosed with Balance Assessed with Romberg`s Test among Acute Stroke Patients.
- Patients will be Included if Berg Balance Scale less than 20.
- Ability to Understand and Follow Commands.

**Exclusion Criteria**

- Severe cognitive impairment.
- Presence of severe musculoskeletal or neurological conditions, other than stroke.
- Uncontrolled cardiovascular conditions.
- Recent lower limb injuries.

**Outcome Measures**

- Berg Balance Scale.
- Stroke Specific Quality Of Life.

**Procedure**

A total of 30 subjects were recruited for this study through the convenient sampling method. Subjects were taken from the Saicharan physio center. All subjects were recruited based on the inclusion and exclusion criteria. The recruited subjects were assigned to two groups (Group A: 15 Subjects) and (Group B: 15 Subjects) underwent pre-test analysis on the Berg Balance Scale and stroke-specific quality of life scale (SS: QoL) to analyse the impact of the interventions on the overall quality of life for stroke patients. After the pre- test analysis, Group A received PNF Exercises of 3 sessions per week for the period of 12 weeks, Whereas Group B received a Focused Regimen program of 3 sessions per week for the period of 12 weeks.

After 12 weeks, the Post-test analysis was carried out, and the data were tabulated through Statistical Package for the Social Science [SPSS].

**Group A: PNF Exercise Program**

- Warm-up exercises: Joint mobilization and range of motion exercises for upper and lower extremities.
- PNF techniques: Utilize diagonal patterns, rhythmic initiation, and repeated contractions to facilitate motor control and coordination.

**PNF Techniques:**

D1 and D2 flexion and extension patterns are specific movement patterns used in Proprioceptive Neuromuscular Facilitation (PNF) exercises for the lower limb. These patterns involve diagonal movements that can help improve muscle coordination, range of motion, and functional mobility. Here 'show to perform D1 and D2 flexion and extension for the lower limb in PNF patterns:

**1. D1 Flexion:**

**Starting Position:**

- Position the patient lying on their back with the affected leg extended.
- The therapist stands on the side of the affected.

**Movement Sequence:**

- Initiate the movement by supporting the foot and ankle of the affected leg and guiding it into hip flexion, knee flexion, and ankle dorsiflexion.
- Simultaneously, guide the patient's upper body into a diagonal pattern by flexing the trunk towards the opposite side and rotating it towards the affected side.

**Resistance and Assistance:**

- Apply appropriate resistance or assistance during the movement to engage the targeted muscles.
- To provide resistance, the therapist can apply pressure against the foot or ankle in the direction of extension while the patient resists.
- To assist the movement, the therapist can provide gentle guidance and support to ensure proper form and alignment.

**Repetitions and Sets:**

- Perform a designated number of repetitions (e.g., 8-10) in a controlled and coordinated manner.
- Repeat for the recommended number of sets according to the patient's tolerance and therapeutic goals.

**2. D2 Flexion:**

**Starting Position:**

- Position the patient lying on their back with the affected leg extended.
- The therapist stands on the side of the affected leg.

**Movement Sequence:**

- Initiate the movement by supporting the foot and ankle of the affected leg and guiding it into hip flexion, knee extension, and ankle plantar flexion.
- Simultaneously, guide the patient's upper body into a diagonal pattern by flexing the trunk towards the affected side and rotating it towards the opposite side.

**3. D1 and D2 Extension:**

The extension patterns for D1 and D2 follow a similar approach to the flexion patterns but in the opposite direction. The therapist will guide the patient through the extension movements while considering the diagonal patterns and applying resistance or assistance as necessary. The key is to focus on coordinated and controlled movements that align with the specific D1 or D2 pattern.

**Group B: Focused Regimen Program:**

- Warm-up exercises: General cardio vascular warm-up (e.g., walking, cycling) to increase blood flow.
- Task-specific training: Focused practice on specific motor tasks related to daily activities, such as grasping objects, walking, or balance exercises.
- Progressive resistance training: Strengthening exercises targeting affected muscles and compensatory strategies.
- Cool-down exercises: Incorporate stretching and relaxation exercises.

**Balance and Postural Control Training**:

- Balance and postural control training focus on improving standing balance, weight shifting, and maintaining stability during functional tasks.
- Examples include standing on one leg, tandem stance, heel-to-toe walking, and reaching tasks that challenge balance control. Patients practice activities that challenge their balance, such as reaching in different directions, reaching while standing on foam or unstable surfaces, or performing dynamic weight shifting exercises.

**Weight Shifting:**

- Weight shifting exercises involve shifting the centre of gravity and redistributing body weight to improve postural control.
- Examples include lateral weight shifts, forward and backward weight transfers, and weight shifts in multiple directions.

**Static Balance Exercises:**

- Static balance exercises focus on maintaining balance while remaining stationary.
- Examples include standing on one leg (single-leg stance), standing with feet together (tandem stance), or standing on foam or an unstable surface.

**Dynamic Balance Exercises:**

- Dynamic balance exercises involve maintaining balance during controlled movements or weight shifts.
- Examples include stepping forward and backward, side stepping, and performing multidirectional reaching tasks while maintaining balance.

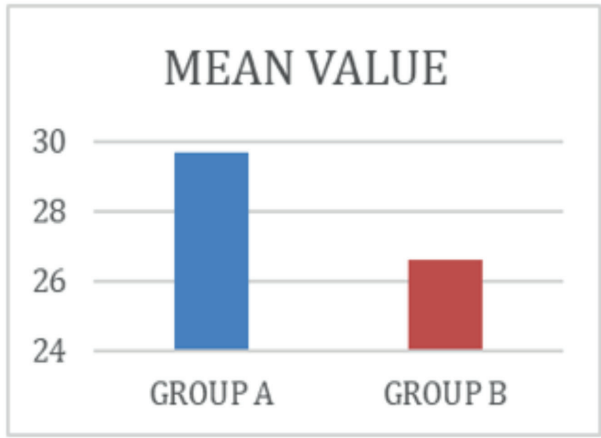
**Wobble Board Training:**

- Using a balance board or wobble board challenges balance control by introducing an unstable surface.
- Patients perform various exercises while standing on the board, such as weight shifts, reaching tasks, or controlled movements.

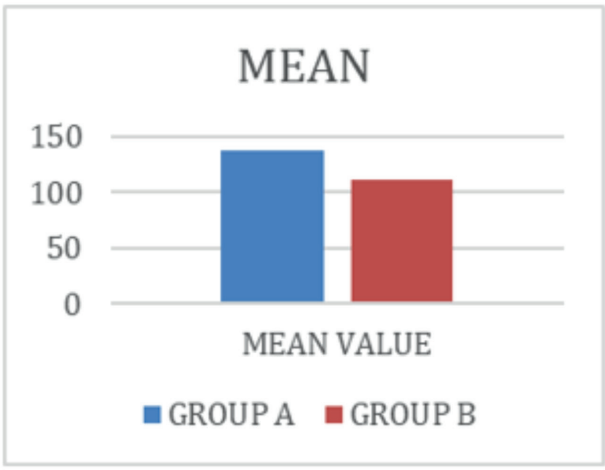
**Mobility Training:**

- Mobility training involves practicing functional mobility tasks, such as sitting up, standing, walking, and navigating obstacles.

**Data Analysis**




**Graph-1 Comparison between post test values of berg balance scale for group A and group B.**




**Graph-2 Comparison between post test values of Stroke specific quality of life for group A and group B.**

## Result

Statistical analysis made with quantitative data indicated statistically significant differences in the values of PNF and focused regimen program.

Graph 1 represents The comparison of post mean value of Berg Balance Scale for Group A PNF Exercise Program and Group B Tailored Exercise Program. Group-A was 29.67 and Group B was 26.60 which shows gradual increase with p value <0.0001 statistically significant.

Graph 2 represents The comparison of post mean value of Stroke Specific Quality Of Life (SS:QoL) for Group A PNF Exercise Program and Group B Tailored Exercise Program. Group-A was 136.93 and Group B was 110.67 which shows gradual increase with p value <0.0001 statistically significant.

## Discussion

PNF exercise utilizes movement patterns and principles to promote neuromuscular re-education, strength, and functional movement. On the other hand, the Focused Regimen Program involves targeted exercises focusing on balance, postural control, and functional activities. The results of the study imply that PNF training is superior in improving balance and quality of life. To improve patient outcomes and general wellbeing, clinicians should think about using PNF exercise as a main intervention in acute stroke rehabilitation. An Early study conducted by Chaturvedi P, Singh AK et.al. (2018) stated that PNF is a noninvasive stroke rehabilitation technique. If the patient is able to follow orders, PNF should be started on the first day after the stroke. Increased functional activity will increase quality of life and neuroplasticity. The research concerning PNF intervention in stroke are both contradictory and they are helpful, however they have not been explored in acute stroke. Therefore, the findings indicate PNF is effective in improving functional outcome following stroke.[1]

An experimental study conducted by Minjeong An et.al. (2011) stated that Aerobic exercise has been shown in this review to enhance balance in chronic stroke survivors. This discovery contradicts prior systematic review findings indicating balance or gait-oriented trainings had little benefit (Teasell, Foley, Bhogal, & Speechley, 2003; van de Port et al., 2007). Furthermore, this review adds to the body of knowledge on balance and falls in stroke survivors. Aerobic exercise improves chronic survivors' balance and, presumably, their level of activity.[5] A Pilot study conducted by Beatriz Fernandes et.al. (2015) states that Strength training of the afflicted lower limb combined with task-oriented training appears to help physiotherapy intervention for postural control dysfunctions after stroke. The findings suggest that lower limb strengthening activities may be beneficial for stroke patients who have muscle weakness. Lower limb muscle group strengthening activities appear to contribute to increased strength and activity without increasing spasticity and should be included in intervention regimens.[8]

## Conclusion

This study finally concluded that the PNF exercise is more effective than the Focused Regimen Program in improving balance and quality of life for acute stroke patients. Clinicians should consider incorporating PNF exercise as a primary intervention in acute stroke rehabilitation to optimize patient outcomes and enhance overall well-being.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws institutional regulations. (Application number 03/074/2022/ISRB/SR/SCPT).

**Funding:** This Study is a Self-Funded Study.

**Conflict of Interest:** The Author State That There is No Conflict of Interest.

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Original Article

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# Effectiveness of Dry Needling on Lateral Epicondylitis Patient Compared to Ultrasound Therapy

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**Abstract**

**Background:** The goal of study is to assess the effectiveness of dry needling and ultrasound therapy on lateral epicondylitis patients.

**Purpose:** To compare the effectiveness of dry needling on lateral epicondylitis patients compared to ultrasound therapy.

**Materials and Methods:** Ninety subjects with lateral epicondylitis (both male and female) divided in two groups. Group "A" acquired dry needling two days a week for a period of two weeks and Group "B" acquired ultrasound therapy four days a week for a period of two weeks. Visual Analogue Scale, Patient-rated tennis elbow evaluation were used to assess patients in before and after treatment. Study period: November 2022 to April 2023.

**Result:** Based on data analysis both visual analogue scale and patient rated tennis elbow evaluation values in each group are significantly different in before and after treatment having $p<0.0001$ for each group. In Group analysis is highly significant with $p<0.0001$ for VAS, $p<0.0001$ for PRTEE dry needling is greater in lowering discomfort and increasing mobility.

**Conclusion:** Dry needling is more effective than ultrasound therapy in lateral epicondylitis.

**Key Words:** Lateral epicondylitis, Dry needling, Ultrasound therapy, VAS, PRTEE

## Introduction

Tennis elbow is a painful condition that most commonly occurs in the dominant hand due to the inflammation of tissue around the lateral epicondyle of the humerus. Most commonly affected in both men and women such as the driver of the construction site and office workers are equally affected that may increases with age. Continuous straining games such as badminton leads to ligament strain.[1] However, the cause of the tennis elbow is unknown even though it occurs at the minor level. Most people experience pain at the point of medial and distal aspect as well as excessive flexion of the elbow.[2] Tennis elbow is treated with the ice, bracing, non-steroidal drugs if it is chronic the patient is initiated for physiotherapy. There are several techniques available for the treatment of tennis elbow, it includes ultrasound, massage, manual techniques, dry needling, and exercise therapy as

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well as electrotherapy. Lateral aspect of the elbow is evaluated by facing the thumb upward and elbow in semiflexion. The continuous tension over the tendon is prevented by keeping the elbow joint in a relaxed position. While, during the resisted wrist extension and radial deviation can evaluate the tenderness over lateral epicondyle of humerus.[3] Dry needling is also called the intramuscular stimulation which involves inserting the needle into the muscle and skin. Trigger point with the dry needling is used to treat the palpable taut band structures and the muscular problems. The effect of the therapy is involving alone or with the combination of the treatment for the patient regarding to the pain progressiveness and its impairment.[4] It results in reducing the growth factors and enhances the blood circulation.[5] Ultrasound is most commonly used among the physical therapy, it increases the blood flow, reduces the pain and improves the tissue repair.6 The pain which is regional is successful with the dry needling.[6] Dry needling helps to treat the chronic pain.[7] When the resistance is applied over wrist extension and radial deviation that causes pain and discomfort over lateral epicondyle of humerus.[9] Before the initiation of treatment, pain is evaluated by visual analogue scale and finger dynamometer is used to measure the grip strength and pinch strength.[10] The condition is treated by placing the head of the ultrasound over the painful area. Low pulsed ultrasound is helpful in repairing the tissues and enhances the process of healing. The normal function of both affected and unaffected hand is tested to identify the improvement. However, lateral epicondylitis is the slow progressive condition.[11] Overall treatment of the tennis elbow is to reduce the pain and improve the functional activity. The most frequently involved structure in the lateral epicondylitis is the origin of extensor carpi radialis brevis.[12] Exercise therapy includes strengthening exercise and stretching exercise whereas strengthening exercise is used to improve the grip strength & reduces the pain. Rehabilitation programs improve the duration of recovery in patients with lateral epicondylitis. If the patient with tennis elbow is untreated it may lead to chronic pain. The pain experienced during rest is measured by the visual analogue scale. The subject is allowed to mark the level of the pain. The patient rated tennis elbow evaluation consists of 15 questionnaires which is used to measure the activity of the individual with tennis elbow.[13] It includes that extensor carpi radialis brevis tearing muscle leads to pain at the origin of extensor.[14] The duration of each session is about 10 minutes. It improves the blood flow, enhances the permeability of the membrane and reduces the inflammation of the tissues. So, the pain over lateral epicondyle of humerus due to the excessive pressure on the joint may be diagnosed as the lateral epicondylitis.[15] Releasing the trigger points is very simple and takes a few minutes. Most commonly releasing the triggers in forearm muscle. Patients are most commonly advised to do the concentric and eccentric type of the exercises to improve the grip strength.[16] Dry needling improves the range of motion, lowers the tone of muscle and decreases the discomfort.[17]

## Aim

To compare the effectiveness of dry needling and Ultrasound therapy on lateral epicondylitis patients.

## Materials and Methods

This experimental study was conducted from November 2022 to April 2023 by Dr. Milton's Physiocare. Age group between 18-50 years, Weakness with gripping, Pain on palpation over lateral epicondyle of humerus were performed in this study. This type of study is a convenient sampling technique.

**Inclusion Criteria**

- Age 18-50 yrs.
- Weakness with gripping.
- Pain on palpation over lateral epicondyle of humerus.
- Cozen test, Mill's test, Middle finger extension test was confirmed.

**Exclusion Criteria**

- Radio-ulnar and radial-humeral osteoarthritis.
- Recent trauma and fracture.
- Recent surgery.
- Peripheral nerve entrapment.

**Outcome Measures**

- Visual Analogue Scale (VAS).
- Patient-rated tennis elbow evaluation (PRTEE).

**Procedure**

Participants were selected based on conditions. The detailed Procedure for performing the study was explained to subjects and informed consent was collected from them before starting the study.

**Dry Needling Group**

**Subject Position:** Patient was made to sit in a comfortable position and the arm well supported on the pillow with elbow flexed to 90°, forearm in pronation and wrist in comfortable position.

**Technique:** A 0.25mm diameter of acupuncture sterilised needle is utilised to expose the treatment area. Before the treatment, the exposed area was wiped with disinfectant. Then, palpate the nodules to position a fine needle and plastic guide tube over a myofascial trigger point and perform tapping movement to cause a twitch response. When a needle was placed into a trigger point penetrated at a 30 degree angle, the fanning technique was used, and the needle was held for a few seconds before removing. Use a Cold pack for 10 minutes twice daily after the procedure to decrease post-needling discomfort. This procedure was given two days a week for a period of 2 weeks.

**Ultrasound Therapy Group**

**Subject Position:** Patient was made to sit in a comfortable position and the arm well supported on the pillow with elbow flexed to 90°, forearm in pronation and wrist in comfortable position.

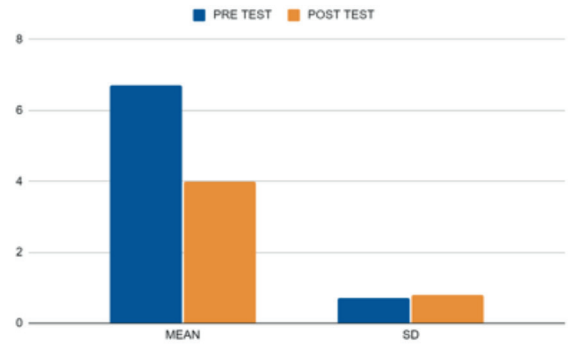
**Technique:** Remove all jewellery that interfered with the application. Patient was encouraged to inform the therapist if discomfort occurs. Gel applied to the Ultrasound head. The head of the ultrasound is done in circular motion. Pulsed ultrasound with 1MHZ frequency was given with an intensity of 1-2 w/cm at the point of tenderness around the lateral epicondyle region for 8 minutes. This procedure was given four days a week for a period of 2 weeks.

**Exercise Programme**

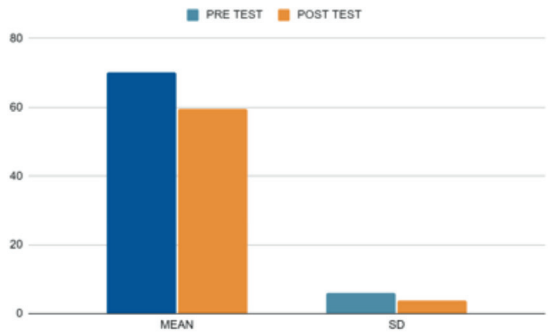
(10 repetitions, 3 sets, 10 seconds hold)

- Isometric supination and pronation
- Supination with dumbbell
- Isometric elbow flexion
- Isometric elbow extension
- Wrist extension with dumbbell
- Fist clench
- Towel twist

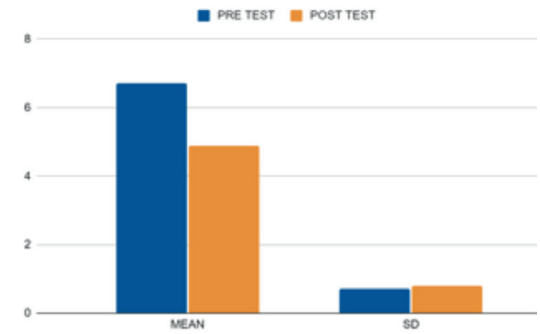
**Data Analysis**




**Graph-1 Paired t-test by using VAS (Dry Needling Group).**



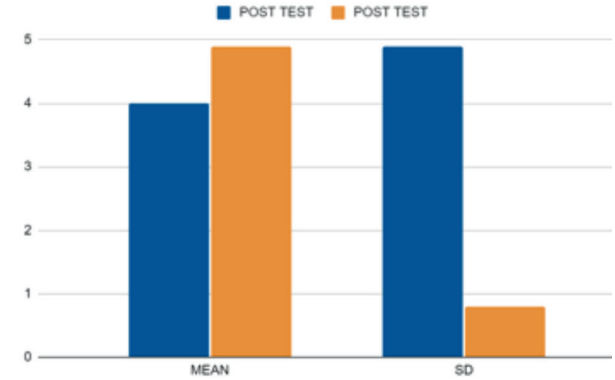

**Graph-2 Paired t-test by using PRTEE (Dry Needling Group)**



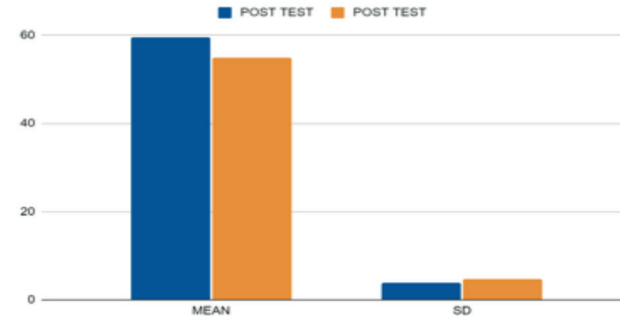

**Graph-3 Paired t-test by using VAS(Ultrasound Therapy Group)**




**Graph-4 Paired t-test by using PRTEE (Ultrasound Therapy Group)**




**Graph-5 Both Groups Unpaired t-test by using VAS**




**Graph-6 Both Groups Unpaired t-test by using PRTEE**

## Result

The 90 individuals participated in the study. There were 45 participants in each group. For visual analogue scale, the mean was 4.04 for Dry needling group and 4.97 for Ultrasound therapy group, p value was <0.0001 and t value was=5.2990 which shows that the result was statistically significant. For patient rated tennis elbow evaluation, the mean was 59.58 for Dry needling group and 54.93 for Ultrasound Therapy group, p value was <0.0001 and t-value was=5.0216 indicates highly significant.

## Discussion

Goal of the study was to compare the effectiveness of dry needling on lateral epicondylitis patients compared to ultrasound therapy. To assess the effectiveness in terms of lowering discomfort and increasing mobility. This comparison is demonstrated with a duration of 2 weeks. In this study 90 subjects were assigned 45 were in the Dry needling group and 45 were in Ultrasound therapy group. Dry needling group two days a week for a period of 2 weeks and Ultrasound therapy group four/times a week for a period of 2 weeks. Both groups received the same set of exercise programmes. The outcome result was measured by visual analogue scale and patient rated tennis elbow evaluation before and after treatment. Based on statistical analysis, both groups showed improvement in visual analogue scale and patient rated tennis elbow evaluation However, subjects in the dry needling group with exercise showed better improvement in visual analogue scale and patient rated tennis elbow evaluation than the subjects in the ultrasound group with exercise. Alireza Kheradmandi, Maryam Ebrahimian, et al., has concluded that tennis elbow syndrome patients' discomfort and sensitivity in their hand extensor muscles improve more significantly when dry needling is combined with regular physical therapy.[6] Esat Uygur, Birol Aktaş, et al., has concluded that during the six-month follow-up period, both dry needling and corticosteroid injections markedly improved lateral epicondylitis. However, dry needling delivered superior results. We experienced modest negative effects with corticosteroid injections; as a result, such injections need to be reviewed.[7] Zahid Mehmood Bhatti Zaib-un-nisa, Atif Dustgir, et al., has concluded that deep friction massage and dry needling are equally effective at improving force and lowering discomfort in patients with lateral epicondylitis. However, when comparing the mean difference between pre- and post- outcome measure scores, dry needling is a more effective intervention.[8] Nensi v Gandhi, Dharmag Vyas, et al., has concluded

that when treating lateral epicondylitis, dry needling was discovered to be more effective than the mulligans approach alone in reducing pain and increasing functional impairment.[15] Jorge Sanchez-Infante, Marcos J Navarro- Santana, et al ., has concluded that physical therapist use dry needling was superior to other treatment for pain management in tennis elbow.[16]

## Conclusion

Dry needling and ultrasound therapy along with strengthening exercises reduces pain and improves the range of motion on Lateral epicondylitis, dry needling appears to be more effective than ultrasound therapy in reducing pain and increasing the range of motion in patients with lateral epicondylitis.

**Ethical Clearance:** The research work has been approved by the ISRB. (Application no: 03/075/2022/ISRB/SR/SCPT)

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Effectiveness of Aerobic Exercise and Resistance Exercise on Improving Cognitive Function in Older Adults

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**Abstract**

**Background:** Every living thing ages, yet it seems that a person's activities and interactions with their surroundings may slow down to the point where their performance begins to deteriorate. Since cognition is linked to cortical and subcortical regions, these regions' deterioration is typically followed by a decline in cognition. Aging affects a number of cognitive functions, including the ability to quickly process information, reason, and pay attention.

**Purpose:** To compare the Effectiveness of aerobic exercise and resistance exercise on improving cognitive function in older adults.

**Materials And Methods:** The study type was a comparative pre-post type, and the study design was experimental. 68 old persons with cognitive scores of less than 20 provided the data. The study lasted for around 8 weeks. Males and females between the ages of 60 and 70 were selected. *Study period :* November 2022 to July 2023.

**Result:** The Mini Mental Examination Test scale and the Montreal Cognitive Assessment scale, when compared between Groups A and B, show a highly significant difference in Mean values at P 0.001.

**Conclusion:** In this study the findings suggest that Aerobic exercise is more beneficial than resistance strengthening exercise in increasing the cognitive function among the older people.

**Key Words:** Cognitive Function, Aerobic Exercise, Resistance Exercise, MMSE and MoCA.

## Introduction

All living things eventually become old; however, it seems that a person's actions and interactions with their environment might slow down the rate at which they approach the point where their performance starts to suffer.[1] The dynamic and progressive process of aging causes a decline in morphological, functional, hemodynamic, and psychological skills, as well as a reduction in adaptive capacity and quality of life and an increase in morbidity. cognitive decline frequently follows the degeneration of these areas. Aging impairs a variety of cognitive processes, including the capacity for quick information processing, reasoning, paying attention, and various memory.[2] Lack of cognitive function is not specific to any one disease or condition, but it could be one of its symptoms. It could be a short-term issue or a long-term issue .It could develop as a result of

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environmental factors including brain injury, mental illness, or abnormal neurological development or it might be present from birth. The capacity to learn and function is significantly hampered as a result.[3] The number of adults above the age of 65 is increasing.[4] A typical issue in the elderly, cognitive impairment occurs at a probability of about 21.05-73.3 per 1,000 person-years and is correlated with aging MCI.[5,6,7] The management of MCI influences whether elderly people will have mild cognitive impairment, such as dementia, or healthy cognitive abilities.[8] It estimates that there are 22.2% of Indians who have cognitive impairment, with North India's rural areas having a higher frequency. Growing older is a progressive process that reduces morphological and functional capacities as well as adaptive capacity, quality of life, and morbidity.[9] In India, 8% of the population and 11% of the global population, respectively, were over 60 in 2011, and that percentage will rise to 19% by the end of 2050. One percent of older persons are affected by Alzheimer's disease, the most widespread cause of cognitive impairment. By 2050, the frequency of cognitive impairment is projected to quadruple while its incidence will increase every five years. Currently, 13% of seniors over 65 experience some sort of impairment.[10]

## Aim

The goal of the study is to compare how well aerobic exercise versus resistance training can help older persons' cognitive abilities.

## Material and Method

The study type was a comparative pre-post type, and the study design was experimental which was conducted in November 2022 to July 2023 . The study's location was the Jeeva Physiotherapy Clinic. 68 older persons with cognitive scores of less than 20 would provide the data. The study lasted for around 8 weeks. Males and females between the ages of 60 and 70 were selected.

**Inclusion Criteria**

1. Subjects who were 60 years old or more
2. Both genders .
3. Subjects who complained of memory issues
4. MMSE is less than 26.

Exclusion Criteria

1. Being bedridden
2. Visual or auditory impairment
3. Subjects with severe osteoarthritis
4. Post stroke patients who have upper limb and lower limb paralysis.

**Outcome Measures**

Assessment was performed at baseline (before starting of treatment) and after eight weeks of study.

1. Mini mental state examination (MMSE)
2. Montreal Cognitive Assessment (MOCA).

**Procedure**

The patient was completely explained about the procedure and had given the consent form for the treatment. Subjects were selected according to convenient sampling techniques and according to inclusion and exclusion criteria. The subject were evaluated with a given questionnaire and the values were taken as pre-test measurement. Group A (n=34) was given a protocol of aerobic exercise and Group B (n=34) was given a protocol of resistance exercise. After eight weeks of intervention the subject was evaluated with a given questionnaire and the values were taken as post-test measurement. The pre-test and post-test measures were statistically analyzed.

**Group –A: Aerobic Exercise**

**Protocol For Aerobic Exercise Group:**

The aerobic exercise A program for eight weeks and was done three times a week on alternate days (Tuesday, Thursday, and Saturday). In order to warm up before each training session, stretching and active limb motions were administered for 5 minutes. After giving the subjects instructions to work out at 65 to 70% of their maximal HR, the subjects' heart rates were recorded. Participants engaged in exercises involving stair climbing and speed walking during each training session. At first, subjects were instructed to exercise for at least 20 minutes in each session, and they were then instructed to gradually increase that time every week until it reached 30 minutes. Jogging for five minutes served as the cooling-down exercise following the workout.

**Group –B : Resistance Exercise**

**Protocol for Resistance Exercise:**

The resistance training group will follow the described protocol 3 times a week on alternate days (Monday, Wednesday, and Friday). The resistance exercise group followed an 8-week exercise program that involves dumbbells and weight rod (Seated Military press) was performed for upper limbs by using dumbbells or weight plates and for lower limb strengthening exercises (Dumbbell squat) is done by using a weight cuff or weight plates. exercise group. Use dumbbells or weight plates to do the (seated military press) exercise for the upper limbs, and weight cuffs or weight plates to perform the (dumbbell squat) exercise for the lower limbs.

**1. Seated Military Press**

Place one dumbbell on each thigh once you're seated. Place your lower back firmly against the bench back while you sit. Keep your back and shoulders as straight as you can. Bring the dumbbells up to shoulder height by raising them from your thighs. And Press the dumbbells up to the top of Your head until your arms are fully extended. After briefly remaining above your head, lower the dumbbells back to shoulder height. The group will adhere to the prescribed regimen. dumbbells and weighted bars were used in the eight-week training program for the resistance.

**2. Squat**

As you begin to lower your body by bending at the knees, move your butt backward. Avoid arching your back forward as you descend until your thighs are parallel to the ground. A shorter distance is ok until you master proper form and hold for a few seconds. Finally, to straighten your knees and hips and stand backup, push firmly into your heels. Keep your chest up high to maintain a neutral spine**.**

**Exercise Programme**

1. Aerobic Exercise (Speed Walking - 1000 Steps , Stair Climbing - 1 - 15 Steps).
2. Resistance Exercise (Seated Military Press - Hand Raise and Down, Squat using weight Plate.

**Data Analysis**

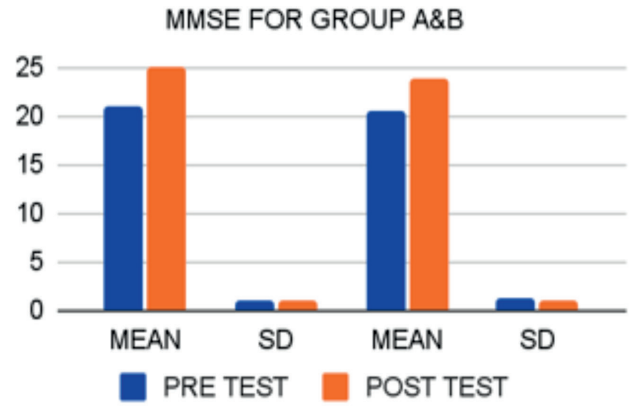



**Fig-1 Comparison of Mini Mental State Examination for group A and B in pre and post- test values**

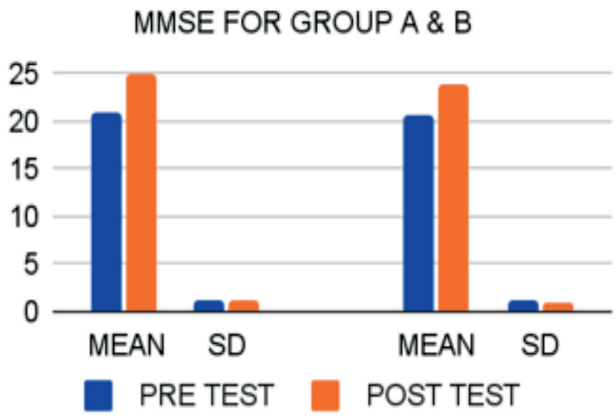



**Fig-2 Comparison of Mini Mental State Examination Within Group-A & Group-B Between Pre & Post Test Values**

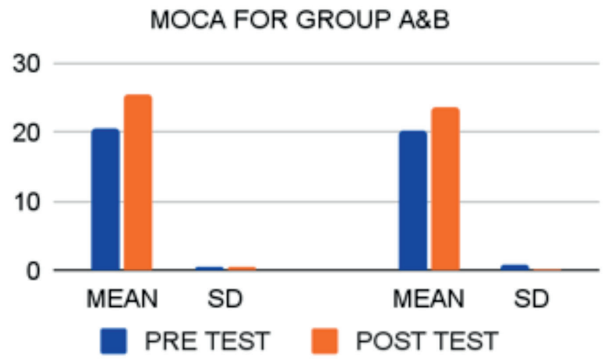



**Fig-3 Comparison of Montreal Cognitive Assessment between for Group-A and Group-B in Pre and Post Test Values.**

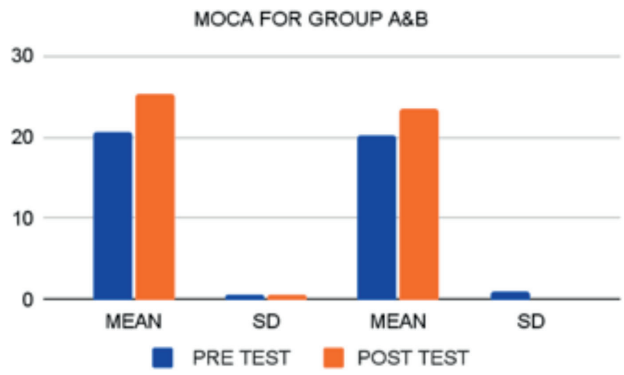



**Fig-4 Comparison of Montreal Cognitive Assessment Within Group-A & Group-B Between Pre & Post Test Values.**

## Result

When analyzing the mean values of Groups A and B on the Mini Mental State Examination, Group A's aerobic exercise group displays a mean value of 25.00, which is higher and more effective than Group B's resistance exercise group 23.88 .There is a considerable rise in the post test scores when comparing the mean values of Group A and Group B on the Montreal Cognitive Assessment scale. Mean values are similar in both groups, however the Aerobic Exercise Group (Group A) reveals that it is more successful than the Resistance Exercise Group (Group B), with a mean value of 25.38. 23.47 at $P \leq 0.001$.

## Discussion

The purpose of this study was to examine how high-impact exercise and obstacle practice affected the development of mental capacity in more experienced adults. It is evident that aerobic and resistance exercise work well to improve older adults' cognitive function. Be that as it may, there are less examinations who had analyzed these approaches on working on mental capability. MMSE and MoCA are used to assess subjects Cognitive performance in the subjects both at the start and end of the intervention. In Aerobic group pre intervention mean of MMSE was (20.50) and MoCA was (20.26). After treating the subject with Aerobic exercise Protocol, the mean value of MMSE and MoCA is increased to (25.00) and (25.38), which shows statistically significant difference between the groups. In Resistance Exercise protocol group pre-mean of MMSE was (20.97) and MoCA was (20.58).After treating the subject with Resistance Exercise protocol, the mean value of MMSE and MoCA is increased to (23.88) and (23.47), which shows statistically significant difference between the groups. Based on the statistical analysis, both groups showed improvement in MMSE and MoCA. However, subjects in Aerobic Exercise protocol groups who received Aerobic Exercise protocol exercise showed better improvement in MMSE and MoCA than the subjects in the Resistance exercise Protocol groups who received Resistance strengthening exercise in the Earlier studies (ozakya 2005) According to studies, resistance training results in similar or improved specific cognitive performances. Both behavioral and neuroelectric cognitive processes supported these advantageous effects.[11] Chodzko & Zajko (2009) define "exercise" as "planned, organized, and continuous movement" with the aim of improving or preserving a few physical fitness-related characteristics. Practice is believed to be neuroprotective through the systems it following up on cardio vascular framework and it likewise advances brain adaptability and it acts straightforwardly on neurocognitive frameworks. Exercise has been shown to increase cognitive function in older adults with cognitive impairments.[12,13] Although resistance exercise is suitable for the elderly, little research has been done into the mechanisms by which it improves cognition or the benefits of resistance training beyond strength. According to Gore lick et al., resistance training improves circulation throughout the body, increasing the brain's food supply. Changes in circulation, an adjustment of steroid hormones a rise in brain concentrations of neurotransmitters, with the production of neurotrophins are the processes by which we acquire discernment during obstruction training.[14]

## Conclusion

According to the research, Resistance strengthening exercises Protocol and Aerobic exercises Protocol both increase Cognitive function in old age people. The findings suggest that Aerobic exercise is more beneficial than resistance strengthening exercise in increase in cognitive function among the older people .

**Ethical Clearance:** Taken from Institutional Research Committee 03 / 076 / 2022 / ISRB / SR / SCPT

**Funding:** Self

**Conflict Interest:** Nil

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Original Article

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# Effectiveness of Aerobic Training with Strengthening Exercise on Endurance in Patients with Below Knee Amputation: Experimental study

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**Abstract**

**Background:** Below-knee amputation (BKA) is a condition in which the limb is amputated in the transtibial level in which the distal tibia, fibula, whole of the ankle joint, and associated musculature and other components are removed.

**Purpose:** To determine the effect of aerobic training with strengthening exercise to increase endurance in patients with below knee amputation.

**Materials and Methods:** Total of 30 subjects with below knee amputation were selected based on the selection criteria. All the subjects were well elucidated about the objective of the study and the intervention and informed consent was obtained before participating in this study. The subjects received strengthening exercise and aerobic training for 4 weeks. The pretest values are taken with 6MWT and Borg scale; the same were recorded for post-test after 4 weeks of intervention. The entire process was performed from November 2022 to March 2023.

**Result:** Using a paired t-test to compare the pre and post-test results, the experiment revealed a significant difference in 6MWT and Borg scale. Independent sample t-test outcome at four weeks showed significant improvement in endurance.

**Conclusion:** The results and the data obtained from this research was statically classified and can be concluded that there was a definite and positive effect of aerobic training with strengthening exercise and increased endurance in patients with below knee amputation.

**Keywords:** aerobic exercise, strengthening exercise, 6MWT, Borg scale, below knee amputation

## Introduction

An ankle joint, the distal tibia and fibula, as well as any related soft tissue components, are removed during a below-knee amputation (BKA), which is a transtibial amputation. A BKA is typically preferred over an above-knee amputation (AKA) because it provides better functional and rehabilitation results.[1] Lower extremity amputation is a necessary medical procedure. In more than 50% of instances, ischemia of the lower limbs, any peripheral artery disorders, and diabetes are thought to be the primary causes of amputation. The second most common reason for lower-extremity amputations is trauma.[2] An amputee

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who is able to use prosthesis to walk independently in the community has a higher aerobic potential to those who are receiving rehabilitation intervention, but they might not have postural control to walk easily on a treadmill. Hence, as opposed to the aforementioned conventional exercise tests, a field type of exercise test (such as a walk test) may more accurately contemplate the ability of amputees to exercise in the societal population. It is acknowledged that the residual component of the limb on the severed side of BK amputees performs daily activities like standing and walking with less activity (Isakov et al., 1996). Clinical professionals frequently employ manual muscle testing to evaluate the functionality of their patients. [3,4] Exercise is typically divided into power/strength and aerobic/endurance activities. Strength training is traditionally done with a relatively high load for a brief period of time, whereas endurance training is traditionally done with a relatively low load over a long period of time. Pure strength and endurance training, however, is uncommon. The majority of activities combine strength and endurance, and this sort of training is known as concurrent exercise.[5] Aerobic exercise, also referred to as endurance activities, cardio, or cardio respiratory exercise, is any exercise that predominantly uses the aerobic energy-generating process. The term "aerobic" refers to the use of oxygen to sufficiently satisfy the energy demands during activity. Through aerobic metabolism.[6] The word "aerobic" is defined as relating to, involving, or requiring oxygen". Cyclic sequences of light-to-mild intensity exercises over a sustained period of time is known as aerobic exercise. It may be more accurate to refer to aerobic activity as low-intensity exercise because this ensures that all carbs are produced in the mitochondria to produce ATP. Oxygen is required by mitochondria for the metabolism of carbohydrates, proteins and lipids.[7,8]

A valid and practical exercise test is necessary to evaluate exercise potential, recognize indicating signs and indicators of lack in exercise tolerance, and prescribe optimal or cautious exercise regimens in a societal environment when creating a fitness regimen program for patients with an amputation. Determining a person's ability to exercise after losing a lower limb has proven difficult.[9]

## Aim

To investigate the effect of aerobic training with strengthening exercise on endurance in patients with below knee amputation.

## Material and Method

The study was conducted as a Quasi Experimental study. The sample was collected at Kirubai Physio & Rehabilitation Centre. Depending on the inclusion and exclusion criteria a total of 30 subjects were selected and after describing the selection process. The safety and simplicity of the study was also explained. Materials used in this study were chair, stop watch, 30m walkway, pulse oximeter, two cones.

**Study period:** from November 2022 to March 2023.

**Inclusion Criteria**

- Below knee amputated patients
- Controlled medical conditions.
- Below the age of 55
- Patients using prostheses for 6 months.

**Exclusion Criteria**

- Those who use assistive devices.
- Recent illness or hospitalized.
- Patient who are mentally unstable
- Patient with heart conditions.

**Outcome Measures**

Assessment was performed before and after four weeks of intervention. The 6-Minute Walk Test evaluates both aerobic capacity and endurance. The distance traveled over a 6-minute period is the metric used to compare shifts in performance capability. The goal of this test is to cover as much ground as you can in six minutes by walking as swiftly as you can. Participants can go at their own pace and take breaks as often as they choose. Borg rating of perceived exertion (RPE) is a scale used to determine the recommended exercise intensity. In cardiac patients as well as other patient populations undertaking rehabilitation and endurance training, it is utilized to assess exercise progress and mode. The aim of this test is to find out the breathlessness rate after the patient has completed the 6-minute walk test.

**Procedure**

The subjects of age group between 18 to 55 years of both genders with below knee amputation. Pre-test values were recorded using the outcome measure 6MWT and Borg scale. The subjects were prescribed treatment for a period of four weeks with 4 to 5 sessions per week. Following the training session, the post-test values were again recorded using the same outcome measures and the significant differences were noted.

**Study Procedure:** from October 2022 to July 2023

**1. Hamstring Strengthening**

- Subjects were asked to lie in prone position
- Raise their prosthetic leg
- Hold for 10 seconds
- Repetitions were gradually improved from 5-8 times and 3 sets

**2. Quadriceps Strengthening**

- Subjects were asked to sit with the elbow supporting their back in supine position.
- With the other knee slightly flexed subject is asked to raise their prosthetic leg
- Hold for 10 seconds.
- Repetitions were gradually improved from 5-8 times and 3 sets.

**3. Abductor Strengthening**

- Subjects were asked to lie on normal side
- Raise the prosthetic leg
- Hold for 10 seconds
- Repetitions were gradually improved from 5-8 times and 3 sets.

**4. Adductor Strengthening**

- Subjects were asked to lie on prosthetic side with normal leg placed in front of it
- And head supported by hand
- Raise the prosthetic leg
- Hold for 10 seconds
- Repetitions were gradually improved from 5-8 times and 3 sets

**5. Squats**

- Subjects were asked to stand tall with feet shoulder-width apart and toes pointing outwards and keep the prosthetic foot flat on the floor.
- They are asked to maintain an upright posture
- Start squatting by bending their hips and knees simultaneously.
- Lower their body until their thighs are parallel to the floor
- Hold for 10 seconds and they are asked to maintain balance.
- Support the patient on the wall and ask them to perform squats to improve sitting.

**Aerobic Exercise**

**Walking**

After completing strengthening exercise, the subjects were asked to walk for 8 to 10 minutes. It was gradually increased according to the subject. If they feel any discomfort, they are asked to sit on a chair and take rest at any time.

**Data Analysis**

Descriptive and inferential statistics were used to analyze the study's data. Standard deviation (SD) and mean were applied to all parameters. The significant variations in outcome measure were examined using a paired t-test.

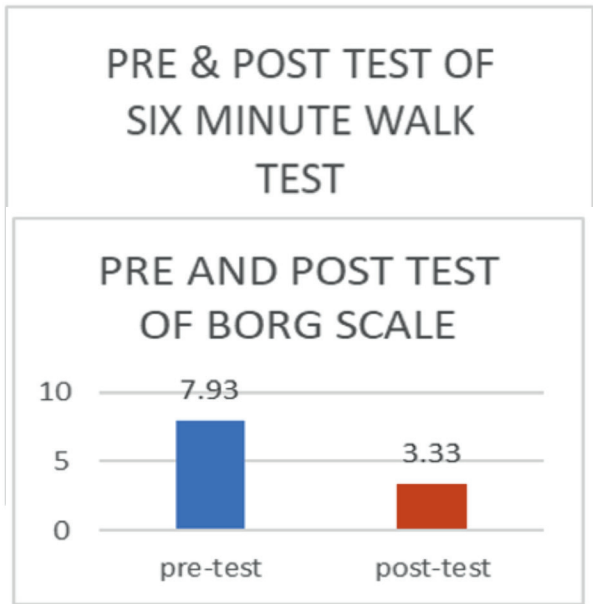


**Fig-2 Pre & Post Test of Borg scale**

## Result

As needed descriptively, statistics, mean and SD were calculated. All the p values were considered as statistically significant using paired t-test.Subjects of 30 members with below knee amputation were assessed for pre and post-test using 6MWT and Borg scale. Fig 1 represents the comparison of the pre-tests and post -tests values of aerobic training with strengthening exercise using a 6-minute walk test. The mean value of the pre-test is 316.97 and the post-test is 336.6. Fig 2 represents the comparison of the pre-tests and post -tests values of aerobic training with strengthening exercise using Borg Scale. The mean value of pre-test is 7.93 and post-test is 3.33. As a result of statistical analysis, the values show that Aerobic training with strengthening exercise is effective in subjects with below knee amputation.

## Discussion

The study was directed to show the efficacy of strengthening exercise with aerobic training to improve endurance in subjects with below knee amputation. An ankle joint, the distal tibia and fibula, as well as any related soft tissue components, are removed during a below-knee amputation (BKA), which is a transtibial amputation.[6] In more than 50% of instances, ischemia of the lower limbs, any peripheral artery disorders, and diabetes are thought to be the primary causes of amputation. The second most common reason for lower-extremity amputations is trauma.[2] Therefore, focusing on exercise is an important way to improve health status. I.Moirenfeld (2000) in his study concluded that Long-term transtibial (TT) amputees frequently have muscle wasting of the thigh muscles in the limb that is amputated. Proprioceptive feedback is lost after TT amputation, primarily from the articular surfaces of the ankle and associated musculature.[5]K H Pitetti (1987) et al, conducted study and concluded that aerobic conditioning has been found to boost walking efficiency in those who had lower limb amputations, as well as cardiovascular fitness.[10] Lin S-J, BOSE (2007) demonstrates that the 6MWT, which involves a moderate degree of exercise intensity and has some correlation to postural control skills in individuals with transtibial amputation, might be used as a reliable predictor of functional ability.[1] According to Darter BJ study domestic treadmill walking is an efficient technique to enhance gait performance in people with transfemoral amputation, according to research on the use of treadmill training to help people with chronic amputations of the femur.[9] Aerobic exercise and endurance: enhancing fitness for health advantages, according to Wilmore JH TFA found that patients who are active as children will be active as adults and will lessen the natural losses of strength, endurance, and flexibility that come with aging and sedentary lifestyles, maintaining independence throughout life.[3] According to Wezenberg D study on Relation between $VO_{2max}$ and ambulation in older adults with a lower-limb amputation, concluded that especially in people with a vascular amputation, the $VO_{2max}$ is an important determinant for ambulation. The information offers quantitative forecasts on how aerobic exercise will affect health.[11] Enright PL (1998) in his study concluded that High correlations between workloads, heart rate, and SaO2 as well as the dyspnea responses when compared to treadmill and bicycle ergometry exercise tests have proven the validity of the 6-min walk test. In addition to aerobic training, strengthening exercise has beneficial effects on below knee amputation.[12] With the conclusion of all the above-mentioned studies, we designed a protocol involving strengthening exercise along with aerobic training for the patients with below knee amputation to improve endurance and muscle strength. With this attempt, the pre- and post-tests measures were analyzed and tabulated in the result column. Thus, the results could be that strengthening exercise combined with aerobic training is effective in improving endurance and muscle strength in patients with below knee amputation. The patients who use assistive devices were not included in the recruitment of participants, which was the best way to enhance sample size. Future studies may concentrate on the long-term impact of these interventions, as this study only did a four-week follow-up. However, the six-minute walk test score and Borg score indicated a substantial change. A statistically significant difference is seen in statistical analysis of quantitative data of pre and post-test values of 6-minute walk test and Borg scale. The mean value of 316.97in the pre-test and 336.6 in the post-test by using a 6-minute walk test and 7.93 in pretest and 3.33 in post-test

by using Borg scale. The present study concluded that strengthening exercise combined with aerobic training were effective for below knee amputees.

## Conclusion

The aim of the study was to estimate the effectiveness of aerobic training with strengthening exercise in subjects with below knee amputation. From the collected data it has been proved that aerobic training is effective and increases endurance in subjects with below knee amputation.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/077/2022/ISRB/SR/SCPT).

**Funding:** This study is a self-funded study.

**Conflict of interest:** The authors state that there is no conflict of interest**.**

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Original Article

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# A Study of Effectiveness of Calf Stretching in Managing Catastrophizing Pain in Plantar Fasciitis

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**Abstract**

**Background:** Calcaneus distress is a frequent moan in the trotter and talus , and plantar fasciosis , which accounts for 11–15% of adult patients' symptoms of the foot need medical attention. One in ten people are predicted to get PF at some point in their lives. It is further prevalent in mid-life fat women and adolescent athletes. The desire of this project is to evaluate the success of calf stretching by theraband among plantar fasciitis patients.

**Purpose:** To determine the effects of calf stretching using theraband on managing pain among plantar fasciitis patients

**Materials and Methods:** Fifty eight people were covered for addition and prohibition. They were splitted into two groups: passive calf stretching group (29) and self-calf stretching group (29). The pre and post-test values were measured by pain catastrophizing scale. Group-A received passive calf stretching using theraband and group-B received self-calf stretching. Both programs were given for 2 weeks, weekly 5 days.

**Result:** Using pain catastrophizing scale, Group A's (Passive calf stretching group) post-test mean was 27.38 and whereas group B's (Self calf stretching) was 32.24. This demonstrates that group-A has decreased pain catastrophizing score less than group-B. And this suggests that group A showed considerably finer than group B.

**Conclusion:** Passive calf stretching using theraband by group-A was found to be more effective than self-calf stretching of group-B..

**Keywords:** Plantar fasciitis, calf stretching, theraband

## Introduction

The beginning of the plantar aponeurosis the near midline of heel bone nodule , as well as the nearby connective tissues, become inflamed due to degenerative processes, resulting in plantar fasciitis. The fascia itself plays a crucial role in cushioning shock and supporting the arch. Although the diagnosis includes illness, it is distinguished by the absence of inflammatory cells. Patients with this illness frequently have tight soleus, gastrocnemius, and/or related posterior leg muscles.[1] Bursitis is a frequent charge in the base and talus , which accounts for 11–15% of adult patients' symptoms of the foot requiring medical attention, is the habitual of adult patients' stubborn pain beneath the heel.[2] One in ten

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persons are predicted to get PF at some point in their lives. The frequency of PF is higher in the athletic population, while not all cases necessitate medical attention. It is additionally prevalent in adulthood aged obese females and adulthood sports person.[3] Expanded quetelet index (BMI) and jogger heal in lack of sports activity in people have a substantial correlation, according to the literature. According to the data, height and PF are unrelated, in contrast to weight. Additionally, increasing heaviness is linked to PF, rarely with shorter stature. The main risk of plantar fasciitis are females who are pregnant or obese or both in the middle of the age of 40 and 70 have extremely elevated arches or flat feet possess tense. Rarely does further research need to be done after a clinical diagnosis of PF.[4] The subjects tells of discomfort in the side of the 1st metatarsal bone, which is obvious with the first steps after some time period of inactivity and normally gets better when the subjects increases their level of work along the day, but tends to get worse as the day goes on. Following extended weight bearing, symptoms may worsen; this is frequently brought on by an increase in weight-bearing activities. Paresthesia is rather rare. While PF often presents unilaterally, up to 30% of patients do so bilaterally MRI may be utilized in suspect cases that don't respond to traditional therapy or added possible etiology of jogger heal, including tibial nerve dysfunction, cartilages and bone cancer, infection of the bone and fractures due to stress are suspected. [5] Upon ultrasound examination, the plantar fascia frequently exhibits calcifications, intra substance rips, thickness, and heterogeneity. These alterations, which are frequently seen by ultrasonography, point to a non- inflammatory state and an uncooperative vascular. It is thought that the ailment first manifests as micro tears brought on by the repetitive tension of weight bearing and upright posture. Chronic fascia degradation from the plantar fascia's continuous stretching eventually causes pain while sleeping or at rest.[6,7] The biggest risk factor in non-athletes, according to one study, is decreased ankle dorsiflexion.[8] As a result of the foot over pronating due to limited ankle dorsiflexion, which can lead to an overuse injury.[9] The propensity to overestimate the warning worth of torture signal and to powerlessness in the presence of pain are characteristics of severe catastrophizing. It is also identified by a relative incapacity to stop or suffer-connected feeling in advance of, throughout, instead preposition after a discomfort occurrence.[10] In individuals with PF, a stretching exercise programmed at home proved successful in lowering pain and improving the strength of the external and internal foot muscles.[11] Exercises to stretch gastrocnemius, soleus, and fascia that were part of the programmes. Each exercise took in the middle of twenty -thirty seconds to complete, with a ten- second break in the middle of each set of stretching. Over the course of three weeks, they invested a total of about twenty minutes in the exercise, working out five days a week. So, the research was to find the effectiveness of calf stretching in plantar fasciitis patients through a pain catastrophizing scale.

## Material and Method

This was an experimental study done with 58 subjects with plantar fasciitis, aged between 25-60 years of both genders from a private clinic from Chennai. Samples were conveniently selected and allocated into two groups.

Study period: December 2022 to June 2023

**Inclusion Criteria**

- BMI-25 to 35
- Patients of both genders between the ages of 25 and 60 were enrolled.
- Windlass test positive

**Exclusion Criteria**

- Foot ulcer
- Recent ankle surgery
- Fracture of ankle joint

**Material Used**

- Theraband

**Outcome Measures**

Assessment was done at initial and at the end of the study using

The pain catastrophizing scale: Was created to assist a person's agony event by query regarding their feeling with thoughts during time of pain .This questionnaire is distinct from other methods of measuring pain related thoughts in the subjects but

not required to be in pain while completing it. On a scale of 0 (not at all ) to 4(always), participants are asked to rate how often they have the aforementioned thoughts and emotion when they are in pain Three subscales scores measuring cogitation, exaggeration, weakness and bearing. with a total score(range from 0-52).[12]

**Procedure**

Fifty eight subjects diagnosed with plantar fasciitis by windlass test were screened for inclusion and exclusion criteria and selected from sri jhanani clinic and goodness physiotherapy clinic. All participants are requested to indicate their conscious consent form. The instructions were given to the participants clearly. The subjects were splitted into two groups (Group-A- 29, Group-B- 29). The pre and post-test values were measured by pain catastrophizing scale. Group-A received passive calf stretching using theraband whereas Group-B did Self calf stretching.

Passive calf stretching group: Legs straightened, sit on the mat or other solid surface. While holding the theraband, keep your arms at your sides and relax. As the therapist, make sure you have a firm hold on the theraband and that it is tightly wrapped over the heel of your foot. Maintain a straight back and proper posture when you sit up tall. The therapist will slowly pull the theraband in the direction of flexing your ankle joint upward. The band will feel the tension as a result. Pull on the rope until your calf muscle stretches comfortably. Use caution. Feel the strain in the muscle of your calf as you maintain the position for fifteen to thirty seconds. Return to the beginning position gradually while loosening the band on your Thera band and relaxing your ankle. A minimum of three to five repetitions on each foot should be enough to complete the stretch. Self stretching group: Locate a wall or other reliable vertical surface to lean on. Make sure all obstructions are removed. Place your arms at roughly arm's length from the wall as you face it. Maintain a hip-width distance in the middle of your feet, using one of your feet little in place of the other. Keep your arms straight and place both hands at shoulder height on the wall. Your front foot should remain firmly on the ground as you advance. The heel of your back foot needs to be firmly placed on the ground. Lean forward gradually, allowing your weight to transfer in the direction of the wall. The calf muscle in your back and the leg should feel stretched. Avoid rounding your shoulders and maintain a straight back. To manage the stretch's severity, keep your front knee slightly bent. Focus on deep breathing while holding the stretches for in the middle of 20 and 30 seconds, letting the muscle relax. Step back and swap legs, then carry out the exercise again on the other side after the allotted amount of time. A minimum of three to five repetitions on each foot should be enough to complete the stretch. Total duration of therapy was 10 sessions, 5 sessions each week for 2 weeks.

**Data Analysis**

Statistical analysis was done to evaluate the effects of calf stretching among plantar fasciitis patients. Pre and post result values for pain catastrophizing scale were noted and paired, unpaired t test was conducted. The pre-test mean value of pain catastrophizing scale in passive calf stretching group and self calf stretching group are 37.52 and 35.76 and with p value of <0.0001

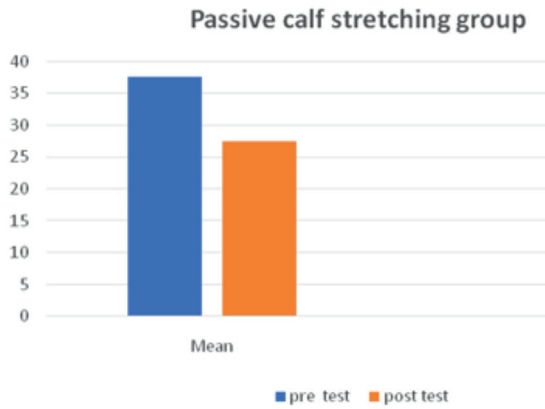



**Fig-1 Pre and posttest analysis of passive calf stretching**

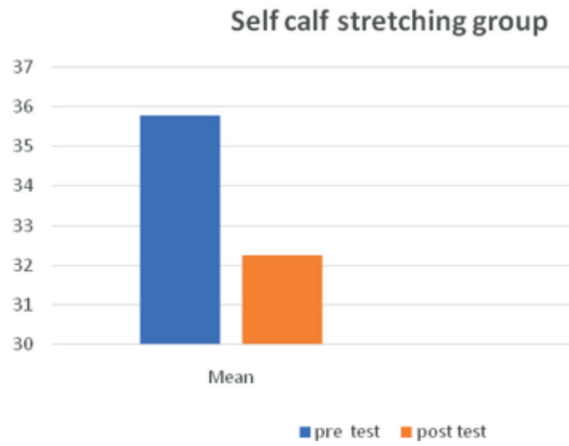



**Fig-2 Pre and post test analysis of self calf stretching**

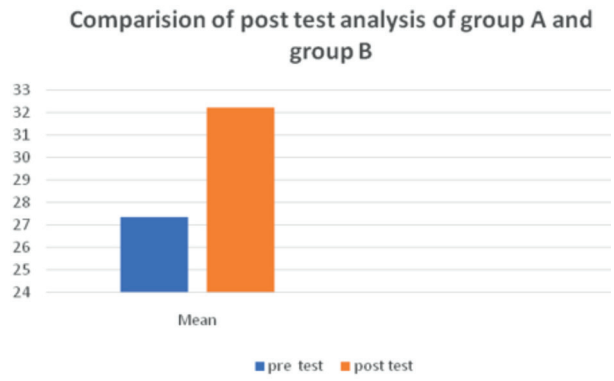



**Fig-3 Comparing post test analysis of group-A and group-B**

## Result

All 58 subjects completed the study successfully pre-test and post-test values of passive calf stretching group and self stretching group The statistical analysis of quantitative data of the passive calf stretching groups and self calf stretching groups, as well as within the groups, showed a statistically significant variation.

The statistical analysis of pre and post test of passive calf stretching group by using pain catastrophizing scale, pre- and post-test values of mean 37.52 and 27.38 , SD value of 2.77 and 1.86 , P <0.0001 were statistically significant.

The statistical analysis of pre and post test of self calf stretching group by using pain catastrophizing scale, pre- and post-test values of mean 37.76 and 32.24 SD values of 2.67 and 2.40 and P <0.0001 were statistically significant. The statistical difference in middle of the passive calf stretching and self calf stretching subjects was evaluated by post values of pain catastrophizing scale and comparison of post test of passive calf stretching and self calf stretching test of mean 27.38 and 32.24 and ; SD value of 1.86 and 2.40 and P value is <0.0001. These values were considered to be extremely statistically significant. These differences indicated that the subjects received passive stretching, was highly effective in reducing plantar fasciitis.

## Discussion

The dense connective tissue on the foot, which attaches your tarsal bone to your digit, becomes inflamed while you have fasciitis. Heel awkwardness from plantar fasciitis can be excruciating. One of the frequent sources of calcaneal discomfort is plantar aponeurosis. The condition known as jogger heal is thought to be the reason for 1 million health care visits annually. About 10% of injuries suffered by runners are caused by plantar fasciitis, which also accounts for 11–15% of foot problems that need medical notice. It is estimated that 10% of the wider population also has it. A statistically significant difference in the middle of groups A and B as well as with each group was found by statistical analysis of quantitative data. Using a pain catastrophizing scale, group A's (Passive calf stretching group) post-test mean was 27.38 whereas group B's (Self stretching) was 32.24. This demonstrates that group-A has decreased pain catastrophizing score less than group-B. This suggests that group-A performed considerably better than group B. This strongly suggests that passive calf stretching is effective in decreasing suffering and thus improves function in plantar fasciitis subjects Cole C,et al., (2005) in his research concluded that ample research has not been done on the majority of interventions used to treat plantar fasciitis, however footwear inserts and lengthen exercises, nontropics injections, and specially constructed ankle foot orthosis may be helpful.[2] Fabrikant JM, et al., 2011 june in his research concluded that investigation, it was discovered that therapeutic treatment using injection and biomechanical adjustment does actually reduce the thickness of the plantar aponeurosis as seen on ultrasonography.[5] In 2018, Sep, Ling Y, et al., concluded that when it came to lowering pain and enhancing operation in those suffering from plantar fasciitis, platelet rich plasma was just as successful as alternative treatments. According to subgroup analysis, PRP had a better impact on AOFAS Score than steroids did, and this impact lasted for a considerable amount of time. More extensive RCTs are necessary to support the present findings, though, given the inherent flaws in this study.[6] A quetelet Index and plantar fasciopathy are consistently connected clinically, according to our research. In the middle of subgroups of athletes and non-athletes, this correlation may be different. The orthodoxy concerning clinical and mechanical evaluations of the ankle and foot function is not supported by consistent evidence, despite a variety of soft tissue and bone

problems being supported by such evidence. In a collaborative decision-making process, therapists can use this knowledge.[9]

## Conclusion

This finding led to the conclusion that passive calf stretching using theraband training was found to be more successful than self calf stretching in lessen suffering and restoring mission and well being in long-suffering case also managing catastrophizing pain in plantar fasciitis subjects

**Ethical clearance:** Taken from the institutional ethical committee.ISRB number 03/078/2022/ISRB/SR/SCPT

**Funding:** This study is a self- funded study.

**Conflict of interest:** No conflict of interest during this research.

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Original Article

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# Comparing the Effects of Maitland Mobilization Technique Versus Exercise with Therapeutic Ultrasound in Adhesive Capsulitis

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**Abstract**

**Background:** Adhesive capsulitis is an inflammatory condition that causes discomfort and stiffness in the shoulder which has a prevalence of 2% to 5%. Hence this research work is done to check the efficacy of Maitland mobilization technique versus Exercise with therapeutic ultrasound in adhesive capsulitis.

**Purpose:** To find out the effects of Maitland mobilization technique & exercise with therapeutic ultrasound in adhesive capsulitis.

**Materials and Methods:** Total of 28 participants were selected from Vijay physiotherapy clinic and divided into two groups. Group A was allocated with 14 participants and managed with Maitland mobilization technique and ultrasound. Group B 14 participants were managed with exercises and ultrasound for 4 weeks. The participant's intervention effects were assessed using VAS, SPADI Scale and Range of motion Study Period: November 2022 to July 2023.

**Result:** This study results showed a significant (p value 0.0001) reduction in pain and improvement in shoulder disability values and ROM of adhesive capsulitis participants in group A (Maitland mobilization technique and Ultrasound) compared with group B (Exercise and Ultrasound).

**Conclusion:** This study found that the Maitland Mobilization technique as well as Exercise both seems to be effective in treating adhesive capsulitis. But the patients in Maitland Group show greater improvement than the exercise group.

**Key Words:** Adhesive capsulitis, Mobilization, Maitland, Ultrasound.

## Introduction

Adhesive capsulitis, often known as frozen shoulder, is an inflammatory condition that produces pain and stiffness in the shoulder.[1] Patients between the ages of 40 and 60 are most frequently affected by adhesive capsulitis, which has a prevalence of 2% to 5%. The majority of affected patients are postmenopausal women for unclear causes. Diabetes, hypothyroidism, hyperthyroidism, hypoadrenalism, and any other hormonal imbalances are examples of systemic risk factors.[2] Adhesive capsulitis

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comes in two varieties: primary and secondary. Primary idiopathic adhesive capsulitis may be the first symptom of Diabetes mellitus. Secondary conditions can occur as a result of shoulder injuries or immobilization. Frequently, frozen shoulder develops in three stages: the painful freezing, sticky freezing, and melting phase.[3] There are several linked factors for adhesive capsulitis, despite the fact that its aetiology is unknown.[4] Clinically, the treatment for adhesive capsulitis involves joint mobilization, such as the oscillatory techniques of Maitland and the sustained stretch technique.[5] It has been advised to passively extend the shoulder capsule and tight soft tissues using mobilization techniques in order to restore their normal extensibility.[6] The three types of mobilization that Maitland, Kaltenborn, and Mulligan advise are mobilization with movement (MWM), end-range mobilization (ERM), and mid-range mobilization (MRM). [7] The traditional approaches to treating adhesive capsulitis focus on reducing discomfort, preserving range of motion, and ultimately regaining function.[8] An effective treatment for adhesive capsulitis is joint mobilization. Although Maitland Mobilization and Exercise have received substantial support in the literature and in research studies, none of them have demonstrated one method is more successful than the other for treating adhesive capsulitis.[9] Pain and stiffness in the shoulder are treated by Maitland Mobilization using a passive oscillatory approach, which is graded from Grade I to IV according to intensity. Grade I describes a modest amplitude intensity that is supplied at the beginning of the joint's range of motion (ROM), when there is no stress on connective tissue, when there is significant discomfort. While Grade II describes an intensity that is provided from the start of the joint ROM to the midway with a somewhat larger amplitude. Grade III is applied with a significant amplitude between the midpoint of the joint's range of motion and the beginning of the limitation. Finally, Grade IV is administered to the confined area of the joint while resisting the tissue resistance at a small amplitude. By applying in a shorter tissue, oscillation stimuli of grades III and IV are employed to cause a stretching to reduce joint stiffness.[10] The primary goals of the majority of exercise programs are to lessen discomfort and enhance the gleno-humeral range of motion (ROM) that has been decreased due to capsular contracture.[11] In addition to manual therapy techniques conventional exercises can also be given to get effective results. Exercises that can be performed include the Codman's and Pendulum exercises as well as isometric scapular retractions, rotator cuff workouts, wall crawling exercises, and active aided range of motion exercises.[12] One of the most popular ways for ACS patients to relax their muscles is through thermotherapy since heat increases tissue temperature and local blood flow, which reduces stiffness in the muscles and joints. [13] Modalities are tangible tools utilized to achieve the intended therapeutic outcome.[14] Particularly, it is known that ultrasonic therapy (UST), which is frequently used to treat ACS, causes molecular vibrations that aid in the breakdown of the capsule's thick collagenous components.[15] When ultrasonic energy travels through tissue or another attenuating medium, the wave's amplitude diminishes over time.[16]

## Aim

To find out the effects of Maitland mobilization technique & exercise with therapeutic ultrasound in adhesive capsulitis.

## Material and Method

Based on inclusion and exclusion criteria, 28 patients with a confirmed diagnosis of adhesive capsulitis were chosen from Vijay Physiotherapy Clinic for the research. By using the convenient sampling approach, they were separated into two equal groups, each of which had 14 patients. Before group division, the patients were given a thorough explanation of the treatments and evaluation process and given the opportunity to provide their agreement. Study Period:November 2022 to July 2023.

**Inclusion Criteria**

- An X-ray or MRI that shows an adhesive capsulitis diagnosis.
- Capsular pattern restriction of active and passive ROM
- A minimum of one month of shoulder soreness.
- Pain prevents you from sleeping on the affected side.

**Exclusion Criteria**

- People who have had shoulder surgery in the past
- Serious shoulder damage within six months.
- Shoulder arthritis or previous dislocations.
- Patients who may have rotator cuff tears.

**Outcome Measures**

- The Shoulder Pain and Disability Index (SPADI)
- The VAS (Visual Analogue Scale)
- Shoulder Range of Motion.

**Procedure**

**Group A:** Maitland Mobilization Technique with ultrasound.

The therapist was standing, holding the proximal end of the humerus, maintaining a lateral humeral distraction in the center of its range, while the patient was lying face up with their arm bent at a 30-degree angle. Anteroposterior, poster anterior glide mobilization was done five times, each time for 30 seconds, at a speed of 2-3 glides per second. This was done in five sets of five. The approach was used for four weeks (12 sessions), three times each week.

**Group B:** Exercise with ultrasound

The patients in this group were given the following exercise, pendulum or Codman's exercise, isometric scapular retraction, active and passive range of motion, wall creeping exercise. All of these were given for 4 weeks.

**Codman's Pendulum Exercise:**

- Bent over front waist using good arm for support on a table
- Let sore arm hang loosely
- Shift weight from front leg to back leg so arm wiggles simply
- Move the arm side to side and front and back. Given for 3 minutes 5 times per day.

**Finger Ladder Exercise:**

- Patient facing a ladder that is suspended over a wall.
- The injured hands should be placed over the ladder at a low level, the patients requested.
- Once at the top, the finger ladder will gently descend back to the bottom, where it will then slowly ascend again.

**Isometric Scapular Retraction:**

- Make the patient to sit comfortable in the chair with their elbow rests on their thigh
- Ask the patient to sit erect with spine straight and ask to retract the shoulder
- Ask then to hold it for 15 secs and continues for 5 sets 10 repetition

**Wall Creeping Exercise:**

- Without flexing the elbow, place your hand against the wall.
- Try to lift your arm as high as you can while slowly nipping your fingers up against the wall.
- Hold the arm in the maximum position for a few seconds before lowering it gradually.

Ultrasound was administered to both groups of patients in an effort to treat their discomfort. The patient was properly positioned for therapeutic ultrasound treatment with parametric settings of 1 MHz frequency. 10 minutes of treatment time in continuous mode with a transducer of 5 cm2 and 1.5 W/cm2 of intensity. Ultrasound was administered by rotating the treatment head slowly, circularly, and overlapping over the anterior, superior, and posterior portions of the shoulder after covering the coupling media (aqua sonic gel) in the transducer.

**Data Analysis**

Using descriptive and inferential statistics, the acquired data was tabulated and evaluated.

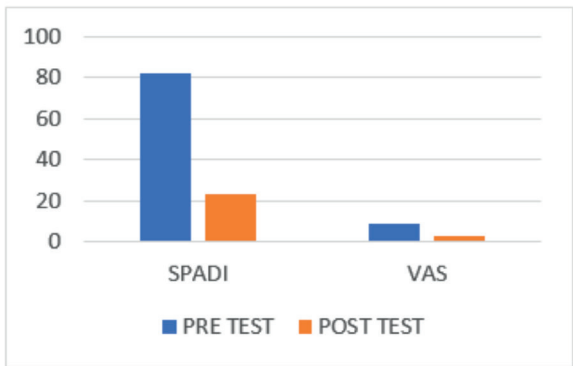



**Fig-1 Group A-Pre and Post test values of SPADI and VAS**

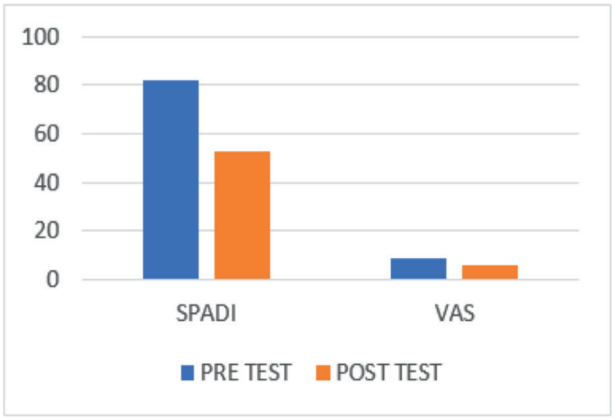



**Fig-2 Group B-Pre and Post test values of SPADI and VAS.**

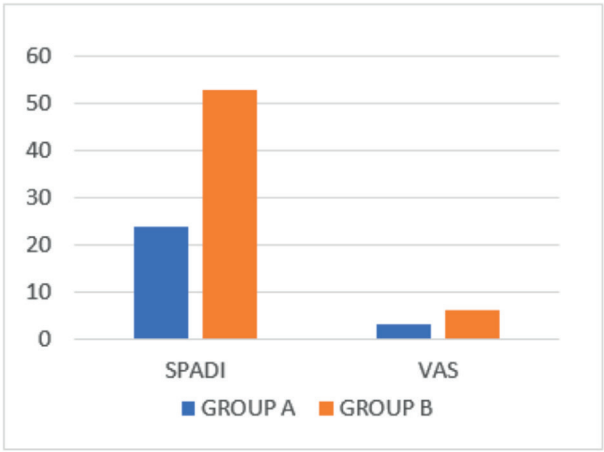



**Fig-3 Mean values of Group A & B for SPADI**

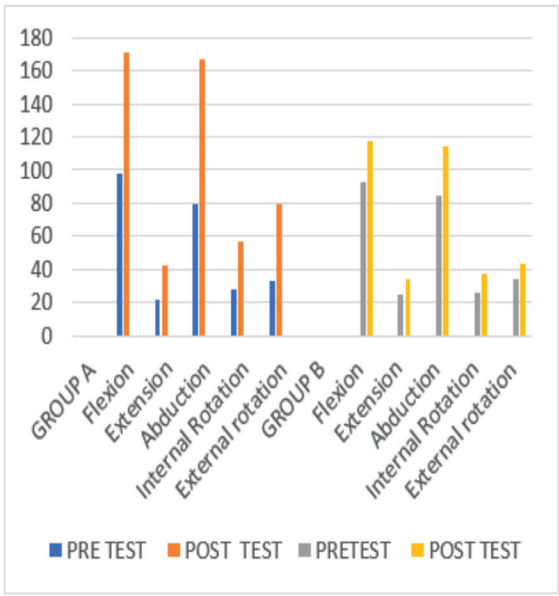



**Fig-4 Pre and Post test values of Range of Motion of Group A & B.**

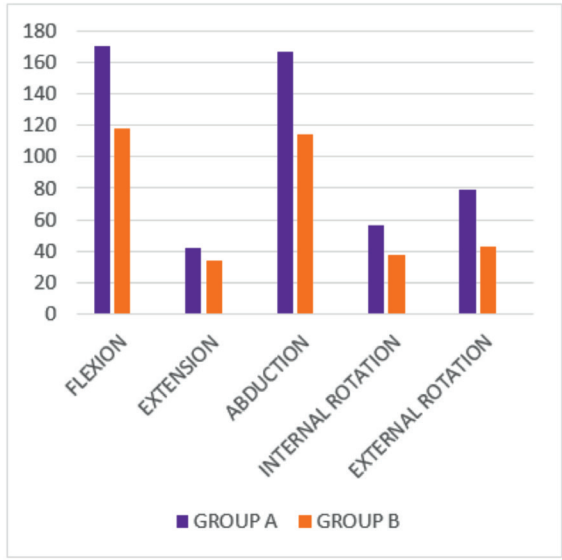



**Fig-5 Mean values of Range of Motion for Group A & B.**

## Result

Two equal groups of 14 and 14 patients each were formed from a total of 28 patients. The difference between the SPADI pretest and posttest scores in Groups A and B is statistically significant. The average improvement was 22.943 in Group A and 52.900 in Group B. In terms of SPADI scores, both groups have shown statistically significant improvement. The difference between the two groups in the post-treatment reading at the conclusion of the fourth week was determined to be statistically significant, with Group A demonstrating more improvement than Group B. The difference between the pretest and posttest values for the pain score is statistically significant for both groups, i.e. Group A and Group B. The average improvement was 3.21 in Group A and 6.00 in Group B. The improvement in Pain ratings was statistically significant for both groups. A statistically significant difference between the two groups was detected in the post-treatment reading at the conclusion of the fourth week, and Group A demonstrated greater progress than Group B, much like SPADI.

Furthermore, the range of motion in the shoulder varies. Flexion (170.36), Extension (42.14), Abduction (166.43), Internal Rotation (56.79), and External Rotation (78.93) are the movements with the highest mean values in Group A. In contrast, the average

values for Group B are as follows: Flexion = 117.86, Extension = 33.93, Abduction = 114.64, Internal rotation = 37.50, and External rotation = 43.21. There was evidence of statistical significance for both Group A and Group B's mean improvement. This study therefore concludes that Group A has improved more than Group B in terms of pain, disability, and range of motion.

## Discussion

The study's goal is to ascertain if the Maitland mobilization technique and exercise with ultrasound treatment are effective at promoting range of motion and reducing pain in adhesive capsulitis. Both groups had statistically significant results, but the Maitland group outperformed the exercise group, according to the study's findings. Based on the outcomes measured by VAS, SPADI, and ROM, the findings were drawn. In 2018 Dr. Abdullah Al Shehri, conducted study between Maitland Mobilization technique and Ultrasound therapy in adhesive

capsulitis condition, concluded that Maitland's group demonstrated greater progress than the Ultrasound group. The results demonstrated that both interventions produced beneficial results, but when comparing the interventions' most beneficial results, the Maitland approach implemented an impressive rate of recovery in regaining pain-free range of motion in comparison to ultrasound and is successful in treating frozen shoulder.[6]

Gui Do Moon, MSc, PT, et.al, in 2015 For FS patients' discomfort or ROM improvement, the MM and KM groups did not significantly vary from one another ($p > 0.05$). This study shows less evidence regarding the range of motion. They have explained only about the Internal and External rotation. Study for all the motion has to be done. In our study Range of motion difference between the groups ah clearly explained with the statistical reference which shows that Maitland mobilization technique shows greater effects in all motion than that of Exercises.[10]

In the latest study conducted by Krupa M. Soni,et.al, in 2021 the research study indicated that women were more actively involved than men. The study suggests that tightness in distinct capsular segments may be restricting motion in more than one plane at once. A larger sample size and other outcome measures can be used for the same research. Thus the study discovered five distinct patterns of restriction as opposed to a single pattern of capsular restriction. Measured by passively performing ROM using goniometer.[17]

SY Lee et.al in 2015 suggested that A reduction in shoulder range of motion, notably in the abduction and external rotation directions, was significantly correlated with glenohumeral joint capsular stiffness, even though there were no relevant correlations with shoulder pain while performing or at rest. In the current study, between shoulder ROM limits and in vivo assessed capsular stiffness are for the first time made public. The correlations between shoulder ROM limits as indicated by the goniometer in the ACS and the quantitatively calculated in vivo Kcap have never been examined before, but they are in this work.[18]

## Conclusion

This study found that the Maitland Mobilization technique as well as Exercise both seem to be effective in treating adhesive capsulitis. But the patients in Maitland Group show greater improvement than the exercise group. Hence this study concluded that the Maitland mobilization Technique found to be effective when compared with exercise in improving Range of motion and reducing shoulder pain and disability of shoulder in Adhesive Capsulitis.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, and institutional regulations. (Application Number-03/079/2022/ISRB/SR/SCPT).

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Comparing the Effectiveness of Scapula Stabilization Exercise Versus Scapula Stability Taping on Shoulder Impingement Pain

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**Abstract**

**Background:** Shoulder impingement pain is caused by the compression of the rotator cuff and the subacromial bursa. Reduced scapular stability was found to cause shoulder impingement. So, the purpose of the study was to identify whether scapula stability taping vs. scapular stabilization exercise is more effective in the treatment of shoulder impingement pain.

**Purpose:** To compare the effectiveness of scapula stabilization exercise versus scapula stability taping on shoulder impingement pain.

**Methods:** This experimental study has been conducted from November 2022 to April 2023. 58 subjects were divided into Group A (29 Subjects) and Group B (29 Subjects). Group A was treated with shoulder stabilization exercises, and Group B was treated with shoulder stability taping. The treatments were given for 4 days per week and continued for 4 weeks.

**Result:** The results showed that the subject's pain, shoulder ROM, and disability improved statistically stabilization exercise Group than stability taping Group.

**Conclusion:** Findings conclude that 4 weeks of scapular stabilization exercises were found to be more effective in increasing scapular muscle strength in preventing shoulder impingement.

**Key Words:** Shoulder Impingement Pain, Scapular Stabilization Exercise, Scapula Stability Taping, VAS, Neer's test, Goniometer, SPADI.

## Introduction

The shoulder joint, also known as glenohumeral joint, has a wide range of motion in the ball and socket joints of the human body. The scapula, which is where all the muscles come together at the shoulder, is the main bone structure.[1] The primary muscle group in charge of sustaining the shoulder joint is the rotator cuff muscles. Rotator cuff problems, adhesive capsulitis, shoulder instability, and shoulder arthritis are common ailments that can cause chronic shoulder discomfort.[2-3] One of the most prevalent causes of shoulder discomfort is impingement of the shoulder syndrome, which is characterized by irritation of the rotator cuff muscles and the subacromial bursa. In as many as 65% of cases,

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shoulder impingement syndrome may be blamed for the pain in the shoulder.[4] While impingement and rotator cuff illness are more prevalent in players whose sports entail repetitive overhead movements, rotator cuff tears are more prevalent in the early population. According to Neer, athletes experience impingement syndrome and rotator cuff disease at an earlier age than people in the general population.[5] In patients with impingement of the shoulder syndrome, the benefits of scapular stability exercises right after surgery on pain and function.[6] Weakness of the scapula stabilizer and ensuring changes in biomechanics might lead to aberrant stresses being placed on the anterior shoulder structure, an increased risk of the rotator cuff compression, and impaired performance. To evaluate the impact of scapula training on reducing signs of impingement and stability as our capacity to measure the strength of these muscles advances exercise for strengthening the scapula are often not taxing on the rotator cuff and are simple to incorporate into a shoulder treatment regimen.[7] Taping is frequently utilized in therapies as an extrinsic feedback mechanism to enhance muscle pattern, postures,and muscular activation.[8] One frequent complementary therapy for shoulder impingement disease is scapula taping.[9] The elastic tape may extend up to 130 to 140 percent of its static resting length, guaranteeing that the attached muscle and joint can move freely it include reducing pain stimulating the nervous system, restoring proper muscular function by strengthening weak muscles, removing lymphatic fluid buildup or hemorrhages beneath the skin, and adjusting joint misalignment by stimulating the nervous system, lowering spasms of the muscles. Kinesiotaping may be an alternate therapeutic choice for shoulder impingement syndrome.[10]

## Aim

To compare the effectiveness of scapula stabilization exercise versus scapula stability taping on shoulder impingement pain.

## Material and Method

This research is an experimental study. The study was conducted with a sample size of 58 participants between the age group of 17-32 years. Randomized technique is used in this study. The participants were selected from SCPT (SMCH Hospital) and Illam's Physio Centre, according to selection criteria. Participants received an overview of the method, and a formal informed consent form was acquired. Materials required are Kinesiotaping, Goniometer, ball.

**Study procedure:** From November 2022 to April 2023

**Inclusion Criteria**

1. 17-32 Years of age
2. Male overhead recreational players for at least 6 hours a week
3. Less than one month has passed from beginning of shoulder impingement symptoms
4. A VAS pain level of less than or equal to 7/10.

**Exclusion Criteria**

1. Previous dislocation of the shoulder in the same or opposite shoulder
2. Players who have bilateral shoulder soreness
3. Acromioclavicular joint pathology
4. Cervical spine radiculopathy.

**Outcome measures**

- Visual analog scale (VAS)
- Shoulder Pain and Disability (SPADI)
- Goniometer
- Neer's test

**Procedure**

Subjects were selected based on selection criteria. 58 subjects were divided into two groups.Group A was taken as experimental group (n=29) and treated with shoulder stabilization exercise and Group B was taken as control group (n=29) treated with shoulder stability taping. The detailed procedure for performing the Neer's test was explained to the subjects prior. Outcome measures used for identifying the shoulder impingement are Goniometer which was used to assess the range of joint (Flexion, Abduction, Internal rotation) and VAS score for determining the intensity of pain and SPADI was used to evaluate the level of disability.

**Group A: Scapular stabilization exercises for shoulder impingement pain.**

The experimental group receives six types of scapula stabilization exercises for the shoulder impingement pain. The protocol used for all six exercises was 3 sets of 8 repetitions, 2 sessions were given daily. Each participant was treated for 4 weeks, 4 days a week. Procedures to do for the respected exercises

1. **Scapular retraction:** Patient asked to maintain a straight spine in a seated position in a meantime asked to Squeeze shoulder blades together and sustain for a little while.
2. **Prone shoulder blade squeezes:** Patients were asked to place the arms down on a mat or flat surface and with arms straight they had to squeeze the shoulder blade together and then release it and continue it several times.
3. **Scapular wall slides:**In this exercise patients were asked to place the arms facing forward in standing position with feet apart and against the wall. And they were asked to slide the arms above the wall until the elbows are at top touching the wall, and then slowly they were asked to step back to the normal position
4. **Prone Y, T and W Exercises:**Patients were asked to lie down on the flat surfaces with the arms extended on the flat surface with the arms. For the "Y" exercise, raise your arms up and slightly outward, forming a "Y" shape. For the "W" exercise, bend your elbows and raise your arms up and out to the sides, forming a "W" shape. Hold each position for a few seconds before lowering your arms and repeating several repetitions.
5. **Wall press up**: Patients were asked to keep the shoulder blades back and down to set the scapula and then Lift your arms forward, elbows straight, so your hands barely reach the wall and slowly bend your elbows to push your chest towards the wall, as if performing a press-up. Next, squeeze your scapula while pushing back through your hands to stand back up and the procedure was repeated for 20 to 40 times. Always start with little resistance or your own weight and go up as you grow stronger. Maintaining appropriate form is essential, and any workouts that make you uncomfortable or in pain should be avoided**.**

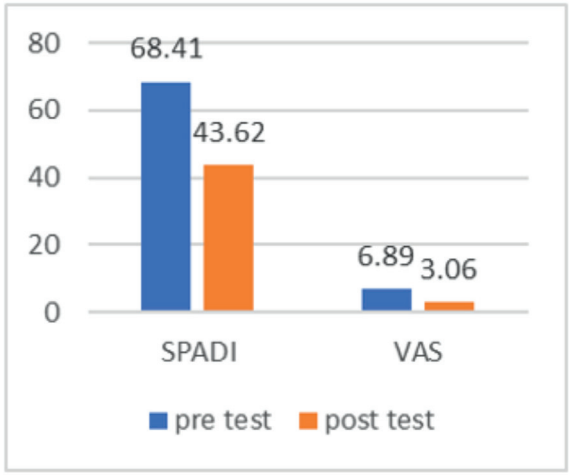
**Group B: Kinesio taping for shoulder impingement pain**

The primary purpose of Kinesio taping for shoulder impingement is to support and encourage the shoulder joint's normal alignment and mobility. Here is a common gain line for Kinesio tape application for shoulder impingement.

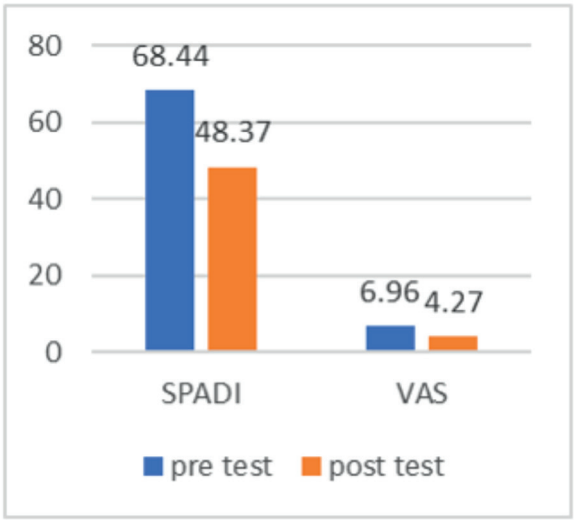
1. **Positioning:** The patient was asked to widen the space between the acromion process and the rotator cuff tendons, first place the shoulder in a slightly retracted and depressed posture.
2. **Prepare:** The skin around the shoulder was cleansed and dried to maintain the tape adhesion.
3. **Anchor**: It started by placing an anchor strip of tape on a sturdy location, such as the upper back or upper arm, where the tape is not stretched.
4. **Main tape strip:** The two tape strips were cut to the proper length for the four main tape strips. Then the first straps were applied vertically down the side of the shoulder blade, working your way up from the lower edge. Stretch the tape just a little bit when you apply it. Then the second strip was applied horizontally over the upper back, right below the acromion process. Applied the tape without allowing it to stretch.
5. **Additional strips:** Depending on each person's requirements, more strips were added. These could comprise shoulder support strips or muscle activation strips to target certain muscles causing the impingement.

**Data analysis**

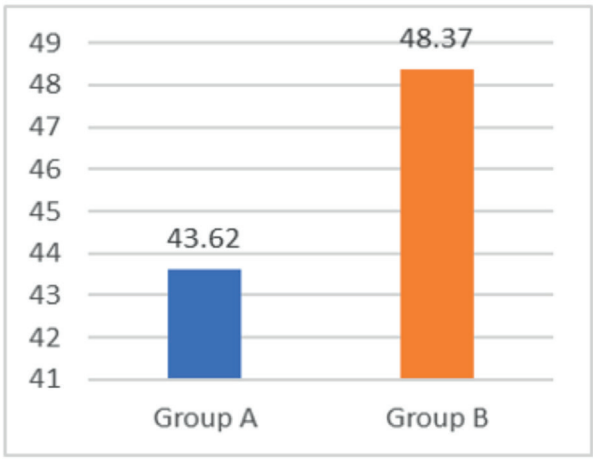
Using tabular and inferential statistics, the gathered data was evaluated. The mean and standard deviation (SD) were utilized for all parameters. The statistically significant differences between pre-test and post-test measures were examined using a paired t-test. When utilizing the unpaired t-test to look at significant changes in the experimental group, the significance level of p 0.0001 was determined to be statistically significant.



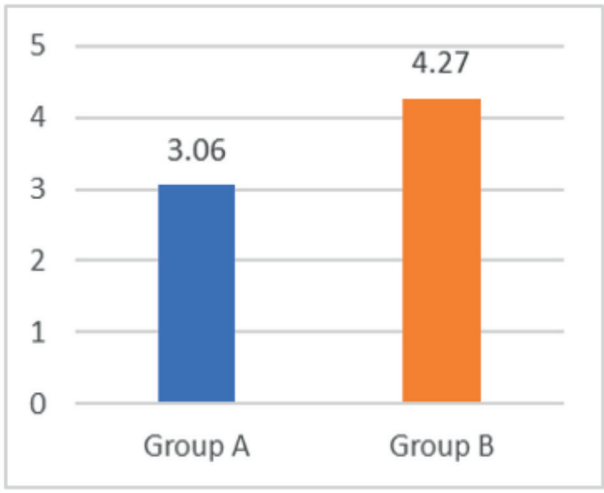

**Graph-1 Comparison of pre-test and post-test values of Group A SPADI and VAS**



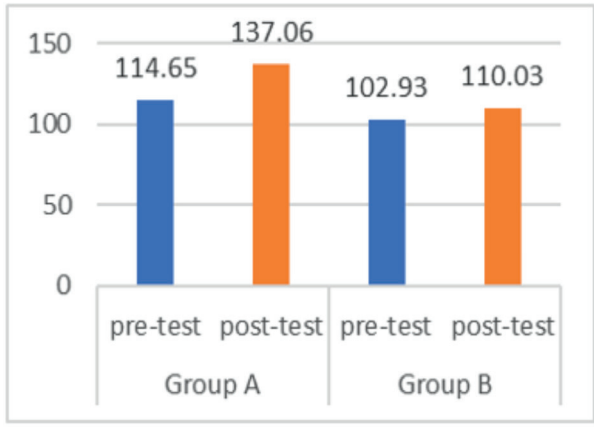

**Graph-2 Comparison of pre-test and post-test values of Group B SPADI and VAS**




**Graph-3 Comparison of post test values of Group A and Group B for SPADI**



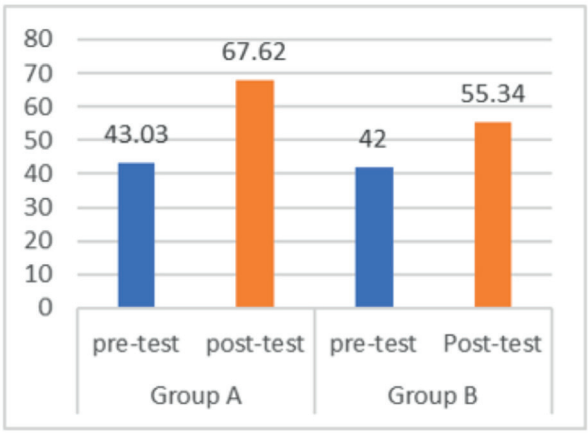

**Graph-4 Comparison of post test values of Group A and Group B for VAS**




**Graph-5 Comparison of pre and post test values of group A and group B for shoulder flexion.**




**Graph-6 Comparison of pre and post test values of group A and group B for shoulder abduction.**




**Graph-7 Comparison of pre and post test values of Group A and Group B for shoulder internal rotation.**

## Result

As a result, Mean and Standard deviation were calculated by descriptive statistics. Paired T test was used and the P values were considered statistically significant. Subjects of 59 individuals with shoulder impingement pain were assessed for pre and post-test using VAS, Goniometer, SPADI and Neer Test. A statistical analysis for group A pre values of mean and standard deviation for VAS 6.89 ± 0.81 post values 3.06 ± 0.84 , pre values of mean and standard deviation of SPADI 68.41 ± 1.15 post values 43.62 ± 1.11, pre values of mean and standard deviation for shoulder flexion 114.65 ± 1.68 post values 137.06 ± 15.26, pre values of mean and standard deviation for shoulder abduction 88.1 ± 19.56 post values 119.82 ± 14.42,pre values of mean and standard deviation for shoulder internal rotation 43.03 ± 9.73 post values 67.62 ± 10.17. A statistical analysis for group B pre values of mean and standard deviation for VAS 6.96 ± 0.82 post values 4.27 ± 0.79, pre values of mean and standard deviation for SPADI 68.44 ± 1.08 post values 48.37 ± 1.11,pre values of mean and standard deviation for shoulder flexion 102.93 ± 11.99 post values 110.03 ± 11.32,pre values of mean and standard deviation for shoulder abduction 87.93 ± 13.72 post values 105 ± 12.53,pre values of mean and standard deviation for shoulder internal rotation 42 ± 8.53 post values 55.34 ± 8.33. Statistical analysis shows that both Group A (stabilization exercise) and Group B (stability taping) where significant with p value less than 0.001.however, the stability exercise values were found to be slightly higher and revealed a beneficial effect of pain and function outcome in subjects with shoulder impingement pain

## Discussion

The goal of the present study is to compare the effectiveness of scapula stabilization exercises versus scapular stabilization taping on shoulder impingement pain. A statistical analysis for group A pre values of mean and standard deviation for VAS 6.89 ± 0.81 post values 3.06 ± 0.84, pre values of mean and standard deviation of SPADI 68.41 ± 1.15 post values 43.62 ± 1.11, pre values of mean and standard deviation for shoulder flexion 114.65 ± 1.68 post values 137.06 ± 15.26, pre values of mean and standard deviation for shoulder abduction 88.1 ± 19.56 post values 119.82 ± 14.42, pre values of mean and standard deviation for shoulder internal rotation 43.03 ± 9.73 post values 67.62 ± 10.17. A statistical analysis for group B pre values of mean and standard deviation for VAS 6.96 ± 0.82 post values 4.27 ± 0.79, pre values of mean and standard deviation for SPADI 68.44 ± 1.08 post values 48.37 ± 1.11, pre values of mean and standard deviation for shoulder flexion 102.93 ± 11.99 post values 110.03 ± 11.32, pre values of mean and standard deviation for shoulder abduction 87.93 ± 13.72 post values 105 ± 12.53, pre values of mean and standard deviation for shoulder internal rotation 42 ± 8.53 post values 55.34 ± 8.33. Both the groups showed betterment in VAS, Goniometer, SPADI. However, subjects in group A who were treated with scapular stabilization exercise showed better improvement in VAS, SPADI, shoulder range of motion, than the subjects in group B who received scapular taping. Rajalaxmi. V et al. in 2015 found an effective improvement in shoulder functions following scapular stabilization exercise[11]. Goksu H et al. in 2016 had significant effective in KT had better recovery from shoulder impingement.[12] Hence, the results obtained from this study has identified that the effectiveness of scapula stabilization exercise versus scapula stabilization taping had proved to be effectively incorporated in the recovery for the patients of shoulder impingement. The effective intervention that addresses the specific cause of shoulder impingement might prevent the occurrence of upper limb discomfort or postural abnormalities of the younger population.[13]

## Conclusion

This study shows that Scapula stabilization exercise has a longer effect compared to taping which provides short-term relief. The data that was collected showed that scapula stabilization exercise is effective in improving functional activities and reducing pain in people with shoulder impingement pain.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/080/2022/ISRB/SR/SCPT).

**Funding:** This study is a self-funded study.

**Conflict of interest:** The authors state that there is no conflict of interest.

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Original Article

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# Efficacy of Soft Tissue Manipulation for Primary Dysmenorrhea among Late Adolescent Girls

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**Abstract**

**Background:** The most prevalent gynecological condition in young girls, dysmenorrhea, is experienced by over 50% of girls. The Myometrium's hyperactivity and the co-occurrence of uterine ischemia are believed to be the primary causes of pain. Prostaglandins seem to play a major role in the development of myometrial hyperactivity. Soft tissue manipulation, a form of therapeutic tissue massage, may be beneficial for the treatment of dysmenorrhea, according to the scant research on the subject and the personal clinical experience of one of the authors. This has been suggested that therapeutic tissue massage, which involves applying pressure to soft tissues, is effective in relieving menstrual discomfort. The entire process was performed from November 2022 to April 2023.

**Purpose:** The study aims to determine the efficacy of soft tissue manipulation for primary dysmenorrhea among late-adolescent girls.

**Materials and Methods:** 62 subjects in total were chosen based on the inclusion and exclusion criteria. The Soft tissue manipulation group (n=31) received treatment over the course of two sessions. The stretching group (n=31) received treatment with 5 stretches in 2 sessions, each stretch lasting for 10 seconds of hold with a 3 seconds rest in between. The material used were Couch, Pillow, Bedsheet, Petroleum Gel, Gloves, Yoga Mat, Sanitizer.

**Result:** The result showed significant improvement in minimizing symptoms of menstrual cramps among late adolescent girls using soft tissue manipulation.

**Conclusion:** This study concluded that the effect of soft tissue manipulation was found to be more significant than stretching in reducing primary dysmenorrhea.

**Key Words:** Primary Dysmenorrhea, menstrual cramps, prostaglandin, stretching, soft tissue manipulation, menstruation.

## Introduction

The most prevalent gynecological condition in young girls, dysmenorrhea, is experienced by over 50% of girls. Preventive and supporting actions are required for young girls due to their detrimental effects on their quality of life. These strategies include raising knowledge and promoting a curriculum about healthy lifestyles, which include a proper diet and regular physical activity.[1] The term "painful

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menstruation" refers to a condition in which the lower abdomen experiences intense, painful cramping and is frequently accompanied by additional symptoms, including sweating, headaches, nausea, vomiting, diarrhea, and trembling, which appear just before or during the menses. A typical monthly problem, dysmenorrhea has a significant negative influence on the quality of life, productivity at work, and use of medical services. While a considerable percentage of girls in their teenage experience dysmenorrhea, less often experience severe discomfort that prevents from going about their everyday lives.[2] When pelvic pathology is absent, primary dysmenorrhea develops. Inflammation causes uterine contractility and cramping pain, which is mediated by increased prostaglandin and leukotriene levels. In primary dysmenorrhea, mechanisms that may be pathophysiological significant are examined. Menstrual Pain is thought to be mostly caused by the myometrium being hyperactive and having uterine ischemia as a co-occurring condition. The growth of myometrial hyperactivity appears to be significantly influenced by prostaglandins. Other pathways with potential clinical significance, including ovarian hormones, cervical factors, vasopressin, nerves, and psychological variables, may function ultimately through prostaglandin release, but they may also act directly on the myometrium and blood flow.[3] The sparse literature on the topic and the individual clinical experience of one of the authors suggest that soft tissue manipulation, a type of therapeutic tissue massage, is helpful for the treatment of dysmenorrhea.[4] Reflex treatment is often referred to as soft tissue manipulation. According to the notion of soft tissue manipulation effect mechanism, it may cause the autonomic nervous system to stimulate the cutaneous-visceral reflexes.[5] It has been claimed that massage treatment is useful for treating menstruation discomfort because it involves manipulating soft tissues with pressure.[6] Soft tissue manipulation (STM) incorporates the majority of mechanical stimuli that have the potential to directly affect the cellular response, molecular pathways, tissue structure, and function, as well as healing, repair, and regeneration. Clinicians regularly employ STM, a non-invasive, affordable, and easily accessible kind of mechanotherapy, to treat a variety of illnesses. Not only does it feel nice, but it also does good.[7] Muscle rigidity, enhanced tone of the muscles, and muscle spasms attributed to acute neurological illnesses are treated with soft tissue manipulation techniques including the neuromuscular treatment and muscle energy technique. The methods can lessen muscle tension, discomfort, and spasms while increasing muscle strength, coordination, and range of motion.[8] A form of manual treatment known as soft tissue manipulation (STM), or therapeutic massage, is delivered solely by the hands or in conjunction with a rigid instrument. Muscle entrapment is released by soft tissue manipulation that employs oblique pressure, a mix of extending and cross-fiber strokes, anchor, and stretch.[9] Exercise is a suitable therapeutic option for dysmenorrhea in adolescents. The endorphin hormone produces a sense of ease and unrestrained enjoyment, which acts as a natural sedative. By stretching your abdominal muscles, you can employ physical activity to lessen dysmenorrhea during your periods. It was shown to be quite useful to perform a sequence of stretching abdominal exercises.[10] According to studies that have focused on this issue in teenagers and young adults, absenteeism from school and job is a detrimental effect of dysmenorrhea. The WaLIDD score entailed three commonly encountered criteria recognized by the definitions of menstrual cramps that exist in the literature: days of pain (D), workability (Wa), and biological part of pain location (L).[11] Increasing rates of dysmenorrhea were found to be related to some psychological characteristics, such as significant emotional disturbance and psychologic symptoms. According to a study, the level of somatic complaints, depression, and anxiety all had a positive correlation with the seriousness of dysmenorrhea. Depression, anxiety, and Stress (DASS-21) is a 21-item self-report questionnaire intended to measure various common symptoms of depression, anxiety, and stress.[12] The estimated prevalence of primary dysmenorrhea varies greatly and can be anywhere between 50% and 90%. In adolescent girls, the disorder is the most frequent reason for absence from work and school.[13]

## Aim

The study aims to determine the efficacy of soft tissue manipulation for primary dysmenorrhea among late adolescent girls.

## Material and Method

Couch, Pillow, Bedsheet, Petroleum

Gel, Gloves, Yoga Mat, Sanitizer.

**Inclusion Criteria**

- Age from 18 - 25
- Menstrual pain associated with the onset of menses
- Subjects diagnosed with primary dysmenorrhea for the last 6 months
- Regular menstrual cycle +/- 7 days.

**Exclusion Criteria**

- Known case of Anemic
- Any Gynecological and endocrine disorder
- Recent abdomen surgery
- Urinary tract infection
- Irregular menstrual cycle
- Positive pregnancy test
- Oral contraceptive or antidepressants for the last 6 months
- Hyperemia.

**Outcome Measures**

- WaLIDD score (Working ability, Location, Intensity, Days of pain, Dysmenorrhea).
- ASS-21 Questionnaire (Depression, Anxiety, Stress Scale -21 questionnaire)

**Procedure**

The study procedure was held at the Health Science Block of Saveetha Institute of Medical and Technical Sciences (SIMATS). In an Experiment group (n=31) the subjects were given soft tissue manipulation in the lower abdomen, and lumbar (low back) region with soft tissue manipulation with 2 repetitions and 20 strokes of each technique with a rest time of 3 minutes. The technique used is the Broadening technique, circular technique, and longitudinal technique which was given in two sessions before the consumption of food. The treatment started from the onset of menses till the last day of menstruation (during menses) meanwhile Stretching group (n=31) was encouraged to do stretching exercises inclusive of Cat and Camel, Pelvic Bridge, Mountain pose, Cobra pose, and Child pose. The protocol for the five stretches was given Each stretch was performed for 10 seconds of hold and 3 seconds of the rest period and 2 repetitions as two sessions which are in the morning and evening. The treatment started from the onset of menses till the last day of menstruation.The entire process was performed from November 2022 to April 2023.

**A) Soft Tissue Manipulation Group:**

**1) Circular Technique:**

For convenience, Subjects were provided with the couch, Pillow, and Bedsheet facilities. asked to lie down on the couch in a supine position, a pillow placed for head support, and exposing the lower abdomen for performing the circular technique with a bedsheet covered in the upper and lower part of the body.

**2) Broadening Technique:**

The subject was asked to lie down on the couch in a prone position, a pillow placed for head support, and exposure of the lower abdomen for performing the broadening technique with a bedsheet covered in the upper and lower part of the body. The broadening technique was administrated in a direction of perpendicular to the muscle fiber.

**3) Longitudinal Technique:**

The hand position and the protocol are the same as the broadening technique. The longitudinal technique is performed in such a way the direction of the muscle fiber runs.

**B) Stretching Group:**

**1) Child Pose:**

- Subjects were asked to Squat and take a seat on their knees.
- Put the top of your head on the ground while stowing your buttocks firmly on your heels with arms stretched.

**2) Cobra Stretch:**

- The Subject was asked to lay out their entire body on the mat while lying face down (prone).
- Hands placed below the shoulder blades.
- Elevate your upper body gradually and Lift higher by using your lower back muscles.

- Take a modest upward and forward glance.
- Carefully descend.

**3) Mountain Pose:**

- Both your hands and your knees should be positioned beneath your shoulders.
- weight should be properly distributed over your palms and fingers when you straighten your elbows.
- Legs straightened; knees raised off the floor.
- To create a triangle that resembles a mountain top, lift your buttocks and slide your head in between your arms.
- In the ultimate posture, your upper body and legs shouldn't be bent. Straight in the back.
- Your heels should be on the ground or at least close to it.
- Bring your head and shoulders up to your knee.

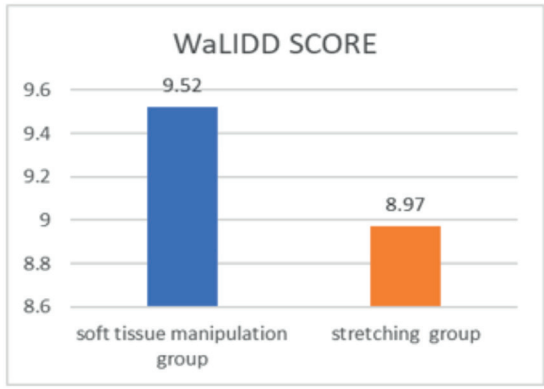
**4) Cat Pose:**

- Subjects were asked to Start in the quadruple position (hands and knees), with their wrists just below their shoulders and their knees just below their hips.
- Make an effort to align your hip, spine, and shoulder.
- The spine should remain neutral at all times.
- Lie on the ground with your back to it.
- Your neck is then raised to the ceiling.
- With your spine, strive to form an arch.

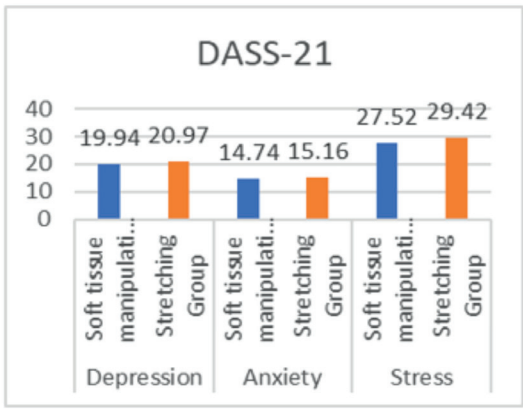
**5) Camel Pose:**

- Subjects were asked to Start in the quadruple position (hands and knees), with their wrists just below their shoulders and their knees just below their hips.
- Make an effort to align your hip, spine, and shoulder.
- The spine should remain neutral at all times.
- lift your spine upward. Then, hunch your chin and tailbone in.
- Make a hunch over your spine if you can.

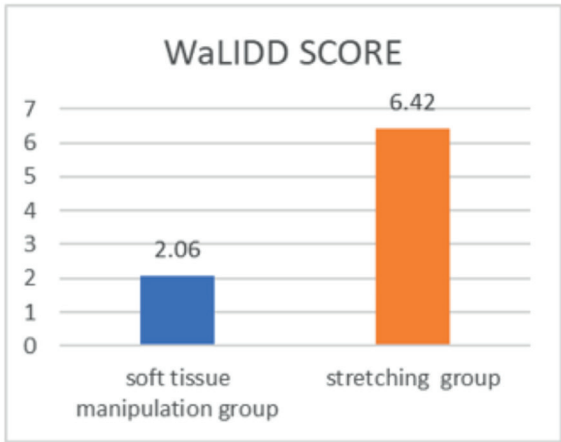
**Data Analysis**



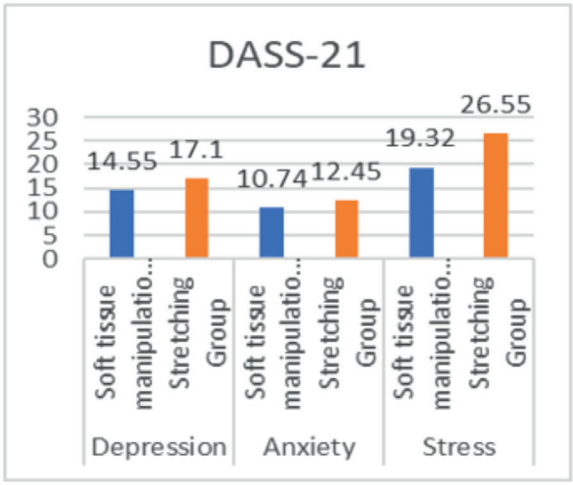

**Graph-1 Pre-value based on a WaLIDD scale of the soft tissue manipulation group & the stretching group.**




**Graph-2 Pre-value based on a DASS-21 scale of the soft tissue manipulation group & the stretching group.**




**Graph-3 Post-value based on a WaLI+DD score of the soft tissue manipulation group & the stretching group.**




**Graph-4 Post-value based on a DASS-21 scale of the soft tissue manipulation group & the stretching group.**

## Result

The result shows significant improvement in minimizing symptoms of menstrual cramps among late adolescent girls using soft tissue manipulation. The post-value using WaLIDD score for the soft tissue manipulation group is 2.06 as the Mean value, and the post-value of the stretching group shows a mean value of 6.42. Post-value using the DASS-21 scale showed for the soft tissue manipulation group is 14.55 (depression),10.74 (anxiety), and 19.32 (stress) as the Mean value. the post-value of the stretching group shows the mean value is 17.10 (depression),12.45 (anxiety), and 25.35 (stress).

## Discussion

The purpose of the present study was to compare the efficacy of soft tissue manipulation for primary dysmenorrhea among late adolescent girls. The outcome measured used was WaLIDD score and the DASS-21 scale before and after the treatment. Significantly soft tissue manipulation group shows in minimizing menstrual cramps. The stretches workout was done based on the subjects' menstrual cycle, plus or minus seven days. The pelvic bridge, which is comprised of the muscles of the gluteus maximus, hamstrings, and hip abductors, is stretched during this exercise. The muscles addressed by the cat and camel stretches include the trapezius, supraspinatus, latissimus dorsi, and erector spinae. The calf muscles, back, hamstring muscles, and forearms are all covered in the mountain position. The child pose performs a gluteus, hip flexor, and internal and external oblique stance. The Pectoral muscle, Pyramidalis, Rectus abdominis, Transversus abdominis, External and Internal obliques, Trapezius muscles, and Erector spinae are also damaged by the cobra stretch. In the meantime, the soft tissue manipulation group performed soft tissue manipulation and the technique used is the Broadening technique, circular technique, and longitudinal technique. Yağcı N et al concluded Patients with persistent non-specific low back pain can benefit from soft tissue mobilization in addition to conventional physiotherapy by experiencing a decrease in pain intensity and level of disability.[14] P Pramanik et al concluded that the results of the current study revealed that dysmenorrhea is linked to psychological discomforts, such as worry, melancholy, irritability, and mood swings. To minimize the severity of menstruation discomfort, psychological therapies, and counseling are crucial for young girls with primary dysmenorrhea.[15] Omidvar S et al concluded that adolescent girls are more likely to encounter dysmenorrhea and irregular menstruation. Restlessness, rage, and back pain are common signs of dysmenorrhea; the discomfort associated with the condition is variable in degree. Girls who had intense discomfort also had cramping in their stomachs, nausea, and loss of appetite, along with immobility. Dysmenorrhea looks to be becoming more common among people; such suffering would reduce female output. On the basis of this, it can be said that a thorough school education program on menarche and menstruation challenges may aid girls in coping better and seeking appropriate medical care. [16]

## Conclusion

This study concluded that the effect of both soft tissue manipulation and stretching reduces the menstrual cramp among late adolescent girls with increased working ability and suffering from pain for a number of days are been reduced and minimized symptoms along with decreases in depression, anxiety, and stress during menses. Hence, among the two interventions, the effect of soft tissue manipulation was found to be more significant than stretching.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, and institutional regulations. (Application Number 03/081/2022/ISRB/SR/ SCPT).

**Funding:** This study is a self-funded study.

**Conflict of Interest:** Nil

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Original Article

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# Effect of Pilates Training for Urinary Incontinence in Postpartum Mother

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**Abstract**

**Background:** This study was designed to inspect the effect of Pilates training for urinary incontinence in postpartum mothers

**Purpose:** To find the effect of Pilates training for urinary incontinence in postpartum mothers.

**Materials and Methods:** According to their inclusion and exclusion criteria, 38 subjects were included. Two groups: the experimental group received Pilates instruction, and the control group underwent kegels exercises. Kegels exercises are categorized as Group B and Pilates training as Group A. Sample sizes of n=19 for group A and n=19 for group B make up these groups. The study period was carried on the month of July 2023.

**Result:** Statistical analysis of quantitative data showed significant differences not only in Pilate's group but also in kegels exercise group.

**Conclusion:** The findings suggest that Pilates training is more beneficial than kegel`s exercise in reducing urinary incontinence and strengthening pelvic muscles.

**Key Words:** Pilates training, Kegel`s exercise, Urinary incontinence, Modified Oxford Scale

## Introduction

The most frequently suggested physical therapy regimen for women who experience stress urination leakage is pelvic floor muscle training. Additionally, it is used to treat mixed incontinence in females and, less frequently, urge incontinence.[1] Pelvic floor muscle training is a part of physiotherapy for UI, however despite evidence to the contrary, it is acknowledged that patient motivation and dedication frequently limit the effects.[2] The most popular physical therapy treatment for women with stress urinary incontine(SUI) is pelvic floor muscle training. Urinary incontinence caused by mixed and, less frequently, urgency is occasionally also advised.[3] More people are realizing that physical symptoms alone are not good indicators of how incontinence affects people's lives. As a result, more all-encompassing methods of UI treatment, such Pilates instruction, have been suggested.[4] Urinary incontinence (UI) affects about one-third of women after giving birth. For both preventing and treating incontinence, pelvic floor muscle therapy (PFMT) is frequently advised throughout pregnancy and after giving birth.[5] Training the pelvic floor muscles (PFMT) is frequently advised for the treatment of

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postpartum urine incontinence (UI). However, it is still unclear how postpartum PFMT affects anal incontinence (AI), sexual function, and pelvic organ prolapse (POP). Therefore, our goal is to evaluate how well postpartum PFMT treats these pelvic floor issues.[6]

Women frequently experience urinary incontinence (UI), which lowers quality of life and makes them less likely to engage in fitness and exercise activities. Childbirth and pregnancy are recognized risk factors. The evidence on the role of PFMT in the prevention and treatment of UI is either not addressed at all or only briefly in the current recommendations for exercise during pregnancy.[7] The levator hiatus is closed, pubovisceral length is decreased, the pelvic floor and pelvic organs are raised, and the bladder is raised in its resting posture thanks to PFMT's increased muscle volume. This review's goal is to assess PFMT's effectiveness in preventing and treating UI throughout pregnancy and after childbirth. Following hormonal and anatomical changes during pregnancy and after delivery, the strength of the pelvic floor muscles may decline, allowing musculoskeletal changes that may cause UI. The repetition of one or more sets of pelvic muscle voluntary contractions is pelvic floor muscular training (PFMT).[8]

During Pilates movements, unintentional co-contraction of the PFM would balance out increases in intra-abdominal pressure that occur during exercise, preventing leakage and supporting the pelvic floor muscles. Breathing and muscle contractions occur during the entire therapy session when practicing Pilates. More research is required to determine the effectiveness of Pilates training in improving bladder function.[9] Instead than concentrating on a single muscle group, Pilates is a type of exercise that uses a variety of exercises to both strengthen and build flexibility throughout entire body. While combining movements that may unintentionally train the pelvic floor, stay away from vigorous abdominal contractions, breath holding yourself or putting pressure on your pelvic floor otherwise.[10] Utilizing vaginal palpation, the Modified Oxford Grading of PFM System can assess the strength of the PFM. It contains six-point scale with 0 being no contraction, 1 being flicker contraction, 2 being weak PFM contraction, 3 being moderate PFM contraction, 4 being good PFM contraction, and 5 being strong PFM contraction. Physiotherapists frequently utilize this measuring scale since it can be combined with vaginal palpation in the clinical assessment. Manual dexterity on the part of the physiotherapist is thought to be crucial for its proper use.[11]

When using the ICIQ-UI SF, the first three questions result in a total ICIQ score with a range of 0 to 21. No urine leakage and no impairment of quality of life result in a score of zero. The frequency of urinary leaking is quantified in question 1 (Q1), the amount of leaking is assessed in question 2, and the interference of urinary incontinence with daily living is assessed in question 3.[12] Because most Pilates exercises are performed while contracting the core abdominal muscles and the diaphragm, it is believed that Pilates movements that concentrate on pelvic stability, mobility, and body alignment would significantly increase PFM strength. These exercises are essential due to the interdependence of respiratory mechanics, intra-abdominal pressure maintenance, and urine continence. However, there isn't enough clear evidence to say whether Pilates exercises can improve UI yet.[13]

## Aim

The aim of the study to determine effectiveness of Pilates training in patients with Urinary incontinence by strengthening pelvic floor muscle.

## Material and Method

According to their inclusion and exclusion criteria, 38 subjects were included two groups: the experimental group received Pilates instruction, and the control group underwent kegels exercises. Kegels exercises are categorized as Group B and Pilates training as Group A. Sample sizes of n=19 for group A and n=19 for group B make up these groups duration of 4 weeks.

### Inclusion Criteria

Postpartum mothers with normal vaginal delivery, Age above 18, Score 0-2 in Modified Oxford scale of pelvic floor muscle.

**Exclusion Criteria**

Patients with history of Neurogenic Bladder, Tumors of the Bladder, Genital prolapse and any medical condition making it impossible to perform interventions.

**Outcome Measures**

Modified Oxford Scale for Pelvic Floor Muscle International Consultation on Incontinence questionnaire Urinary Incontinence.

**Procedure**

Experimental study was carried out among the urinary incontinence patients. Samples were collected from Shri Tanishq Nakshatra multi speciality hospitals Chennai. Total of 38 subjects were selected by convenience sampling method based on inclusion and exclusion criteria. Postpartum mothers by normal vaginal delivery above the age of 18 were included and those who had episiotomy and LSCS were excluded from the study. The study was explained full and written consent was obtained from the subjects. Modified oxford scale of pelvic floor muscle is used to measure each subject pelvic floor muscle strength and International Consultation on incontinence questionnaire used has question to the subjects. The 38 participants are divided into two groups. Each groups have 19 postpartum mothers, with group A as experimental group and group B as control group. The study clarified that Group A will be more effective and more useful within the short period of time The observations will be noted. The statistical rate will be used to assess the prevalance rate. The Study procedure was held at nearby Gynaecology and obstetrics hospital (Shri Tanishq Nakshatra multi specialiy hospital). A total of 38 subjects were chosen for an experimental study on urinary incontinence. Subjects received information about the study`s goal and were assured of it (Shri Tanishq Nakshatra multi specialiy hospital) referred with urinary incontinence were screened. However, little is known about how specifically Pilates activities influence the female pelvic floor muscle. Modern pilates training routines include breathing exercises and pelvic floor muscle contractions. Instead of being specifically trained, pelvic floor muscles are inadvertently trained through exercise and movement. During Pilates movements, unintentional co-contraction of the pelvic floor muscles would counteract increases in intra-abdominal pressure that occur during exercise, preventing leakage and supporting the pelvic floor muscles. Breathing and muscle contractions occur during the entire therapy session when practicing Pilates. More research is required to determine the benefits of Pilates exercise for improving bladder function. Group A is trained with Pilates for 30 minutes,5 days a week for 4 weeks. Group B is given For four weeks, the members of Group B underwent Kegel's exercise, a pelvic floor muscle strengthening exercise, for 30 minutes each week. Participants were initially instructed to consciously contract their pelvic floor muscles while holding their urine to prevent leakage in the semi-Fowlers position. As they progress, participants are instructed to use the same technique while sitting, standing, or performing other activities that may increase intra-abdominal pressure.

Pilates training: Exercising breathing Slow down your breathing and pay attention to your diaphragm. Slimnastics are performed in the "power house" as air is released when pursed lips are used. Covering up adoration or Opening Gradually bend your legs in a long sitting position so that they are heel to heel and extend your band as far as you are able to. genital cock In the crock position, crock the pelvis in the clockwise and anticlockwise directions.(Increment in standing) shoulders down crook-lying position, the power house is activated to start the movement. This is followed by gluteal compression, retroversion of the pelvis, and lifting of the pelvis (hold for 3 to 5 seconds, if possible). The movement then resumes where it left off. a thicker wall Keep one base's spacing between two bases while standing with your back against a wall, and thicken your base as much as you can by contracting your "power house" muscle.

Kegels Exercise : Exercise technique by Kegel: initial position of the semi-fowlers Participants are asked to deliberately tense the muscles in their pelvic floor as holding the pee in order to stop leaks, then in person in the sequence is requested to act the same method while standing or sitting stance or during and after activities that can elevate abdominal pressure.

**Data Analysis**

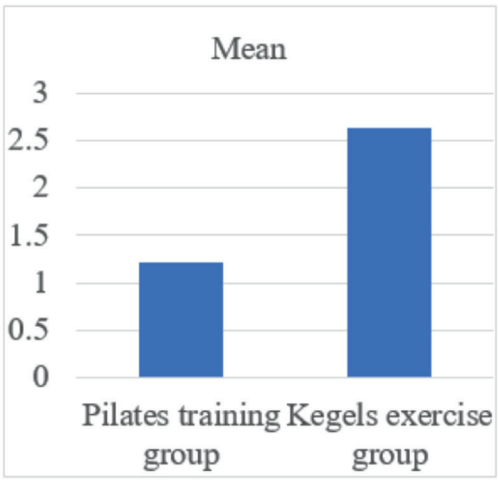
A statistical analysis made with quantitative data revealed a statistically significant difference between Pilates training group and kegels exercise group.




**Graph-1 ICIQ-UI questionnaire in pre and post test value in Pilates training Group**




**Graph-2 ICIQ-UI questionnaire in pre and post test value in kegels exercise Group**



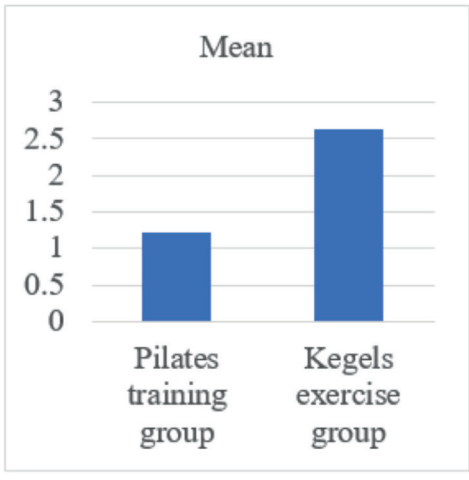

**Graph-3 ICIQ-UI questionnaire in post value in Pilates training Group and kegels exercise Group.**




**Graph-4 Modified oxford scale of PFM pre and post test value of Pilates training Group.**




**Graph-5 Modified oxford scale of PFM pre and post test value of kegels exercise Group.**




**Graph-6 Modified oxford scale of PFM post test value of Pilates training Group and kegels exercise Group.**

## Result

Pilates training group consisted of 19 subjects who received Pilates training exercise and kegels exercise group consists of 19 subjects who received kegels exercise. Statistical analysis of quantitative data showed significant differences not only in Pilates group but also in kegels exercise group. The ICIQ-UI SF Post Test mean value in the Pilates group was 4.16 while it was 6.74 in the Kegels exercise group. This indicates the Pilates training group were significantly higher than the Kegels exercise group, with a p value of <0.0001.

## Discussion

The objective of the current study is to assess the effectiveness of Pilates training and Kegel`s exercise on urinary incontinence and Pelvic floor muscle strength And also to assess the effectiveness in terms of reducing UI and strengthen the pelvic floor muscle. This comparison is demonstrated with duration of 4 weeks. The outcome result were measured by Modified Oxford scale of pelvic floor muscle and International Consultation on Incontinence questionnaire-Urinary Incontinence before and treatment. Beneficial effect was significantly greater in Pilates training than the kegel`s exercise. When response was compared between both groups, the result showed a significant difference in Pilates training than the Kegel`s exercise.

Afsha Parveen et al ( 2023) has concluded that Pilates may meliorate QOL while strictness, mobility, strength, vital capacity, respiration rate, body mass index, and balance. To find out if Pilates is effective at enhancing women's health difficulties, new, high-quality research is required.[14] Stephany Gordon et al( 2020) both treatment protocols dropped circumstances of urine leakage when there is an increase in intra-abdominal pressure, increased PFM power, adherence, and quantity of quick condensation boosted women's quality of life with UI. still, only the group that entered only the Pilates protocol showed an increase in repetitions of slow contraction.[15] Kannan, P., Hsu, W., Suen, W.T., Chan, L., Assor, A., Ho, et al. Pilates and yoga are contrasted with pelvic floor exercise for urine incontinence in older women. controlled, randomized birdman experiment. Complementary antidotes in clinical practice.[16]

## Conclusion

According to the study, Pilates training and Kegels exercises both reduce urinary incontinence among Normal vaginal delivery mothers. The findings suggest that Pilates training is more beneficial than Kegels exercise in reducing Urinary Incontinence and strengthening pelvic muscles which aids in urinary incontinence for women's undergone normal vaginal delivery.

**Ethical Clearance:** Taken from Institutional Ethical Committee ISRB number:03/082/2022/ISRB/SR/SCPT

**Funding :** Self

**Conflict of Interest :** Nil

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Original Article

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# The Effect of Threshold Inspiratory Muscle Training Device and Incentive Spirometry Device for Dyspnoea among Third-Trimester Antenatal Women

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**Abstract**

**Background:** During pregnancy, the progesterone hormone causes the respiratory system to increase oxygen consumption. Maternal hyperventilation causes the partial pressure of oxygen to increase and partial pressure of carbon-dioxide to decrease. During the third trimester, the compression of the diaphragm in the lower base of the lungs, which causes dyspnoea.

**Purpose:** The purpose of the study to find the prevalence and to evaluate the effect of threshold inspiratory muscle training device and incentive spirometry device for dyspnoea among third- trimester antenatal women using modified borg dyspnoea and dyspnea-12 questionnaire.

**Materials and Methods**: The study analysed prevalence of dyspnoea in third-trimester antenatal women from December 2022 to April 2023 using the dyspnea-12 questionnaire. Out of 77 participants, 15 subjects were excluded due to improper follow-up, lack of participation, and withdrawal from the study. In phase 2, in May 2023, 62 participants were divided into two groups: 31 antenatal women underwent threshold inspiratory muscle training along with diaphragmatic breathing exercises, and 31 underwent incentive spirometry along with diaphragmatic breathing exercises.

**Result:** Statistically significant differences between the two devices were evaluated by post-values of 13.80 ± 23.20; and the P value is < 0.0001. These values were considered to be extremely statistically significant.

**Conclusion:** Threshold inspiratory muscle training device is more effective than Incentive Spirometry device for dyspnoea among third-trimester antenatal women.

**Keywords:** Threshold Inspiratory Muscle Training Device, Incentive Spirometry, Diaphragmatic Breathing Exercises, Breathlessness, Functional Capacity.

## Introduction

Pregnancy is a phenomenon in which anatomical and physiological changes begin after conception and have an impact in every system in the body. In the respiratory system, the level of progesterone hormone increases oxygen consumption that raises the minute ventilation. Maternal hyperventilation causes the partial pressure of oxygen to increase and partial pressure of carbon dioxide to decrease.[1]

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Dyspnoea or shortness of breath is the most common symptom in pregnancy. According to previous study (2019), 60-75 percent of pregnant women experience dyspnoea in third trimester due to appearance of foetal head compressing the diaphragm and being positioned beneath a rib just before the baby starts to turn and sink deeper into pelvis.[2,3] So, the latency of the airway and ability of gas exchange between the alveoli of functional lung capacity, which slightly lowers the blood partial pressure of carbon dioxide levels.[4] Threshold inspiratory muscle training device is a pressure-based type of device, that gives resistance that helps to improve and strengthen the respiratory muscles, and it provides a consistent and specific pressure for the inspiratory muscle for strengthening and endurance training.[5-9] It consists of a spring-loaded valve that provides resistance to generate a load up to 9 cm H2O to 41 cm H2O. Thus, the purpose of the study was to evaluate the effect of a threshold inspiratory muscle training device is used to strengthening the weakened inspiratory muscles which reduces the dyspnoea and improves pulmonary functions.[10-13] Incentive spirometry, otherwise called as sustained maximal inspiration, is used to raise the transpulmonary pressure and inspiratory volumes, enhancing the function of the inspiratory muscles which activate the typical pattern of hyperinflation. Airway patterns may be maintained and lung atelectasis is prevented. There are two types of spirometry; flow-oriented and volume-oriented spirometry.[14,15] Flow-oriented incentive spirometry device makes you work harder to breathe. It helps to increase the muscles in the upper chest. which has three chambers with one ball in each chamber and a capacity up to 1200 ml to improve only accessory muscles of respiration. Whereas, a volume-oriented incentive spirometry device does not make you work as hard. It has a one- way valve with a capacity up to 5000ml. Current evidence that proves this type of spirometry requires less work of breathing and improves diaphragmatic function and pulmonary function better compared to tri-flow.[16,17] Diaphragmatic breathing exercises are also known as belly or abdominal breathing. It is an important muscle that helps to breathe and also has an effective role for primary muscles of inspiration. Which involves breathing deep into the stomach that helps to strengthen the diaphragm.[18] Using the diaphragm consciously during respiration, increases the lung capacity and alveolar oxygen saturation to improve the efficacy of oxygen ventilation. It has been shown to be beneficial during pregnancy.

## Aim

To find the prevalence of dyspnoea among third-trimester antenatal women and to evaluate The effect of Threshold inspiratory muscle training device and Incentive spirometry device for dyspnoea among third-trimester antenatal women.

## Materials and Methods

This study has been conducted in two phases, from December 2022 to May 2023. The antenatal women were selected based on inclusion and exclusion criteria. The sampling technique was convenient and the sample size was 62 Antenatal women.

**Inclusion Criteria**

1. Antenatal women in the age group of 20-30 years.
2. Moderate to severe dyspnoea by using the dyspnea-12 questionnaire
3. Primigravida women

**Exclusion criteria**

1. Antenatal women who all had high body temperature.
2. Psychiatric disorders.
3. Myocardial infarction.
4. Unstable angina.
5. Not willing to participate.

**Outcome Measures**

**A. Modified Borg Dyspnoea Scale:**

The Modified Borg dyspnoea scale was termed the CR10(category ratio) scale, it indicates 0-10 scores; 0- denotes no exertion score whereas, 10 which is classified by maximal exertion score. Based on various studies, modified Borg dyspnoea scale is a valid and reliable tool to measure dyspnoea.

**B. Dyspnea-12 Questionnaire:**

Dyspnoea 12 questionnaire, is a reliable and valid questionnaire to measure Breathlessness. It is

examined by 12 sets of questions, which are evaluated by components that are mild, moderate, severe. It ranges from 0 to 36, where 0-12 represents mild; 13-24 represents moderate score; at lastly, 25- 36 represents severe scoring.

**Study Procedure**

This study has been conducted in two phases. In phase-1 from December 2022 to April 2023, a cohort study was used to determine the prevalence of dyspnoea among antenatal women, which was analysed by the dyspnea-12 questionnaire to collect the data. Before the study started, an informed consent form was given to the participants. The prenatal census which is collected from Saveetha institute of technical sciences in obstetrics and gynaecology outpatient department. 976 antenatal women who have been found as third trimester per month, around 32 third trimester antenatal women came for consultation per day. out of 32 antenatal women, 6 antenatal women were diagnosed with dyspnoea symptoms as determined by dyspnea-12 questionnaire. Therefore, during a period of five months. 756 antenatal women had reported with dyspnoea symptoms which is divided by the total number of pregnant women in the third-trimester. 77 antenatal women had reported with moderate to severe dyspnoea around 20%. As a result, the study has seen only the prevalence in phase-1. In phase 2, an experimental study was conducted in May 2023 a total of 77 antenatal women were selected based on inclusion criteria. In this study, Antenatal women in the age group of 20-30 years, moderate to severe dyspnoea by using the dyspnea-12 questionnaire and primigravida women were included. Antenatal women who all had high body temperature, psychiatric disorders, myocardial infarction, and unstable angina were excluded in this study. Out of 77 antenatal women, 15 women were excluded due to improper follow up, lack of participation, and in between withdrawal from the study. 62 antenatal women underwent phase-2 study. Which is divided into two groups. 31 antenatal women underwent threshold Inspiratory muscle training device along with diaphragmatic breathing exercises, and another 31 antenatal women underwent Incentive spirometry device along with diaphragmatic breathing exercise. Before the treatment, participated women were assessed by antenatal assessment.

**Threshold Inspiratory Muscle Training Device and Incentive Spirometry Device for Dyspnoea among Third-Trimester Antenatal Women**

**1. Patient Position**: Sitting in a comfortable position.

**2. Therapist Position**: Standing position.

**3. Procedure**: a. Antenatal women held the Threshold Inspiratory Muscle Training over the hands, then increased the pressure from 9 cm H2O to 41 cm H2O. Before beginning the treatment, secure the nose with a nose clip to prevent holding the breath. The antenatal women place their mouth over the mouthpiece, carefully inhale and hold their breath for two to three seconds. This helped the spring load valve provide resistance, which inflates the alveoli to expand in order to receive the oxygen and to prevent hyperventilation. The mouth should be free from the mouthpiece while exhaling.

b. Volumetric incentive spirometry device has one valve up to 5000 ml which gives visual feedback to the patient. Antenatal women were used to inhale through the mouthpiece so the piston will raise up to the levels and hold it for two to three seconds and the mouth should be free from the mouthpiece while exhaling.

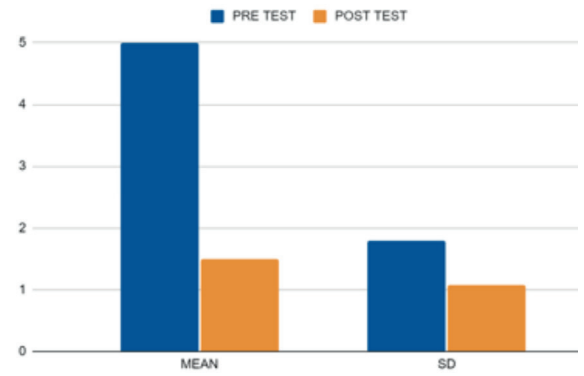
**4. Precautions**: Not encouraged to inhale quickly through the mouthpiece.

**5. Frequency and Duration**: The treatment session was given for five days a week followed by four weeks. The antenatal women underwent diaphragmatic breathing exercises were trained to inhale deeply while holding the breath for up to two seconds and to exhale through the mouth in pursed lip position, for 10 repetitions. Then, the threshold Inspiratory muscle training device and Incentive spirometry device treatment sessions were given for up to 15 minutes, which consisted of 3 sets with 30 repetitions, and 10 seconds rest period in between each set. The pre and post-test values were evaluated by the modified Borg dyspnoea scale and the dyspnea-12 questionnaire**.**

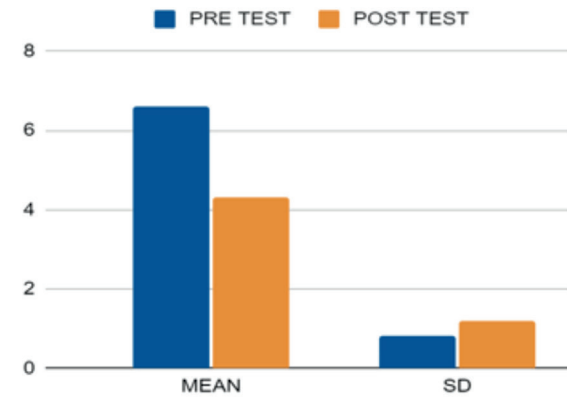
**Statistical Analysis**

In this study, paired ‘t test was used for analysing pre and post-test values of individual groups.

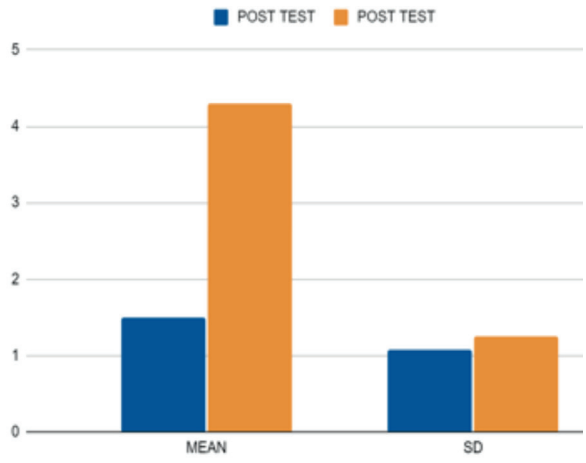
Whereas, unpaired 't test' was used for analysing post-test values of individual groups.




**Graph-1 Pre and Post test of modified borg dyspnoea scale in Threshold inspiratory muscle training group using Paired-T test.**




**Graph-2 Pre and Post test of modified borg dyspnoea scale in Incentive spirometry group using Paired-T test.**



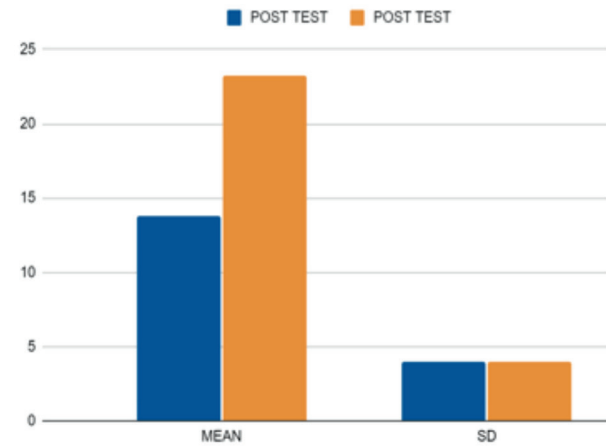

**Graph-3 Post values of modified borg dyspnoea scale in Threshold inspiratory device and Incentive spirometry using unpaired- T test.**




**Graph-4 Pre and Post Test of Dyspnea-12 Questionnaire in Threshold Inspiratory muscle training group using Paired- T test.**




**Graph-5 Pre and Post Test of Dyspnea-12 Questionnaire in Incentive spirometry group using Paired- T test.**




**Graph-6 Post values of Dyspnea-12 Questionnaire in Threshold Inspiratory muscle training and Incentive spirometry using unpaired- T test.**

## Result

In Graph-1, The pre- and post-test of modified borg dyspnoea scale in threshold inspiratory muscle training device group using paired-t test of mean 5.0 ± 1.50; SD 1.8 ± 1.08; P value <0.0001. In Graph-2, The pre and post test of modified borg dyspnoea scale in Incentive spirometry group using paired-t test of mean 6.60±4.30; SD 0.84 ±1.25; P value <0.0001. In Graph-3, The post values of modified borg dyspnea scale in threshold inspiratory muscle training device and incentive spirometry group using unpaired-t test of mean 1.50 ± 4.30; SD 1.08± 1.25;P value < 0.0001. In Graph-4**,** The pre and post test of Dyspnea-12 questionnaire in threshold inspiratory muscle training device group using paired-t test of mean 17.10 ± 13.80; SD 4.65±4.02; and P value is <0.0001. In Graph-5, The pre and post test of Dyspnea-12 questionnaire in Incentive spirometry group using paired- t test of mean 25.50 ± 23.20; SD 4.14± 3.94;P value is < 0.0001. In Graph- 6, The post values of Dyspnea-12 questionnaire in threshold inspiratory muscle training device and incentive spirometry group using unpaired-t test of mean 13.80 ± 23.20;SD 4.02±3.94; P value < 0.0001. These differences indicated that the threshold Inspiratory muscle training device was highly beneficial compared to the incentive spirometry device.

## Discussion

This study examined the effects of a threshold Inspiratory muscle training device and incentive spirometry along with diaphragmatic breathing exercises on dyspnoea in third-trimester pregnant women. The interventions lasted for four weeks, and 62 antenatal women were divided into two groups: 31 of them underwent a threshold Inspiratory muscle training device along with diaphragmatic breathing exercises, and another 31 underwent an Incentive spirometry device along with diaphragmatic breathing exercises. The result of the study, evaluated by post-values of mean 13.80 ± 23.20; P value <0.0001. These values were considered to be extremely statistically significant. These differences indicated that the threshold Inspiratory muscle training device was highly beneficial compared to the Incentive spirometry device. Lee SY, Chien DK, et al.**,** The study was to identify the mechanisms of change within the respiratory system during pregnancy. In this study, Dyspnoea in a normal pregnancy was reported to be distinguished from pathological dyspnoea.[1] Amola M, Pawara S, Kalra S et al., stated that, The effect of threshold inspiratory muscle training device and diaphragmatic breathing exercises which reducing the symptoms of dyspnoea in third trimester antenatal women. 34 subjects were included in this study was performed by 4 weeks session and concluded inspiratory muscle training device are effectiveness on dyspnoea and pulmonary functions.[5] Gamze Fisken et al., Has concluded that the effect of Abdominal breathing exercise is used in increasing blood sugar level of pregnant women which reduces depression and stress, 60 women were performed, around 30 days followed by less than eight weeks of intervention. The diaphragmatic breathing exercises which practice a session of 5 minutes is effectively significant.[18]

## Conclusion

This study concluded that there was 20 % in prevalence of dyspnoea among third-trimester antenatal women and the effect of both threshold inspiratory muscle training device and incentive spirometry along with diaphragmatic breathing exercises which reduces the dyspnoea among third trimester antenatal women. But among the two interventions, the effect of threshold inspiratory muscle training device was found to be more significant than incentive spirometry in reducing dyspnoea among third trimester antenatal women.

**Ethical Clearance**: The research work has been approved by the ISRB Committee. Application No:03/084/2022/ISRB/SR/SCPT

**Funding**: Self

**Conflict of Interest:** Nil.

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Original Article

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# Comparing the Effectiveness of Mikhled Knee Exercise Program and Quadriceps Based Training in Patellofemoral Pain Syndrome among Collegiate Athletes

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**Abstract**

**Background:** Patellofemoral pain syndrome (PFPS) is a relatively common musculoskeletal condition that produces pain at the front of the knee that may last for a long period. It is characterized by extensive pain in/ around the patella. Individuals commonly report an exacerbation of their symptoms when engaging in activities that increase compressive load pressures in the joint.

**Purpose:** The purpose of the study is to determine the effects of Mikheld knee exercise program and quadriceps based training in patellofemoral pain syndrome among collegiate athletes.

**Material and Method:** From November 2022 to April 2023, 54 participants with patellofemoral pain syndrome were selected and randomly divided into two equal groups at Saveetha Medical College and Hospital .During a four-week treatment session, Group A received a Mikheld knee exercise program, whereas Group B received quadriceps-based training. Subjects were evaluated twice (pre-treatment and post-treatment) using the Numerical Pain Rating Scale (NPRS) and the Kujala Patellofemoral Scale.

**Results:** Statistical analysis show that there is a significant change within-group for NPRS, kujala patellofemoral scale in pre and post treatment, with a p value of < 0.0001, the mean of the Mikhled knee exercise program at the post test was shown to be greater than the mean of quadriceps-based training.

**Conclusion:** According to the findings of this study, the Mikheld knee exercise program is more helpful in participants suffering from patellofemoral pain syndrome than quadriceps-based training persons. The study was limited by the small number of participants.

**Key Word:** Patellofemoral pain syndrome, Kujala Patellofemoral scale, NPRS, Mikhled knee exercise program.

## Introduction

A common musculoskeletal condition called patellofemoral pain syndrome (PFPS) causes discomfort at the front of the knee, which tends to last a long time.[1] Women are affected around twice as much as men.[2] The prevalence of "anterior knee pain" is considerable, at 22/1,000 people annually.[3]

It is characterized by widespread discomfort in/

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around the patella, which gets worse when you sit down for a long time, stand, or climb stairs. Although several extrinsic and intrinsic knee-related variables have been proposed, there has been no conclusive evidence linking foot or ankle traits to knee health.[4]

Patients typically report an exacerbation of their symptoms when performing activities that increase compressive load forces in the joint, such as ascending and descending stairs, bending down, running.[5]

The patellofemoral joint's anatomical and biomechanical characteristics are altered in patellofemoral pain syndrome (PEPS), also known as peripatellar pain.[6] It's additionally one of the most commonly occurring injuries to the knee reported by athletes in a variety of sports. With a 30% incidence and representing 9% of all injury sustained by young competitors.[7]

A recent study found that although PFPS has been linked to arthritis of the knee and an elevated body mass index, this is not the case in teenage patients .[8] Because of its tendency for recurrence the syndrome of patellofemoral pain can result in several medical visits, with 94% of patients experiencing pain for a maximum of four years after the first visit and 25% expressing significant discomfort up to 20 years afterwards.[9]

Numerous conservative therapy programs have been carried out in the past.[10] The thermal and non-thermal consequences of therapeutic ultrasound resulted in biological responses such as inflammation reduction, time-regeneration, and muscular tension reduction. By providing ultrasonic energy, therapeutic ultrasound physically and thermally penetrates deep tissue.[11]

## Aim

The aim of this study is to compare the effectiveness of the Mikheld knee exercise program and quadriceps based training in patellofemoral pain syndrome among collegiate athletes.

## Material and Method

It was an experimental study conducted on 54 subjects with patellofemoral pain syndrome, ages between 18-25 yrs who were taken from private universities. A convenient sampling method was used in the study. Study period :November 2022 to April 2023

**Inclusion Criteria:**

- Subjects who are athletes
- Both genders of age between 18-25 years
- Experienced distributed anterior knee discomfort for at least 8 weeks (about 2 months).
- Patients who have never undergone any treatment.

**Exclusion Criteria:**

- Tendonitis
- Osgood-Schlatter syndrome
- Previous knee surgery
- Fracture
- History of meniscus damage
- OA knee.

**Outcome Measure:**

Assessment was done at initial and at the end of the study using

1. Numerical Pain Rating Scale (NPRS)

The NPRS is a segmented numeric version of the visual analog scale (VAS) in which a respondent selects a whole number (0–10 integers) that best reflects the intensity of his/her pain. The 11-point numeric scale ranges from '0' representing no pain extreme (e.g. "no pain") to '10' representing the other pain extreme (e.g. "pain as bad as you can imagine" or "worst pain imaginable". [12]

2. Kujala patellofemoral scale

The Kujala Score or Anterior Knee Pain Scale (AKPS) is a 13-item self-report questionnaire that assesses subjective reactions to activities and symptoms that are known to correlate with anterior knee pain syndrome. The AKPS is graded on a scale of 0 to 100, with 100 being the highest possible score. Lower scores reflect greater pain and disability. The 13 items on the scale are used to assess subjective symptoms and functional restrictions. A score can have a minimum of 0 points or a maximum of 100 points. Athletes would receive a score of 100 if they showed no signs of anterior knee pain. [13,14]

**Procedure**

Participants were included considering the inclusion and exclusion criteria. Procedure was explained to the participant & participants were then asked to sign the consent form. Assessment of all the included participants was done according to the assessment form. Participants were randomly divided into two groups i.e group 'A' and 'B'. Group A(n=27), Group B(n=27). Assessment was performed at baseline and after four weeks of study. Both Groups underwent ultrasound with a frequency of 1MHz and continuous mode for a duration of 10 minutes in a comfortable position.

**Group A: Mikheld Knee Exercise Program**

The Mikhled Knee Exercise Program (MKEP) is a recently developed rehabilitation method that attempts to improve the joint's range of motion, quality of life, health status, discomfort, balance, and muscle strength.

The MKEP technique includes seven therapeutic level postures that should be held for 15-20 minutes each: Level one is supine, level two is on elbows, level three is half sitting, level four is prone, level five is bench long sitting, level six is bench prone, and level seven is bench supine.

The same activity is included in each level but is presented differently as follows:

1) The patient was taught to dorsiflex and to straighten the knee joint.

2) The patient was instructed to elevate one leg 15 inches above the ground while keeping the knee extended.

3) The patient was instructed to stretch his or her leg outward in an abduction stance while maintaining a straight knee.

4) The patient was instructed to keep one leg outside of the body and bend it for 30 degrees.

5) The patient was instructed to straighten his or her knee while maintaining horizontal leg position.

6) The patient was instructed to position his leg inside in a manner similar to a second step, and then to return to step one and take a 30-second rest.

After each adaptive isometric exercise level, participant was asked to hold for ten seconds or number to Ten. The muscle groups of the hamstrings and quad muscles, which are often weak or atrophying in patients, can be most efficiently strengthened through changing the positions used.

The researcher gave the participants instructions to return to class on a regular basis after each session. The researcher called a person to remind them to attend the lesson if they failed to show up for the next session. All subjects were instructed not to take part in any other treatment plans or visit the clinic for supplementary care during the course of the treatment. All participants were required to continue taking their regular medication schedule during the trial.

**Group B: Quadriceps Based Training**

**1. Straight Leg Raise**

- Contract your quadriceps and raise the extended leg until it creates a 45-degree angle.
- Hold your leg in this position for two seconds
- 20 times in all. Run two or three sets.

**2. Step Up**

- Put your left foot on the step.
- As your left leg straightens and tightens, lift your right leg into the air and keep it there for a brief while.
- Return the right leg to the floor gradually.
- Repeat ten repetitions, then swap legs.

**3. Short Quad Arc Exercise**

- Lay flat on your back with your knees extended.
- Under the knee of the quad, place a bolster.
- Until your leg is fully extended, gradually straighten your knee, contract your quadriceps.
- Keep your knees straight for three to five seconds, then gently return to your starting position.

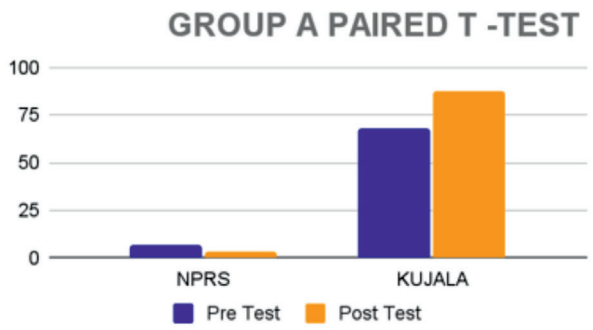
**4. Wall Side**

- Put your back against a wall and stand up. Your feet should be spaced around shoulder-width.
- Slide your back and hips down the wall gently until your knees are at a 45-degree angle.
- Remain in this position for about 5 seconds, then stand up again.
- Ten to fifteen times, repeat the slide. Perform a few sets.

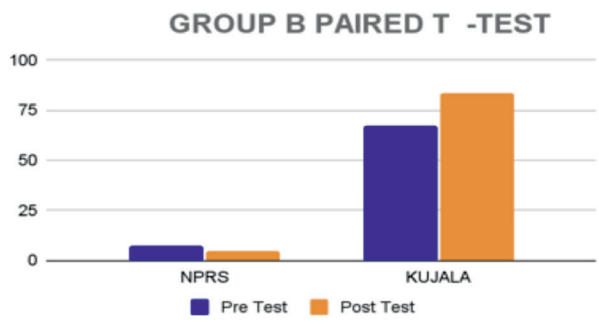
**5. Bulgarian Split Squat**

- On a bench that is around knee height, position your right foot in front of you and your left foot behind you. Hold your hands firmly to your hips.
- Lower your left knee towards the floor while keeping your back straight. Attempt to maintain your front knees behind your toes and a 90-degree angle at the front knee.
- Push down with your right foot to draw your right knee back before the left knee reaches the floor.

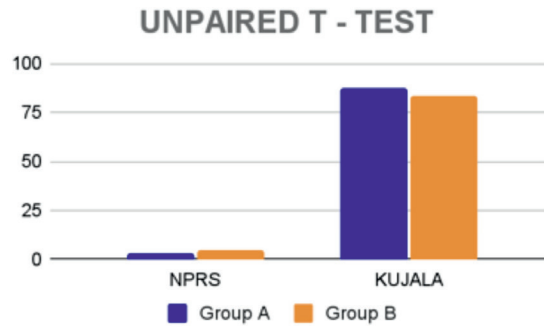
**Data Analysis**




**Graph No 1**




**Graph No 2**




**Graph No 3**

## Result

- The study was conducted on 54 subjects. Both groups had 27 subjects each.
- For NPRS, the mean was 2.89 for Group A (MKEP) and 5 for group B (Quadriceps based training ),p value was = 0.0001 which shows that the result was very statistically significant
- For the Kujala patellofemoral scale, the mean was 87.67 for Group A and 83.48 for Group B ,with p values <0.0002 which shows that the result was very statistically significant.

## Discussion

The purpose of this research project was to look at the efficacy of Mikhled knee exercise program versus quadriceps-based training on individuals suffering from patellofemoral pain syndrome. According to the findings of the study, mikheld knee exercise program is somewhat more effective than the quadriceps-based training. This is the first study to assess the effectiveness of MKEP against quadriceps-based training programs in PEPS patients. According to the findings of this study, both types of exercise are useful in improving physical function and reducing discomfort during the therapy time.

As a result, the improvement of Mikheld knee exercise program with ultrasonic treatment is much greater than the improvement of the quadriceps -based training. Mikhled knee exercises are a sort of isometric knee exercise with a distinct training effect than quadriceps-based training. MKEP does not require any equipment; However, it may be more convenient for participants to continue completing the exercises at home on their own .

Previous research by Jeffrey A Rixe et.al conducted, a research restricted itself to randomized controlled trials, cohort studies, and crossover case-controlled studies in this review of 33 papers .The most effective therapies for lowering knee pain symptoms and improving function in PFPS patients are quadriceps and hip strengthening coupled with stretches in an organized physiotherapy program.(15) As previous research has demonstrated, interventions like orthotics, proprioceptive learning, and strapping may be useful as adjunct therapy but are ineffective when used alone in persons with PFPS. Furthermore, new study indicates that surgery and pharmacological therapy for PFPS patients is ineffective.[16]

Dolak KL et.al A randomized controlled study was conducted. Thirty-three PFPS girls took part in this experiment, which included four weeks of either initial hip strengthening (hip group) or first quadriceps training (quad group), followed by four weeks of a comparable functional weight-bearing exercise program. It has been demonstrated that focusing on hip strength first may be more successful in the treatment of PFPS, allowing for muscular training while reducing exacerbation of patellofemoral symptoms. Those who started with hip exercising reported a much more significant decrease in knee pain after just four weeks of therapy, whereas those who started with quadriceps training required eight weeks of therapy to get a comparable reduction in pain.[17]

Herrington L, et al conducted a randomized controlled trial of carrying weight vs non-weight-bearing training for patellofemoral soreness and claims that both bearing weight and non-weight-bearing quadriceps exercises can improve subjective and clinical outcomes in those with PFPS.[18]

This study has various limitations that must be noted. For starters, the limited number of participants in each group implies that the findings could have limited applicability . Second, the study primarily focuses on athletes and their lifestyle, food, and activity level, which cannot be accurately captured or quantified . Long-term research with a higher sample size is advised as a future study recommendation to make the study more valid. A study for several age groups can be conducted.

## Conclusion

This study compared a Mikheld knee exercise plan with ultrasound to a quadriceps-based training with ultrasound in the management of patellofemoral discomfort syndrome. The findings demonstrated a $p<0.0001$ significance in all parameters when the prior to and following the NPRS and Kujala scores of both groups were compared. The outcomes of the two groups were similar, however the group that underwent the Mikheld knee exercise program combined with ultrasound improved more post-treatment**.**

**Ethical Clearance:** This research work has been approved by the ISRB committee (ApplicationNo:03/085/2022/ISRB/SR/SCPT).

**Source of Funding:** Self

**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# Comparing the Effects of Hypopressive "Exercise"and Kegels Exercise for Pelvic Organ Prolapse among "Patients with" Spontaneous Vaginal Delivery

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**Abstract**

**Background:** This study was designed to inspect the effectiveness of Hypopressive exercise and Kegels exercise for pelvic organ prolapse among patients with spontaneous vaginal delivery. Pelvic organ prolapse is when one or more organs of the pelvis slip down from their normal position and bulge into vagina. Hypopressive exercises help to rectify the prolapse and minimizes its severity. Kegels exercises are usually done for pelvic floor muscle training.

**Purpose:** To compare the effectiveness of Hypopressive and Kegels exercise for pelvic organ prolapse among spontaneous vaginal delivery.

**Materials and Methods:** Total of 42 participants were selected from C3 Care Cure Comfort clinic according to inclusion and exclusion criteria, and the participants were explained about the treatment and written consent were obtained. The subjects underwent study for a time period of 4 months from April 2023-July 2023 and results were obtained. The participating subjects were randomly allocated into two groups, Hypopressive exercise group "and" Kegels exercise group. All the subjects underwent pre-test measurement with modified oxford scale and pelvic floor impact questionnaire at the beginning of the treatment.

**Results:** statistical analysis of data showed significant differences not only in the Hypopressive group but also in the Kegels exercise group. The Hypopressive group was significantly higher than Kegels exercise group, with a p value of <0.0001.

**Conclusion:** Hypopressive exercise is more effective than Kegels exercise for pelvic organ prolapse among spontaneous vaginal delivery. The study was done for a short period of time with a small group of people.

**Key Word:** Pelvic organ prolapses, Hypopressive, Kegel, pelvic floor exercise, spontaneous vaginal delivery, modified oxford scale, pelvic floor impact questionnaire.

## Introduction

Pelvic organ prolapse is when one or more organs of the pelvis slip down from their normal position and bulge into vagina. Pelvic organs include the bladder, uterus, vagina, prostrate, rectum. The main cause of pelvic organ prolapse is pregnancy, vaginal delivery and multiple deliveries as well as

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increased intraabdominal pressure such as weight lifting, chronic cough, obesity can increase the chance of pelvic organ prolapse.[1,2,3] It is a downward descent of women's pelvic organs including bladder, uterus or post hysterectomy vaginal cuffs.[4] Symptoms will cause trouble if the bulge protrudes past the vaginal opening.[5]

Hypopressive exercises are a relatively new technique for training the pelvic floor muscles. Hypopressive are a collection of exercises, posture, and breathing methods.[6] Hypopressive can be done three times a week for six weeks for beneficial results. Hypopressive can be done in various positions like standing, kneeling, four-point kneeling, sitting and supine positions.[7,8]

When we perform Hypopressive exercises the substantial part of the postural muscles are intensely activated[9]. Hypopressive exercise slims the waist and improves the abdominal muscles without harming the pelvic muscles.[10] During hypopressive exercises, it is critical to maintain appropriate "posture" and avoid any straining or breath-holding.[11]

Kegels exercises are usually done for pelvic muscle training, these exercises help in bladder and bowel training.[12] The pelvic floor muscles which support bladder, rectum, bowel can be strengthened by this exercise. Kegels exercise is best to do during pregnancy which makes delivery easier, because it gives greater control over pelvic muscle during labor.[13] Kegels involve tightening and releasing the muscles.[14] Kegels can be performed in positions like sitting, standing, lying and focus should be in performing on squeezing and lifting like you are picking up with the pelvic floor. While performing the exercise, many people contract their hip, abdominal and gluteal muscles rather than pelvic floor muscles.[15]

## Aim

The aim of the study is to find the effectiveness of Hypopressive exercise and Kegels exercise for pelvic organ prolapse among spontaneous vaginal delivery.

## Material and Method

Total of 42 participants were selected according to inclusion and exclusion criteria and the participants were explained about treatment safely and simplicity of the procedure and written consent was obtained. Subjects willing to participate were randomly allocated into two groups: Hypopressive exercise group and Kegels exercise group. All the subjects underwent pretest measurement with modified oxford scale and pelvic floor impact questionnaire in the beginning of treatment. The study procedure was held at C3 physiotherapy clinic. A total of 42 subjects were chosen for an experimental study on pelvic organ prolapse, subjects received information about the study's goal and were assured. The subjects from the C3 physiotherapy clinic with pelvic organ prolapse were screened.

**Inclusion criteria:**

- People with pelvic organ prolapse
- Pelvic muscle weakness
- Urinary incontinence
- Older and postpartum mothers
- vaginal delivery
- No associated neurological disorder

**Exclusion Criteria:**

- People underwent recent surgery
- Muscle injury, spinal injury
- Detrusor overactivity
- Intrinsic sphincter
- High blood pressure
- Chronic neurological disorder

**Outcome Measures:**

Assessment was performed at baseline (before starting of treatment) and after two weeks of study.

- Modified oxford scale

Modified oxford scale is a numerical rating used to quantify the power of pelvic floor muscle contraction.[18]

- Pelvic floor impact questionnaire

It is a health related quality of life questionnaire for women with pelvic floor conditions to fill out.

**Procedure**

Total of 42 participants were selected according to inclusion and exclusion criteria and the participants

were explained about treatment safely and simplicity of the procedure and written consent form was obtained. Subjects willing to participate were randomly allocated into two groups. Group A(n=21), Group B(n=21), Hypopressive group and Kegels group. All subjects underwent pretest measurement with modified oxford scale and pelvic floor impact questionnaire in beginning of the treatment.

**Group A: Hypopressive Exercise:**

**Exercise 1: Hypopressive Exercise In Sitting,**

1. Sit comfortably with an erect spine.
2. Breathe in slowly by fully stretching your ribs, then release entirely all of the inhaled air.
3. As no amount of air is left in, do not inhale. Block the passage of air thus the air may not enter or exit.
4. In the early stages, we can also perform the exercise by sealing our mouth and nose with our hands.

Now, open your ribs and take a deep breath. Your organs will be sensed through your ribcage. Hold this stance for four seconds before breathing in and relaxing.

**Exercise 2: Hypopressive Exercise In Standing,**

1. As the subject is standing, ask them to bend forward by slightly bending your knees.
2. Take a long breath as you breathe in followed by breathing out.
3. Once the air inside is let out, pull the pelvic muscle and as well as abdomen inside while holding the breath as long as possible.

These pelvic exercises enhance back posture, which aids in the prevention of back discomfort.

**Exercise 3: Hypopressive Exercise In Lying,**

1. Lie down on your back in a position where knees are slightly bent.
2. Hands are casually placed parallel to the body, then breathe in and out normally at the initial stage for relaxation.
3. Shrink your pelvis muscle but sucking or pulling it inside towards the spine.
4. At starting this contraction can be held for 20 to 30 seconds later the time can be gradually increased according to the efficacy of the subject.
5. Stay in this position as long as possible without breathing.
6. At the end, fill the lungs with air and the subject can begin to relax and continue their normal breathing.

**Exercise 4: Hypopressive Exercise In Kneeling On The Floor,**

1. In this position of hypopressive the exercise is done in a four-point position.
2. In a four-point position the hand is placed on the floor, bending the back along with knees on the floor.
3. Now, breathe out and release the complete air from your belly as much as positively and hold your breath.

These exercises can be performed for 20 mins to 1 hour, 3-5 times a week.

A decrease in pelvic organ prolapse can be seen if the exercise is continuously done for 20 minutes a week. And waste reduction can be seen for about 2 to 10 cm.

**Group B: Kegels Exercise**

Kegels exercise helps to strengthen the pelvic muscles, which aids for conditions like pelvic organ prolapse, urinary incontinence, stress incontinence, bowels and bladder function.

Kegels exercise can be performed by lifting, holding and squeezing the muscles of the pelvic floor. Once the exercise is started, time can be gradually increased according to the efficacy of the subjects, at least two to three sets of exercise can be performed in a day.

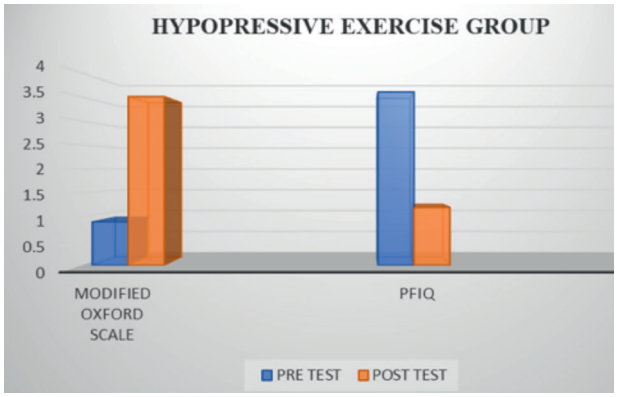
**Steps To Do Kegels Exercise:**

1. The subject is asked to locate their pelvic muscles correctly; the location can be identified by methods like squeezing pelvis while peeing. By inserting a finger into vagina, the pressure can be felt in the fingers.
2. Ask subjects to start the exercise, instruct them to tighten the pelvic floor muscles for 3 seconds, and follow up by relaxing for 3 seconds. This is called one Kegel.

3. Then repeat it for 10 times, which is known as a set.
4. These sets can be done in the morning as well as at night.

5. If the subjects are well versed in doing, the number of sets can be increased. For e.g., instead of holding kegels for 3 seconds it can be increased for 5 seconds.

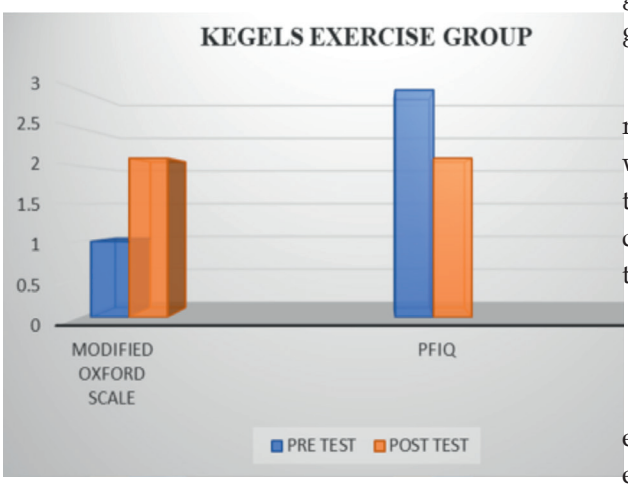
**Data Analysis Hypopressive Exercise Group**




**Graph No- 1**

INTERPRETATION: Graph No.1 shows that the values are extremely statistically significant.

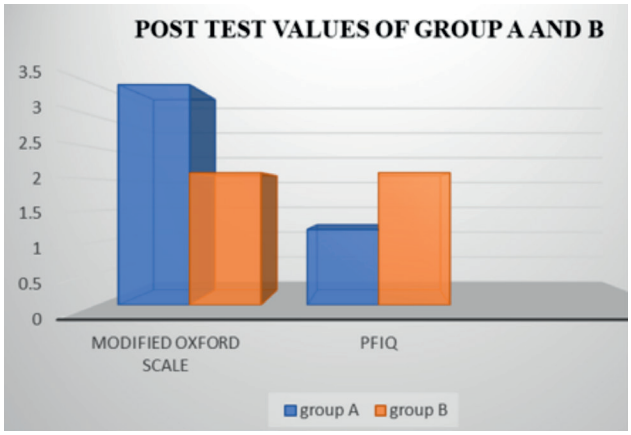
**Kegels Exercise Group**




**Graph No- 2**

INTERPRETATION: Graph No. 2 shows that the values are extremely statistically significant.

**Post test values both group**




**Graph No-3**

INTERPRETATION: Graph No.3 shows that the value is extremely statistically significant

## Result

The subjects were selected according to the inclusion and exclusion criteria and informed consent form was obtained from all the subjects. Subjects were assigned into two groups. The Hypopressive group consisted of 21 subjects who received. Hypopressive exercise and Kegels group consisted of 21 subjects who received Kegels exercise.

The modified oxford scale post-test mean values in Hypopressive group were 3.50, while it was 2.10, in the Kegels group. This indicates that Hypopresive group were significantly higher than then Kegels group, with a p value of <0.001.

The pelvic floor impact questionnaire posttest mean values in the Hypopressive group were 1.20, whereas 2.10 in the Kegels group. This indicates that Hypopressive group pelvic floor impact questionnaire values were significantly higher than the Kegels group with a p value <0.001.

## Discussion

The purpose of this study was to find the effectiveness of Hypopressive exercise and Kegels exercise for pelvic organ prolapse among spontaneous vagina delivery.[16]

Pelvic organ prolapse is when one or more organs of the pelvis slip down from their normal position and bulge into vagina. Pelvic organs include the bladder, uterus, vagina, prostrate, rectum.[17]

Beneficial effect was significantly greater in Hypopressive exercise than Kegels exercise. Statistical analysis of Hypopressive exercise group and Kegels group by using modified oxford scale has p value of less than <0.001 were considered statistically significant. The statistical analysis of Hypopressive exercise group and Kegels exercise group by using pelvic floor impact questionnaire has p value <0.001 were considered as statistically significant.

Kari Bø et.al (2023) has concluded that while accessing the subjects with pelvic organ prolapse the Hypopressive exercise shows significant benefits, there are few RCTs assessing the effects of other exercise programs beside Hypopressive for pelvic organ prolapse.[6] To date, there are no other exercise programs +that are more effective than Hypopressive for pelvic organ prolapse.[9]

Sao Paulo Med et.al 2012 has concluded that, in their study they looked at 58 women with pelvic organ prolapse before and after Hypopressive exercise. Between the ages of 50 and 60, women's muscular mass decreases significantly (10% to 16%).[10] There is also a decrease in cross section area, fat and connective tissue infiltration in muscle, the size and number of muscle fibers, and the number of motor units. Given the ages of the patients in this study, it could be assumed that the levator ani muscles of these ladies had become weak and atrophied. Physiotherapy significantly enhanced the cross-section area of the levator ani muscle in women with pelvic organ prolapse. Both Hypopressive exercise and pelvic floor workouts improve the levator ani muscle.

Shameka Mitova et.al (2022) has concluded that Hypopressive postural techniques result in a significant increase in the abdominal and pelvic muscle strength of the women in the groups to which they are administered. – EGs 2 and 3. The combined methodology is much better and superior results in all metrics in the group of women who utilized it. In turn, dramatically improves both muscle function and prolapse.[7]

Molina-Torres G, et.al (2023) Feb has concluded that, following an 8-week intervention with hypopressive exercises, there is a reduction in pelvic floor dysfunction and related symptoms. Furthermore, there is an improvement in pelvic floor muscular contractility, as well as a reduction in the severity and symptoms associated with pelvic organ prolapse.[12] The goal of this research was to see how an 8-week supervised hypopressive exercise training regimen affected pelvic floor muscle strength and urine incontinence symptoms. These findings support previous research, which found an improvement in pelvic organ prolapse after a 12-week hypopressive exercise program, as well as improvements in pelvic floor muscle contraction, urinary incontinence tone, body image, and sense of well-being, with high satisfaction with the intervention after a 2-month hypopressive exercise programme.[14]

## Conclusion

According to the study, Hypopressive exercises and Kegels exercise both reduces pain and increases pelvic floor function and improves pelvic organ prolapse. The findings suggest that the Hypopressive exercise is more beneficial than Kegels exercise in reducing pain and enhancing functional activities for pelvic organ prolapse among spontaneous vagina delivery.

**Ethical clearance:** Taken from institutional ethical committee. 03/086/2022/ISRB/SR/SCPT.

**Funding:** Self

**Conflict of interest:** Nil

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Original Article

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# Effectiveness of Multidirectional Stepping Training on Balance among Geriatric Population

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**Abstract**

**Background:** In order to perform an activity that requires an upright posture, balance is a complex process that involves receiving and integrating the sensory inputs as well as planning and carrying out movements. Falls are frequent among elderly people. An example of home based aerobic activity is multidirectional stepping training.

**Purpose:** To find out the effectiveness of multidirectional stepping training on balance among geriatric population.

**Materials and Methods:** From November 2022 to April 2023, 200 participants were recruited from the Sai Chai Physio Centre, with only 82 participants selected based on inclusion and exclusion criteria.The subjects were separated into two groups: Group A (n=41) and Group B (n=41).Group A received multidirectional stepping training, whereas Group B received conventional exercise.Both the interventions were given for four weeks, three times a week for 40 minutes.

**Results:** The findings indicated that both the groups showed statistically significant improvement after the interventions in scores of fall efficacy scale and Balance outcome measure for elderly rehabilitation($p<0.005$). Multidirectional stepping training showed statistically significant improvement in both the measures.

**Conclusion:** When compared to conventional exercise, multidirectional stepping training is more effective at improving balance.

**Key Word:** Balance, multidirectional stepping training, Geriatric, Fall, Fall efficacy scale.

## Introduction

The phenomenon of aging, which is described as a dynamic, continuing, and irreversible flow of life linked to biological, psychological, and social elements, affects all people.[1] Additionally, according to the World Confederation for Physical Therapy (WCPT), Every year, one in three people over the age of 65 risk falling.[2] In order to perform an activity that requires an upright posture, receiving and integrating sensory information as well as planning and performing movements are all important parts of the complex process of balancing.[3] Falls are frequent

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among elderly people.[4] Older adults have less functional fitness, which affects their ability to balance, move with agility, and maintain muscle strength.[5] The senior population consequently develops a fear of falling and adopts an inactive lifestyle, which causes severe muscle atrophy and a reduction in lower extremity strength.[6] It has been recommended that for balancing exercises to be effective, the base of support should be reduced, upper limb support should be minimized, and weight shifting exercises like stepping should be included.[7]

An example of a home-based aerobic activity is Multidirectional stepping training.[8] This exercise was created in Japan by Shigematsu and Okura and was approved for use in homes.[9] Multi Directional stepping training involves walking from one side of the mat to the other while following the protocol's basic patterns. Multidirectional stepping training entails a variety of motions in several directions. It is done on a thin mat (100 × 250 cm) divided into 40 squares of 25 cm each. The Multidirectional stepping training exercise appears to be decreasing the chance of falling and enhancing balance. Square Stepping Exercise stimulates the sensorimotor system. The advantage of SSE goes beyond preventing falls, as it also enhances lower body fitness and functional ability.[10] Traditional balancing training exercise that emphasizes flexibility and postural control while building strength and endurance has been shown to be useful in enhancing functional capacity and lowering fall risk in elderly people.[11]

## Aim

To find out the effectiveness of Multidirectional Stepping Training on balance among geriatric population.

## Material and Method

This study was conducted with a total number of 200 subjects (geriatric population) were recruited out of which 82 subjects were chosen based on inclusion criteria and exclusion criteria. This study was conducted at Sai Charan Physio Centre. Activity Specific Balance Confidence Scale Questionnaire sheets were given to the elderly people and those who had moderate levels of physical functioning were included.The study period was performed from November 2022 to April 2023.

**Materials Required:**

Multidirectional Stepping Mats, Chalk, Stop Watch, Foot Stool, Chair.

**Inclusion Criteria**:

- Elderly persons over the age of 65 years who walk independently and without the use of walking aid.
- Activities Specific Balance Confidence scoring 50%-80%.
- Those who are leading sedentary lifestyle
- Both male and female are included.

**Exclusion Criteria:**

- Patients having a history of any neurological condition, musculoskeletal dysfunction, or other disorders that could impair balance (such as CVA, Parkinson's disease, or vestibular disorder), as well as joint replacements.
- Patients with unstable cardio respiratory conditions that may interfere with training.
- Patients who have been diagnosed with vision or hearing loss.
- Patients with recent surgeries or fractures.

**Outcome Measure**:

Evaluation of balance and fall prevention before and after the treatment protocol is done by using Fall Efficacy Scale International assess fear of fall in the elderly. Individuals are asked to rate their concern about when undertaking 16 tasks, there is a chance of falling.Balance Outcome for Elderly Rehabilitation evaluates elderly people's functional ability and standing balance. It includes four assessment that is timed up and go test, functional reach test, step test, test of static standing with feet together and eyes closed.

**Procedure**

All the subjects were informed about the terms of the experimental protocol and procedures before giving their consent. The subjects were divided into two groups, Group A (n=41) performed multidirectional stepping training and Group B (n=41) performed conventional exercise. All the subjects were assessed with fall efficacy scale and

Balance Outcome measure for Elderly Rehabilitation as a pre test and post test at the 4 weeks of the following intervention

**Group A: Multidirectional Stepping Training:**

- Subjects performed the exercise for a duration of 40 minutes which included 5 minutes of warm up, 30 minutes of multidirectional stepping exercise, 5 minutes of cool down activity for three sessions a week for four weeks. It included elementary pattern, intermediate pattern, advanced pattern.
- Practice for multidirectional stepping using a thin felt pad that has been divided into 40 squares of 25 cm each, measuring 100 x 250 cm.
- The subjects had to make their way from one end of the mat to the other by going through the prescribed steps.
- After completing the training mat, subjects were encouraged to exit normally and return to their starting locations, where they would line up for the following step.
- The forward, backward, lateral, and oblique step patterns were all incorporated in the multidirectional stepping training pattern.
- After being acquainted with each of these step patterns, the subjects were taught to walk with their heels lifted, that is, on their toes, rather than on the square frames.
- Every step pattern was repeated four to ten times. Initially, each step pattern took 15-20 seconds to complete, although each pattern took only 15 seconds.
- Warm-up before performing joint motions in all planes, warm-up exercises have been given for the biceps, triceps, flexors of the forearm, wrist, and fingers as well as lower limb hamstrings, quadriceps, and gastroc soleus muscles.

The execution rhythm slows down as you cool down. Slowly moving, swinging the legs while standing, extending the trunk and lower limbs, and relaxation exercises are performed.

**Group B: Conventional Exercise:**

Subjects performed conventional exercise for a duration of 40 minutes which includes 5 minutes of warm up and 30 minutes of specific exercises and 5 minutes of cool down activities.

**Sideways Walking:**

- Place the feet together and hold a small bend in your knees. Move one foot to the side initially and take a slow, controlled step in the opposite direction.
- Join it by moving the other step from one side of the room to the other or take 10 steps in each direction.

**Step Up and Step Down:**

- Hovering over hurdles (10 reps/two sets)
- Rise the right leg and join it by lifting the left leg. Retrace the steps to the starting location.

**Heel To Toe Walk:**

- Right heel should be squarely in front of the toe while standing erect. Continue the same with the left heel after that.
- Always maintain a forward-facing posture. Put fingertips up against a wall if need be for stability. Use your left foot to complete the movement again. Walk 20 steps in this direction.

**Toe Lifts:**

- This senior strength training exercise promotes balance as well. Place arms out in front of the therapist while standing upright.
- Lift up on the toes, then, slowly descend. Twenty times, raise and lower down.

**Single Limb Stance:**

- Hold the back of the chair with both hands. Slowly raise one leg off the ground. Maintain the balance for 5 seconds while standing on one leg.
- Return to the starting location and repeat 5 times more, increase the amount of time spent standing on one leg. Repeat with the opposite leg.

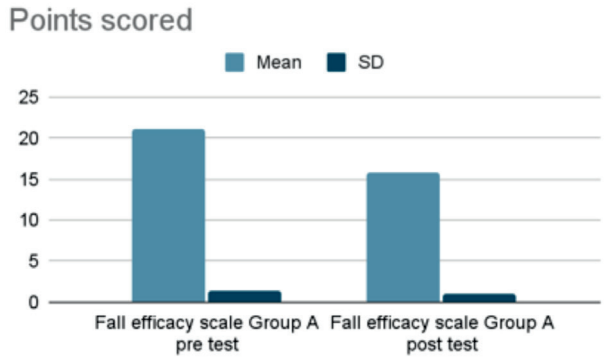
**Marching in a place:**

- For seniors, marching is a terrific exercise for improving balance

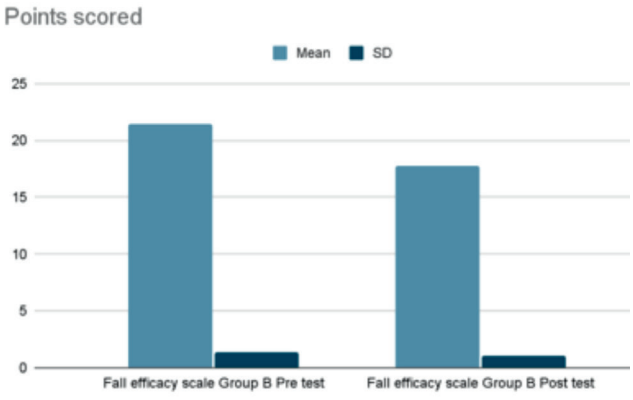
- Exercise in front of a counter, if you need to hold onto something. Keeping your right knee as high as possible, stand straight. Lift the leg after lowering it.
- Elevate and descend the legs 20 times.

**Data Analysis**

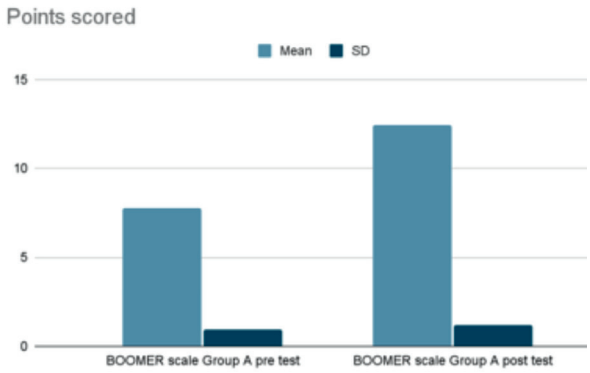
Using descriptive and inferential statistics, the collected data was evaluated. The mean and standard deviation were applied to all parameters. The Statistical Package for Social Sciences was used for statistical analysis. The non parametric test was done to compare groups. To compare the intergroup, the Mann –Whitney U test was utilized. To compare the within groups, the Wilcoxon Signed Rank test utilized $p<0.005$ was considered to be statistically significant.



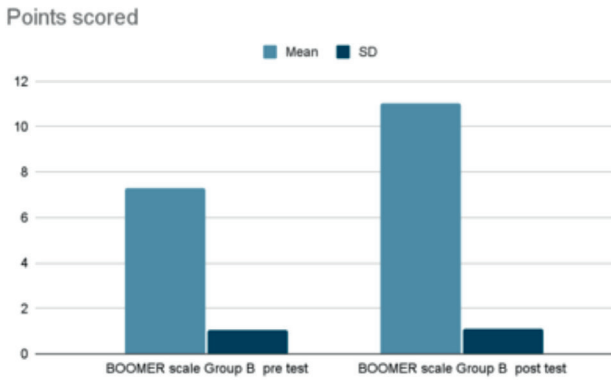

**Graph 1- Comparison of pre test and post test values Group A with fall efficacy scale.**



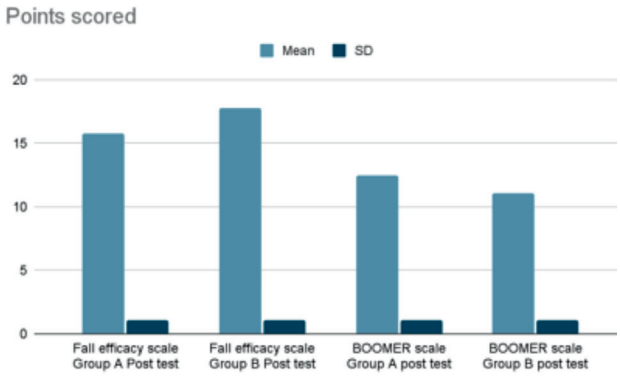

**Graph 2- Comparison of pre test and post test values of Group B with Fall Efficacy Scale.**




**Graph 3- Comparison of pre test and post test values of Group A with Balance Outcome Measure for Elderly Rehabilitation Scale.**




**Graph 4- Comparison of pre test and post test values of Group B with Balance Outcome Measure for Elderly Rehabilitation**




**Graph 5- Comparison of pre test and post test values of Group A and Group B with Balance Outcome Measure for Elderly Rehabilitation and Fall Efficacy Scale.**

## Result

A quantitative data statistical analysis found a statistically significant difference in values between the Multidirectional stepping training group and the conventional balance exercises group.

Graph-1 compares the pre-test and post-test values of (Group A) Multidirectional stepping training using Fall Efficacy Scale. The mean value of the pre-test is 21.073, and the mean value of the post-test is 15.73. As a result, when the p- value <0.005, the findings are considered statistically significant.

Graph-2 Compares the pre-test and post test values of (Group B) conventional exercise using Fall Efficacy scale. The mean value of the pre test is 21.46, and the mean value of the post test is 17.780. As a result, when the p- value<0.005, the findings are considered statistically significant.

Graph-3 compares the pre-test and post-test values of (Group A) Multidirectional Stepping Training using Balance Outcome Measure for Elderly Rehabilitation. The mean value of the pre test is 7.78, while the mean value of the post-test value is 12.43. As a result, when the p-value<0.005, the findings are considered statistically significant.

Graph-4 compares the pre-test and post-test values of (Group B) Conventional Exercise using Balance Outcome Measure for Elderly Rehabilitation. The mean value of the pre-test is 7.31, and the mean value of the post test is 11.048. As a result, when the p-value is, the findings are considered statistically significant.

Graph-5 Compares the post test values of Group A and B, revealing that the mean value of Group A was 12.43 using Balance Outcome Measure for elderly rehabilitation, whereas Group B mean value was 11.048 using Balance Outcome Measure for Elderly Rehabilitation. The post-test value of Group A was 15.73 using Fall Efficacy Scale, whereas the Group B mean value was 17.78 using Fall Efficacy Scale. As a result, the findings are considered statistically significant when p-value<0.005. This shows that Multidirectional stepping Training shows effective results than Conventional Group.

## Discussion

Achieving a goal that requires an upright posture requires planning and executing a movement while also receiving and integrating sensory inputs.[3] The study's goal is to determine the effectiveness of Multidirectional Stepping training in improving balance and preventing falls among geriatric population. This study provides the signs of improved balance and reduced fear of falling and its risk factors among geriatric population. The results showed a beneficial impact on enhancing balance and preventing falls in the older population.

In 2013, a study by Teixeira et.al indicated that elderly people who practice multidirectional stepping enhance their balance and cognitive function.[12] In the view of this finding we decided to instruct the geriatric population with multidirectional stepping Training in order to improve balance and prevent fall among them.

In 2022, S.Khan et.al undertook a study on square stepping exercises and foam stability exercises on falls in community dwelling elderly indicated that foam stability exercises were less efficient than square stepping exercises for preventing falls in elderly people which was carried out for 4 weeks and 5 days a week.[13] With comparing the above study, it can be said that multidirectional stepping training is more efficient and safe in improving balance and preventing fear of fall when it was given for 4 weeks and 3 sessions a week with subjects of 41 in each group.

According to Jessica et.al study, certain aspects of functional mobility appear to be improved by activating synergists and agonists of locomotion muscles, which in turn affects the improvement of mobility.[10] Furthermore, it is said that SSE is a low-intensity exercise that focuses on functional mobility, reducing the likelihood of falling. This mechanism may account for the SSE group's lower rate of falls than the Walking group's, as the former appears to have sufficient functional fall-prevention capacity. From our study findings, the results from fall efficacy scale and Balance outcome measure for elderly rehabilitation indicated that multidirectional stepping training is more efficient than conventional exercises because multidirectional stepping training

is a promotion of public health and rehabilitation simply requires inexpensive, low-tech equipment. SSE on the square stepping mat helps coordination while also providing visual feedback by indicating the number patterns to be followed. Due to the use of low-tech equipment, multidirectional stepping training requires less investment. Furthermore, because of the multidirectional Steps forward, backward, lateral, and oblique, the synergist and agonist leg muscles are better stimulated during SSE. Conventional exercise includes toe lifts, marching in a place, heel to toe walk, step up and step down, calf stretch whereas multidirectional stepping training involves movement in multiple directions. Therefore it can be said that multidirectional stepping training improves balance and prevents fall improves functional fitness and quality of life.

## Conclusion

This study revealed that multidirectional stepping training can enhance balance and reduce fall risk factors among geriatric population. Multidirectional stepping training is a safe, low-cost and practicable exercise alternative to conventional exercise, with a positive influence on improving balance and reducing fear of falling in the senior population. As a result, multidirectional stepping exercise increases lower extremity muscle strength balance, improves quality of life, and leads to fall prevention in the older population.

**Ethical Clearance:** The ISRB Committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations.(Application Number 03/087/2022/ISRB/SR/SCPT)

**Funding:** This study is a self-funded study.

**Conflict of Interest**: The author states that there is no conflict of interest.

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Original Article

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# Comparison of Yoga Asana along with Aerobic Exercise and Aerobic Exercise alone for Dysmenorrhea among College Students with Polycystic Ovarian Syndrome

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**Abstract**

**Background:** Dysmenorrhea is a distressing sensory and emotional experience that occurs usually in the region of the lower abdomen. Polycystic ovarian syndrome (PCOS) is the syndrome in which the ovaries create excessive production of androgens that are typically present in women at a minimal level. This study compares the effect of yoga on PCOS with dysmenorrhea in women of reproductive age using the McGill pain questionnaire and WaLIDD score.

**Purpose:** The purpose of the study is to determine the effectiveness of aerobic exercise and yoga asana for dysmenorrhea among college students with polycystic ovarian syndrome.

**Materials and Methods:** This experimental study has been conducted from December 2022 to May 2023 which included 150 girls (18 to 25 years old) who were screened for PCOS and 98 girls who willingly filled out a Google form to the female college students, Based on the inclusion criteria, 50 people took part and were separated into two groups: one group is given aerobic exercise with yoga, while the other group is given only an aerobic exercise. The treatment is for 60 minutes and 5 days per week is given and continued for 12 weeks. The pre-test and post-test were taken. The values were tabulated and statically evaluated.

**Result:** the results revealed that the addition of yoga along with aerobic exercise results in 70-80% of the women being beneficial for managing the dysmenorrhea and PCOS which are statistically significant with a p value of 0.0001.

**Conclusion:** The study shows that yoga asana with aerobic exercise for PCOS students is more beneficial in lowering the risk of dysmenorrhea than aerobic exercise alone.

**Key words:** PCOS, dysmenorrhea, female college students, aerobic exercise, yoga asana.

## Introduction

One of the most prevalent causes of pelvic discomfort and menstrual problems is dysmenorrhea, which is defined as the occurrence of unpleasant uterine cramps during menstruation. The international association for the study of pain

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defines it as "an unpleasant sensory and emotional experience associated with actual or potential tissue damage.[1] This type of pain normally occurs in the lower abdomen, but if it is chronic, the pelvis is prominently involved.Dysmenorrhea has been divided into two categories: primary and secondary. Primary dysmenorrhea does not involve or are related with underlying causes, however secondary dysmenorrhea can be identified by some particular underlying reasons. Typically, it results in disorders in the reproductive system.[2]

The occurrence of dysmenorrhea is ranging from 40 to 90 percent among the college population and the prevalence of chronic pelvic pain is also reported which ranges from 17% to 80%. There are several other factors also linked in these studies with dysmenorrhea, such as a high body mass index (BMI), smoking, Menarche at a young age, the menstrual flow that lasts a long time, and psychological distress or disturbances.[3] but the true prevalence of primary dysmenorrhea are still unknown.In India it has been established 33.5 percent of women suffer from dysmenorrhea, especially adolescent girls. The conditions which cause Endometriosis, uterine fibroids, and uterine adenomyosis are secondary dysmenorrhea situations where intrauterine devices, certain malignancies, and uncommon illnesses including uterine infections may also be impacted.[4] Prostaglandins and leukotrienes are released as a result of the accumulation of omega-6 fatty acids during menstruation, and it is induced by prostaglandins. So,the blood supply to the uterus is constricted which can result in pain and gastrointestinal symptoms. To prevent ovulation, certain birth control pill varieties can alleviate the manifestation of dysmenorrhea.

Dysmenorrhea is not a life-threatening condition, it can significantly affect a woman's daily life. She might miss work or school, but also be unable to take part in sports or other activities, which might add to her emotional distress. This is especially true for young women in their teens and early 20s.

According to data from a massive survey carried out throughout India in 2020, approximately 16% of Indian women between the ages of 20 and 29 had polycystic ovarian syndrome. Medical experts know that genetic and environmental factors play a role in the development of PCOS.[5] Because the symptoms frequently run in families, and it is believed to be partially genetically driven. And also, this condition has been associated with insulin resistance and obesity, despite the reality of the cause is unknown. Excess insulin causes the ovaries to produce androgens, which can lead to anovulation with higher-than-normal levels of androgens and possibly lower-than-normal levels of oestrogen. Androgen levels that are too high can affect the interference of brain signals that cause ovulation to occur. And other symptoms include abnormal hair growth, acne, pelvic pain, and acanthosis in Nigerians, Enlarged ovaries with small cysts, etc.

So the future moms of society are likely to be college students, who represent a homogeneous group population. Atypically, these students could seem healthy and not be aware that they have PCOS until after marriage when they get to know the difficulties of getting pregnant Regular exercise in PCOS patients can improve metabolic and reproductive management in addition to weight loss. Studies suggested that to completely understand the process behind the association between dysmenorrhea and PCOS.

With the goal of bringing the body and mind into harmony, yoga is a psycho-physiological system of therapy that can improve one's physical, mental, and spiritual health. Some of the yogic postures are all emphasized in this holistic lifestyle approaches.[6]

Numerous studies have suggested that yoga can help to lessen premenstrual symptoms and dysmenorrhea. According to a study using a mixed-method approach, yoga may help lessen both the amount and the severity of pain experienced during menstruation·certain studies indicating that it can help reduce premenstrual symptoms and period discomfort caused by dysmenorrhea.[7] A recent study concluded that practicing yoga can also lessen premenstrual symptoms and discomfort.[8] It also implies that, even though it may be able to treat severe menstrual disorders like PCOS, getting a regular period may be more helpful for those who are experiencing irregular menstruation. Additionally, experimental research is needed to verify the results of this study.

## Aim

The aim of the study is to determine the effectiveness of aerobic exercise and yoga asana for dysmenorrhea among college students with polycystic ovarian syndrome.

## Materials and Methods

**Subjects:** dysmenorrhea with PCOS students.

**Sampling Technique:** Convenient sampling.

**Sample Size:** 50 Samples.

**Selection Criteria:**

**Inclusion Criteria:**

1. Female population between the ages of 17-25.
2. Diagnosed with PCOS condition.
3. Irregular periods until 2 months.
4. quality of menstruation
5. presence or absence of dysmenorrhea
6. Any PMS Symptoms.

**Exclusion Criteria:**

1. any endocrine disorders
2. chronic disorders
3. any major surgeries
4. H/o any cardiac or pulmonary diseases were excluded.

**Outcome Measure:**

**McGill Pain Questionnaire (MPQ):** Patients with a variety of diseases can self-report questionnaires. They have three elements: sensory intensity, the cognitive and emotional impact. It is made up of 78 words and scores range from 0 (no pain) to 78 (severe pain)[17].

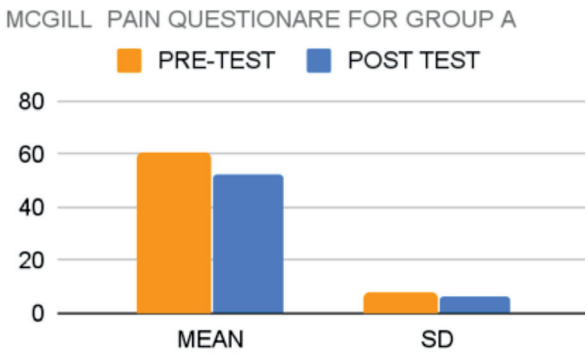
**WALLID Score:** The instrument which is used to diagnose dysmenorrhea includes information of three frequently used criteria: days of pain, workability, and anatomical region of pain location. Scores are evaluated by 0 denotes no dysmenorrhea, 1-4 denotes mild dysmenorrhea, 5-7 denotes moderate dysmenorrhea, and 8-12 denotes severe dysmenorrhea[18].

**Procedure**

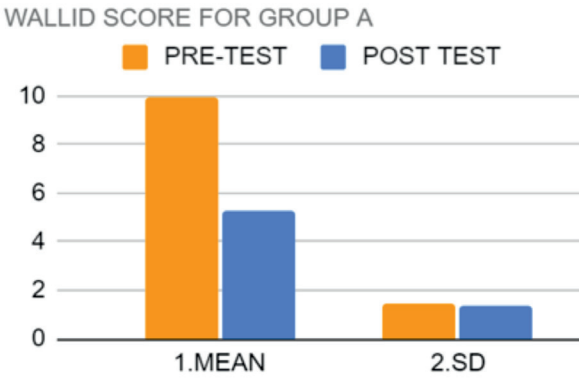
The study has been conducted from December 2022 to May 2023, in Saveetha university, Thandalam, Chennai, INDIA.The study was explained to the female subjects. Based on that, 150 girls were screened and the 98 interested candidates voluntarily filled the given questionnaire for identifying the population with the condition of dysmenorrhea with PCOS. Based on the inclusion criteria 50 candidates were selected and signed the consent form for the study. Once the consent was finalized the group of subjects was divided into two groups. Out of 50 subjects, each group had 25 people, group A underwent aerobic training for 60 minutes per day per week for 12 weeks, while group B underwent yoga asana with aerobic exercise for 60 min / day per week for 12 weeks. Pre-test and post-test values were measured using the McGill pain questionnaire and WaLIDD score. Yoga Sana with aerobic exercise group has been treated which includes Ardhakati chakra Sana -30sec with 6 rounds, Kati chakra Sana -10 to 20 times in a cycle, Malasana - holds up to 30 sec, Vajrasana for 5 to 10 minutes, Baddhakonasa-20 secs,Viparaitakanni-5mins, Bhujangasana -15 mins, balasana 30 secs, Kapalabhati pranayama – 3 rounds with 5 forceful expirations and suptha baddha konasana -15 mins along with aerobic were marching, single step touch, knee lift, leg curl given for all about 60 mins. Another group receives aerobic exercise with the intensity of six episodes of 10 mins each, by a 15 mins active rest period totalling 20–60 minutes of aerobic (interval exercise at moderate to high intensity), done during maximum or submaximal activity. Exercises like Running, walking, jogging, Marching, single step touch, knee lift, leg curl, lunges side and back, were given. The post test was measured in the same manner as the pre-test measurements were taken.

**Data Analysis**

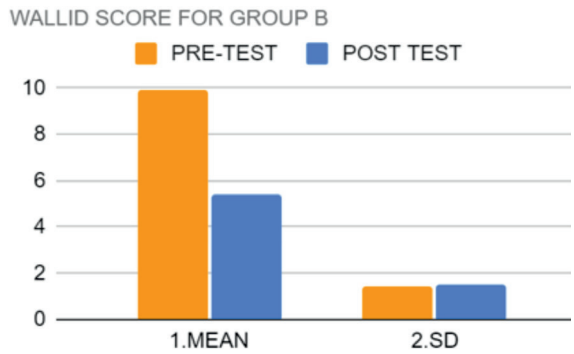
In this study, paired t tests were used for analysing pre and post-test values of individual groups. Whereas, unpaired t test was used for analysing post-test values of individual groups.



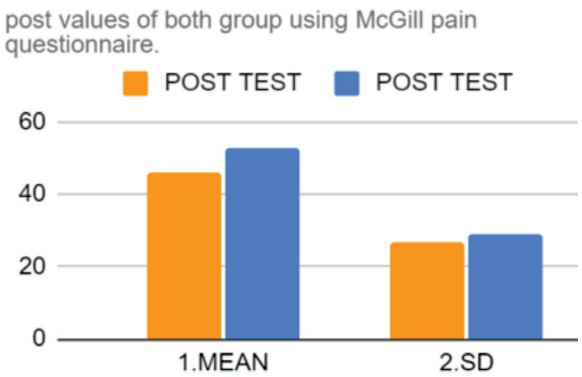

**Graph 1-a paired test for group A**



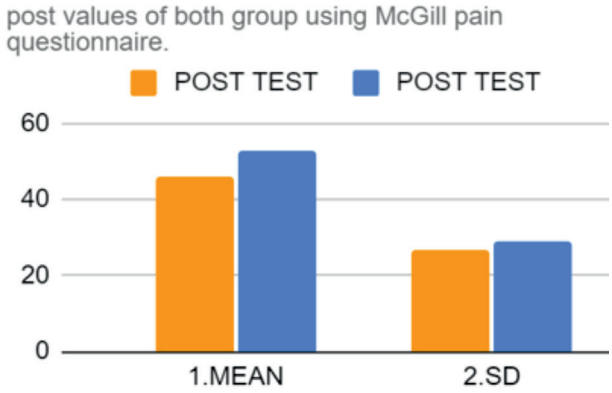

**Graph 1-b paired test for group B**



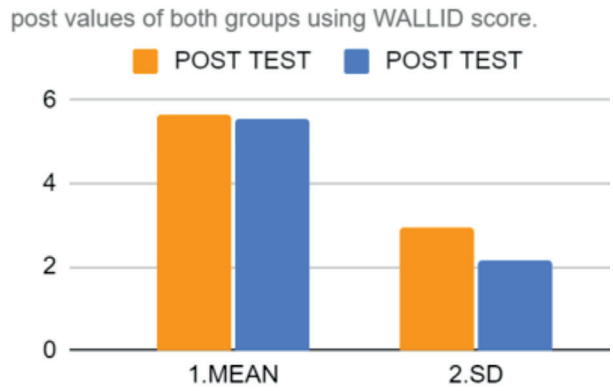

**Graph 2- a paired test for group A**




**Graph 2-b paired test for group B**




**Graph 3-a post values of both groups using McGill pain questionnaire.**




**Graph 3-b post values of both groups using WALLID score.**

## Results

According to the study review, the progression of aerobic exercise with yoga asana results in 80-90% of the people obtaining maximal voluntary contraction and also stretching from maximal or submaximal exercise testing, which is extremely effective in the treatment. However,aerobic training provides a lower base on perceived exertion or sub minimal voluntary contraction. So, statistical analysis of the quantitative data indicated statistically significant differences in the both groups. Comparing the pre and post-test value of experimental group, showing that pre-test value of McGill 60.16 was decreased 52.1 to in post-test and using the WaLIDD scale the pre-test value 9.96 also decreased into 5.28 at post, with a p value of 0.0001(graph 1-a&graph 1-b). (graph 2 -a & b) shows that the pre and post-test value for control group, the pre-test value of McGill of 61.1 is reduced into 46.2 and in WaLIDD scale pretest value 5.65 is

reduced into 5.36, with a p value of 0.0001. Compare the control and experimental group of post-tests, (graph 3-a and graph 3-b) shows that the McGill scale value is 52.93 and the WaLIDD scale experimental value 5.63 is reduced to. 5.56. As the result, it can be said that they are statistically significant with a P value of 0.0001.

## Discussion

This study examined the effects of aerobic exercise, yoga asana with aerobic exercise in college students with PCOS, and the intervention for each group lasted for 12 weeks and 50 students were divided into two groups: 25 underwent aerobic exercise and another 25 underwent aerobic with yoga asana. The result of the study, evaluated mean; p value by the post values. These values were considered to be extremely statically significant. These differences indicated that yoga with aerobic exercise was highly beneficial compared to aerobic exercise .

In the recent study, they looked into the causes of significant pain in female PCOS students with primary dysmenorrhea. According to another research, PCOS is a predictive factor in endometrial cancer for women who are treated with Progestin. Some studies, said that coffee consumption was an important risk factor for dysmenorrhea the finding is consistent with the finding that women with long menstrual cycles are at a higher risk of dysmenorrhea.[9] The study by Muluneh et.al results that physical activity was a protective factor for the development of dysmenorrhea.[10] review study by Geenen et.al who discovered that several physical activities, including Pilates, may be beneficial for managing pain and QoL improvement in individuals with severe pain.[11] Recent study on the treatment preferences of girls with dysmenorrhea, the results showed that 12 percent of participants were from outside Japan who were affected by PCOS.[12] According to some research, Fernández-Martínezet.al the prevalence of dysmenorrhea declines with age, suggesting that the incidence of primary dysmenorrhea peaks in late adolescence by the 20s and then declines with age.[13] Similarly, BMI with dysmenorrhea were observed in a few studies. But results of the current study show no link to BMI.[14]One of the findings says that age of menarche is a significant factor in which the number of girls between the ages of 12 and 15 were taken.[15] According to Aganoff and Boyle's study on the impact of aerobic exercise on menstrual cycle symptoms, regular aerobic exercise can improve both mood and physical relaxation.[16]

## Conclusion

To summarize, dysmenorrhea in PCOS is found to be extremely common among female college students. The findings suggest that yoga practices can offer additional benefits and potentially enhance the overall outcomes for women with PCOS and so, study concluded that the effect of aerobic training with yoga for PCOS students is more effective in lowering the risk of dysmenorrhea than the aerobic exercise training.

**Ethical Clearance:** Taken from the institutional ethical committee.

(ApplicationNo.:03/088/2022/ISRB/SR/SCPT).

**Conflict of interest:** Nil.

**Funding:** self.

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Original Article

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# Comparing the Effect of Swiss Ball and Mckenzie Exercise among Football Players with Non-Symptomatic Anterior Pelvic Tilt

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**Abstract**

**Background:** The anterior pelvic tilt is characterized by ASIS rotating inferiorly in relation to the PSIS or being positioned lower than the PSIS in the sagittal plane. When compared to non-athletes, football players are more likely to have a higher anterior pelvic tilt angle. The anterior pelvic tilt experienced by football players may make them more prone to musculoskeletal problems.

**Purpose:** This study is intended to compare the effects of Swiss ball and McKenzie exercise on a sample of football players who have an anterior pelvic tilt without any symptoms.

**Materials and Methods:** 30 Subjects who were selected in the stadium under Shai physio clinic based on inclusion criteria. They were divided equally among two groups. Group A (n=15) subjects were managed with Swiss Ball exercise and Group B (n= 15) subjects were managed with McKenzie exercise. The subjects were evaluated using Angulus ROM software. Study period:October 2022 to June 2023.

**Results:** In Group A (Swiss Ball), the post-test mean value was 10.80 (2.27), significantly lower compared with Group B (Mckenzie Exercise), 16.33 (3.04). This demonstrates the correction of excessive anterior tilt among football players in Group-A following Swiss Ball Therapy. However, the subjects in both groups were found to have a significantly decreased anterior tilting of the pelvis now exists following the interventions in Group A (Swiss Ball) and Group B (Mckenzie Exercise).

**Conclusion:** According to the present study's findings, participants with anterior pelvic tilt responded well to both the interventions. Nonetheless the subjects who used a Swiss ball exercise were found to have correction in anterior pelvic tilt more quickly than those who performed the McKenzie exercise.

**Key Word:** Exercise, Football, Pelvis, core stability

## Introduction

The term "pelvic tilt" in research often is rarely used to describe frontal plane pelvic motion, the term can also refer to the position or Pelvis mobility in the sagittal direction.[1,2] A horizontal line and a line separate the posterior superior iliac spine (PSIS) from the anterior superior iliac spine (ASIS) in the sagittal plane. Generate what is known as

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a pelvic tilt, a common angle in physical therapy parameters.[3,4] The anterior pelvic tilt is characterized by ASIS rotating inferiorly in relation to the PSIS or being positioned lower than the PSIS in the sagittal plane.[5] The anterior pelvic tilt, also known as forward rotation, causes an increase in lumbar lordosis in the pelvis and is thought to be linked to several common musculoskeletal diseases. Additionally, there is a connection between diminished core stability and anterior pelvic tilt, hence core strength has been evaluated by the degree of anterior pelvic tilt.[6] The literature does not specify a clear cut-off threshold for excessive anterior pelvic tilt, hence an anterior angle greater than 8 degrees is defined in this study.[7] When doing an athletic activity, core stability is the ability to properly retain the trunk in the upper pelvic position producing, transferring, and controlling force and motion to the terminal segments.[8]

Swiss-ball core training has made its way from 1960s hospitals to modern-day gyms. Here are some of the most well-liked trends in physical therapy and fitness in addition to strength. It is well known that the Swiss ball (also known as a gym ball) can be used as a training tool for core stability exercises in a recreational training environment.[9]

The McKenzie back exercises are a part of a protocol of exercises developed in the 1950s by physiotherapist robin Anthony McKenzie, who rose to fame in 1985.[10] Mechanical diagnosis (MDT) and therapy, another name for the McKenzie approach, is a well-liked classification system for the identification and treatment of several musculoskeletal problems.[11]

## Aim

The study is intended to compare the effects of a Swiss ball and McKenzie exercise on selected football players who have an anterior pelvic tilt without any symptoms

## Material and Method

Using inclusion and exclusion criteria, 30 football players were chosen in the Stadium under Shai Physio Clinic. Before recruitment of participants by the Institutional scientific review board 03/089/2022/ISRB/SR/SCPT approval was obtained. There are two groups made up of the participants. utilising the relevant sampling method. Study period: October 2022 to June 2023.

**Inclusion Criteria**:

1. football players who have been exposed at least twice a week for three months.
2. Age.: 18 to 25
3. Gender: Male
4. Anterior angle greater than 8 degree

**Exclusion Criteria:**

1. Subject with low back pain
2. Present or previous core strengthening experience
3. Current participation in any fitness program
4. History of fracture (spine, rib) or injury, a systemic illness, or disc or spinal pathology

**Outcome Measures:**

At the beginning of the study and four weeks later, assessments were carried out**.**

- Angulus ROM software (Goniometer based software) used to measure the pelvic angle.[12]

**Procedure**

In terms of the inclusion and exclusion criteria, participants were included. The individuals and their caretakers were educated well about the study and formal written informed consent was obtained. The participants were split into two groupsUsing the convenient sampling technique. The subjects were evaluated using Angular ROM software and the values were taken as pre- test measurements. After obtaining baseline measurement GROUP A (n=15) subjects were subjected to a Swiss ball programme and GROUP B (n=15) subjects were given McKenzie exercise. Subjects ask to come weekly 5 times for 4 weeks for a follow-up. Measurements of the Angulus ROM were done four weeks following the post-test.

**Group A: (Swiss Ball Exercise)**

Protocol: Training with a Swiss ball for 20 minutes, five days a week, for four weeks.

**Training Procedure:**

1. **Sitting on Swiss Ball With Both Arms Raising In The Sagittal Plane**.

Procedure: A participant was instructed to sit on a ball and lift either one or both arms.

2. **Sitting on Swiss Ball With 90 Degree Hip And Knee Flexed.**

Procedure**:** Asked to position themselves on a ball with their feet (heels & soles) on the ground, bend their hips and knees at a 90-degree angle, and hold their position for 20 seconds.

3. **Anterior / Posterior and Lateral (Right & Left Side) Pelvic Tilt**

Procedure**:**

STEP 1: Place your feet hip-width apart on the floor while seated on a Swiss ball. The feet should be immediately beneath the knees at a 90-degree angle.

STEP 2: To begin the exercise, inhale while rolling your tailbone forward, halt, and then roll back as you exhale. For 45 to 60 seconds, repeat this activity.

4. **Bird Dog Exercise Using Swiss Ball**

Procedure:

STEP 1: Place a Swiss ball under the abdomen as face laying down on it.

STEP 2: The exercise is to inhale deeply before lifting the subject's left arm and right leg.

STEP 3: Take a breath, then let it out as the person lowers them again. Move your arms and legs in succession.

5. **Plank on Swiss Ball**

Procedure:

STEP 1: Put the hands on the ground in front of you with the arms straight and at shoulder-width distance.

STEP 2: Place the legs on the ball by raising them. The shin should be in the center of the ball.

STEP 3: Maintain the plank position for 30 seconds at a time, and as you get more comfortable, extend your holds by another 30 seconds.

**Group B: Mckenzie Exercise**

Protocol**:** 3 sets of 10 repetitions. Depending on the patient's response, repetitions could be spaced out throughout the day or performed back-to-back with a little pause in between.

1. **Trunk Flexion:**

Lying Down*:*

The patient raises their knees towards their chest while flexing their hips and knees. The patient then uses their hands to apply further pressure.

Seated**:**

The patient bends forward while seated in a chair, flexing his or her hips and knees to a 90-degree angle. The patient's hands should be as close to the floor as they may be. The patient's trunk can be brought even closer to the knees by holding onto the ankles.

Standing:

In a standing position, the patient places their feet shoulder-width apart and lays their fingers on the tips of their toes while gliding their hands towards the ground and maintaining their knees extended.

2. **Trunk Extension**:

Lying Down:

The patient starts in a prone posture, with the palms of their hands resting immediately in front of their shoulders on the floor. The patient relaxes her pelvis and thighs while extending her elbows, lifting her upper body.

Standing:

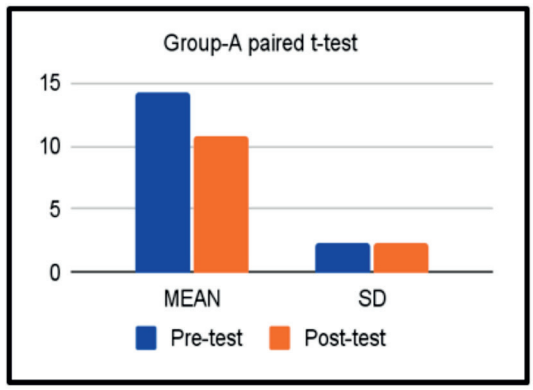
The patient places their hands at the base of their lower back with their fingers pointing down towards the ground. They then extend their trunks back as far as they can while maintaining their neck relaxed

3. **Lateral Shift**:

Standing With Upper Arm Support:

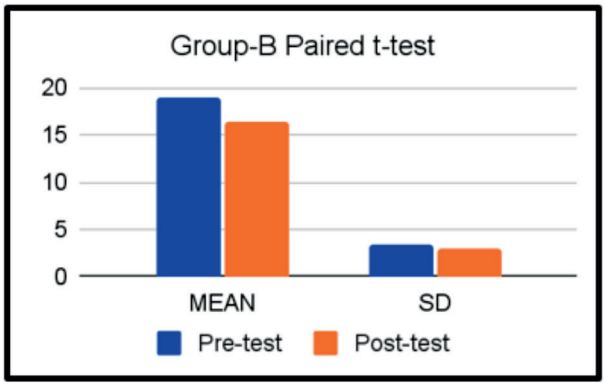
Place the feet shoulder-width apart, bend the upper arm at the elbow to 90 degrees, and place the hand on the side of the trunk. The patient physically transfers the pelvis to the other side using the hand supported by the upper arm.

**Data Analysis**



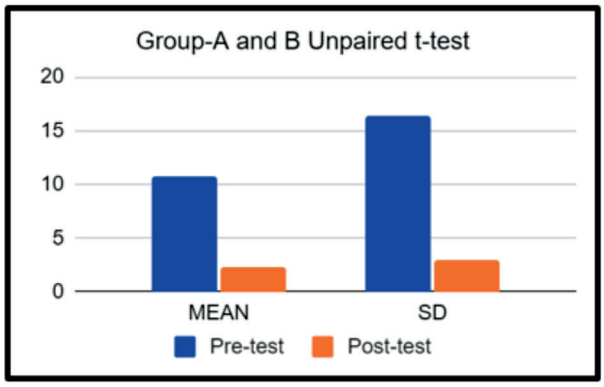

**Graph No. 1**

Interpretation: Graph No.1 shows that the values are extremely statistically significant.




**Graph No: 2**

Interpretation: Graph No.2 shows that the values are extremely statistically significant.




**Graph No: 3**

Interpretation: Graph No.3 shows that the values are extremely statistically significant

## Result

The investigation included thirty individuals. Each group contained 15 people.

Graph 1 the average Angulus ROM pre- and post-test values Group A are 14.20 (2.37) and 10.80(2.27) respectively, The t value is 11.7444, and the p (<0.0001) which demonstrates that the outcome was extremely statistically significant

Graph 2 shows the mean pre-test and post-test scores for Angulus ROM Group B, which are respectively 18.93 and 16.33. The p-value of (0.0001) and the t value of 13.6671, however, indicate that the finding was extremely statistically significant.

The comparison of the Group A and B differences in Graph 3 demonstrates the average Angulus ROM pre- and post-test values in Groups A and B are (10.80) and (16.33), respectively, t = 5.6456 and p (< 0.0001) which shows that the result was very statistically significant.

## Discussion

The purpose of the study was to find out whether football players with anterior pelvic tilt responded in any way to the Swiss Ball and McKenzie Exercise. According to this study The Swiss Ball is an excellent therapeutic rehabilitation exercise tool in correcting the altered pelvic tilt and preventing further musculoskeletal problems. The pre-intervention mean of the Angulus ROM software in the Swiss ball group was 14.20 (+2.37). The mean value of the Angulus ROM software was reduced by 10.80 (+2.27), which indicates statistically significant differences between the groups after the participant had Swiss ball exercise. In contrast to the patients in the McKenzie group who got McKenzie exercise, subjects in the Swiss ball exercise had greater improvement in the Angulus ROM program.

In a previous study, Kuegler P et al. (2015) conducted a study using 16 goniometer apps and reported that a comprehensive list of all applications categorised as "ROM" or "range of motion" was also provided. This study referred to Angulus software as Angulus ROM software in this investigation in accordance with the study.[13]

In a previous study by Daroszewski M et.al (2013) it was found that the Right and left tracheobronchial angles (TBAr, TBAl) were assessed. Angulus software, digital analyses were performed.[14] Similarly in this study we included Angulus software to measure the excessive anterior pelvic tilt among football players.

Sea Hyun Bae, Hong Gyun Lee et.al 2013 the study concluded balance ability significantly more than exercise on the stable support. As per the study, the selected participants who practise on an uncertain surface like Swiss ball are more effective in correcting the excessive Anterior pelvic tilt by enhancing the trunk and core stabilization.[15]

Kothalanka Viswaja et.al (2015) concluded that posture issues in the trunk muscles could be brought

on by physio balls. In order to preserve the right postural stability, the trunk muscles react defensively to the postural disruption caused by the physio ball beneath the patient. The trunk moves in response to a change in weight in any plane, per biomechanical principles, to balance the change in the centre of gravity.[16]

Wonjong Yu et.al (2017) concluded that Swiss-ball exercise has been speculated to contain many exercises to stimulate the core muscle as they mentioned exercise performed on the Swiss ball stimulates the core strengthening.[17]

According to McKenzie, 90% of people react quickly to manual correction, particularly if the change is contralateral. McKenzie created the manual shift correction technique.[18] With the guidance of McKenzie this study conducted among football players to correct the excessive anterior pelvic tilt using McKenzie will also show positive effect but not as much as the Swiss ball group.

**Limitations:**

1. Participants of the study are very few.
2. The outcome measure for this study is less and also includes outcome measures such as kinovea software and pelvic inclinometers.

**Recommendations:**

1. Can be done for players with pelvic tilt in other sports like basketball, tennis and badminton.
2. Outcome measures can also evaluate the increasing muscle strength, endurance, coordination, and flexibility, as well.

## Conclusion

According to the study's conclusions, patients with anterior pelvic tilt who use a Swiss ball can increase their core stability earlier compared with McKenzie exercise. Swiss ball exercises are simple to adapt for the participants after one or two sessions of training. Swiss ball core exercises can therefore aid in enhancing core stability, which aids in enhancing performance, and modify the pelvic tilt as necessary. The Swiss-ball workout might be beneficial in correcting non-symptomatic anterior pelvic tilt among football players.

**Ethical Clearance:** Taken from the institutional ethical committee. ISRB Number: 03/089/2022/ ISRB/SR/SCPT.

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# A Study to Compare the Effectiveness of Strengthening Exercises and Nerve Mobilization Techniques for Tarsal Tunnel Syndrome among Pregnant Women

**Swetha. R[1], Senthilkumar N[2], Kumaresan A[3], Pavithra[4], Anitha[5], Muthu Kumaran[6], Jagatheesan Alagesan[7]**

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**Abstract**

**Background**: The tarsal tunnel syndrome is an entrapment neuropathy of the medial ankle. Most common symptoms are pain, burning, tingling sensation in the sole of the foot. The purpose of this study is to find the effectiveness of strengthening and nerve mobilization on tarsal tunnel syndrome among pregnant women.

**Purpose:** The Purpose of the study is to determine the effectiveness of strengthening exercises and nerve mobilization techniques for tarsal tunnel syndrome among pregnant women

**Material And Method:** The study was performed on 274 women age upto (21-30) year and collected from revival physio care centre on the basic requirements like age, height, education and weight for women and their questionnaires are used to test tarsal tunnel syndrome. The study period was June 2022 to Jan 2023

**Results:** Pre test and post test values were analysed. Results suggest that strengthening with ultrasound group has significant improvement in compared with nerve mobilization group with P value < 0.0001.

**Conclusion:** Study concluded that Strengthening exercise is more effective than nerve mobilization in terms of pain level and tenderness

**keywords:** Tinel's test, Tibial nerve stretch test and ultrasound.

## Introduction

Tarsal tunnel syndrome (TTS) is an entrapment neuropathy of the posterior tibial nerve or its branches within its fibro-osseous tunnel beneath the flexor retinaculum on the medial side of the ankle.[1]It is a rare but important condition which is regularly under-diagnosed leading to a range of symptoms affecting the plantar aspect of the foot.[2] There are several important structures in the tarsal tunnel.[3]It contains the posterior tibialis tendons, as well a the flexor digitorum longus and flexor hallucis longus muscle.[4] It contains the posterior tibial artery and

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vein, as well as the posterior tibial nerve (L4 -S3).[5] It's important to note how these structures are arranged within the tarsal tunnel.[6]

Tarsal tunnel syndrome has two different aetiologies: intrinsic and extrinsic. generalised lower extremity edema, ill-fitting shoes, trauma, post-surgical scarring, inflammatory arthropathies and diabetes are extrinsic factors.[7] tendinopathy, tenosynovitis, osteophytes, and space-occupying lesions are examples of intrinsic causes. Varicosities, pedal edema, ligament laxity, and arch drop have all been associated with pregnancy.[8] these can lead to compression of the posterior tibial nerve, resulting in tarsal tunnel syndrome in pregnant women.[9] tarsal tunnel syndrome symptoms were more common in people between the age 21 and 30.[10]

Tarsal tunnel syndrome is diagnosed with the help of special test; tinel's sign Dorsiflexion -eversion test test, tibial nerve stress test, high frequency ultrasonography (HF-USG), ROM, MMT.[11] the pathogenesis of tarsal tunnel syndrome determines conservative treatment.

Pain, inflammation, and tissue stress should be reduced.[12] rest, ice, physical therapy, balance exercises and NSAIDS can help to relieve pain nerve gliding. Biomechanical anomalies can be corrected by orthotic shoes, which offload the tarsal tunnel.[13] by inverting the heel, a medical heel wedge or heel seat might lessen traction on the nerve.[14]

Nerve mobilization technique is used to help people recover from injuries or improve their performance in activities. [15]It enhances the strength and nerve mobilization also showed a positive effect for decrease in tinel sign and 2-point discrimination, sensory loss.[16]Strengthening exercises for tarsal tunnel syndrome include tibialis posterior strengthening, the function of the tibialis posterior muscle is to stabilize the ankle, also for inversion of the ankle.these can be done with the help of theraband or towel. It can be done by weight bearing and also by non -weight bearing. heel raise, arch lift, single leg balance, single leg calf raise are the common strengthening exercises for tibialis posterior muscles.

## Aim

The aim of the study is to determine the effectiveness of strengthening exercises and nerve mobilization techniques for tarsal tunnel syndrome among pregnant women

## Material and Method

This is a quasi experimental study done with 274 subjects with diabetic peripheral neuropathy, aged between 21-30 years, pregnant women from a private hospital from chennai. Samples were selected and allocated in a single group.

**Inclusion Criteria:**

- Tinel's sign positive
- Tenderness grading more than 2
- Pregnant women age 21-30 years

**Exclusion Criteria:**

- Past history of fracture of injury
- Subject with other neurological disorders
- Recent surgeries in lower limb

**Outcome Measure:**The study were taken from pregnant women with having tinel sign positive ( for 8 weeks)

- Tenderness grading scale.

**Procedure**

The observation study was conducted in revival of physiocare (physiotherapy and rehabilitation clinic)no 1,anthoniyar street, charles nagar, pattabiram ,chennai -600072Tamil nadu, India the study was performed on 274 pregnant women upto (collect the with 21-30 year basic requirements like name, age etc for pregnant women were recorded and their questionnaire were used to the tarsal tunnel syndrome are to noted to the pregnant women pain over the ankle for two weeks, tingling or numbness pain over the foot.

These are noted for the pregnant women and tenderness grading scale (grade 1-Patients complains of pain, grade2- patients complains of pain and winces, grade3-patients winces and withdraws the joint, grade 4- patients will not allow palpation of the joint). and tinel signs are detect with this tenderness grading scale are used to find out the tarsal tunnel syndrome of pregnant women.

Study was conducted on 274 participants with Tarsal tunnel syndrome using convenience sampling techniques based on inclusion and exclusion criteria. The study was explained to subjects and written consent was obtained from the subjects. The participants were split into 2 groups, group A-137 and group B- 137.

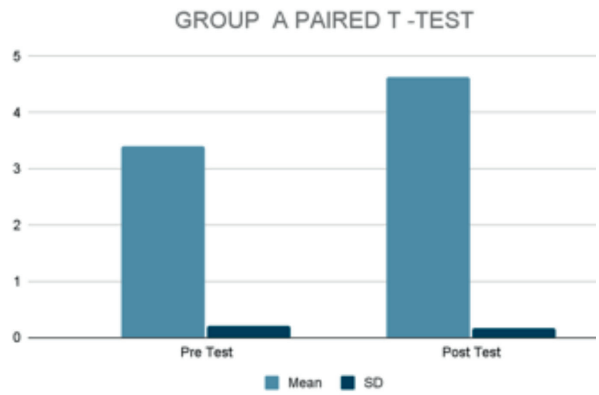
Group A was treated with strengthening exercises. Group B was treated with nerve Mobilization. Both treatment programs were given for 4 weeks, 10 repetition, 5 days per week and 2 session per day with one minute rest period in each set.

**StrengtheningExercises(Ultrasound)Group:** Group A with 137 samples were treated with strengthening exercise along with ultrasound for tarsal tunnel syndrome. The patient was instructed to rest in a supine position. The area other than the treatment are covered. The subjects were given ultrasound with strengthening exercises for a time duration of 10 minutes in a session for a total of 3 days in a week continuously up to 4 weeks.

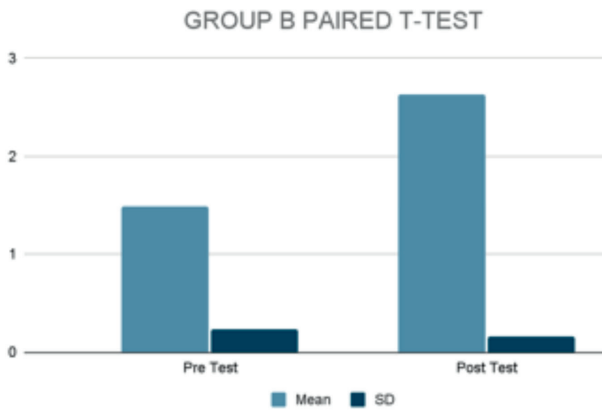
**Mobilization Group:** Group B with 137 samples was given a nerve mobilization technique for tarsal tunnel syndrome. These were instructed to the patients. The patient was instructed to rest in a supine.

- **Tinel Sign**: place the patient's foot into full Dorsiflexion and eversion and hold for 5-10 seconds the results are that it elicits the patient's symptoms are checking for the Tarsal tunnel syndrome patient
- **Ultrasound**: ultrasound are given to patient with the Duration -10 min, mode-continues and intensity -2.0 W/m2 . And strengthening exercises are given to the patient
- **Nerve Mobilization Techniques**: Nerve mobilization techniques patient in supine position. One hand on foot and another hand on feet and gentle pressure applied to the patient and it's called posterior Gliding compressor
- **Strengthening Exercise**-patient assisted them do dorsiflexion and plantar flexion movement using theraband.

**Data Analysis**

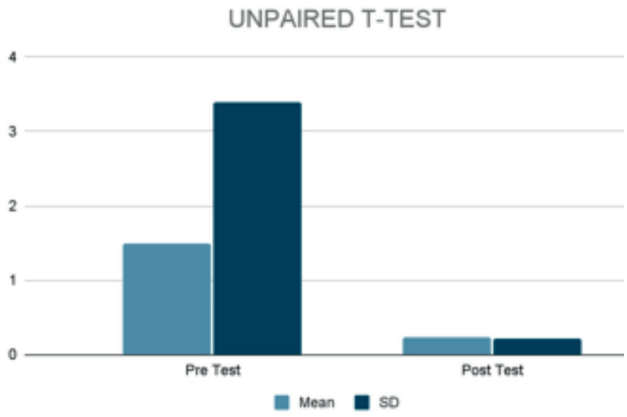



**Graph -1: Comparison of pre and post -test of Group-A strengthening with ultrasound.**




**Graph-2: Comparison of Pre and Post-test of group B (nerve mobilization techniques)**

**Group A and B Unpaired T- test**




**Graph-3: Comparison of post-test values of both group-A and groupB (strengthening exercises with ultrasound and nerve mobilization techniques)**

## Result

To analyze the data, descriptive and inferential statistics were used. as a result, the parameters mean and SD were employed in student t test to look for major differences among the pre-test and post-test measurements. a statistically significant difference between Groups was discovered by analyzing quantitative data.

Graph 1 compares the pre- and post-test value of strengthening exercise using tenderness grading scale shows that pre-test values of 3.394(+0.20) were increased to. 632(+0.16) in the post-test.

As a result, with a p value of <0.0001, this findings are judged statistically significant.

Graph 2 compares the pre- and post-test values of nerve mobilization techniques using tenderness grading scale shows that pretest values of 1.488(+0.164) were increased to 2.628(+0.234) in the post-test.

As a result, with a p value of <0.0001, the findings are judged statistically significant.

Graph 3 compares post-test values of strengthening exercise and nerve mobilization using tenderness grading scale, shows that strengthening exercise values of 4.632(+0.163) whereas values of nerve mobilization 2.628(+0.234). the results are statistically significant with a p value of <0.0001.

## Discussion

According to the inclusion criteria, this study was done on 274 volunteers between the ages of 21-35, who were randomly separated into two groups (strengthening exercise and nerve mobilization). The outcome measures were assessed at the conclusion of the second week using the tenderness grading scale.

The tenderness grading values of strengthening exercise, showing that the pretest values of 3.39(+0.20) in strengthening exercises before intervention.The mean value of the tenderness grading scale increased to 4.632(+0.16) in the post-test.

The tenderness grading scale values of nerve mobilization, showing the pretest values of 1.48(+0.16) in the experimental group before intervention.[1] The mean value of the tenderness grading scale increased to 2.62(+0.234) in the post test.[2]

According to statistical analysis, both strengthening exercise and nerve mobilization groups improved their tenderness grading scale scores.[3]When the two groups were compared at the end of two weeks, the patient in the strengthening exercise group, who received strengthening exercise with ultrasound improved more in the tenderness grading scale than the subjects in the nerve mobilization group.[4]

## Conclusion

This study provides evidence supporting the effectiveness of strengthening exercises as a management strategy for tarsal tunnel syndrome. The findings demonstrate significant improvements in pain level and tenderness following the intervention. Further research and long-term follow-up studies are necessary to validate these results. Strengthening exercise is more effective than nerve mobilization, according to the findings.

**Ethical Clearance**: The research work has been approved by the ISRB committee. ISRBapplicationnumber- 03/090/2022/ISRB/SR/SCPT

**Funding**: Self

**Conflict of Interest:** No conflict of interest during this research.

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Original Article

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# The Effectiveness of Dry Needling in Patients with Piriformis Syndrome

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**Abstract**

**Background:** The research is on assessment of the effectiveness of dry needling in patients with piriformis syndrome. It is a non discogenic form of sciatica brought on by piriformis muscle impingement on the sciatic nerve. It can be responsible for 0.3% to 6.0% of all sciatica and low back pain cases. Post traumatic piriformis syndrome may occur in patients who experience lumbar nerve-root compression symptoms and signs after receiving a forceful injury to the buttock. Dry needling is a minimally invasive therapy by the insertion of tiny monofilament needles into muscles, ligaments, tendons without the use of injectable substances.

**Purpose:** To find the effectiveness of dry needling in patients with piriformis syndrome.

**Materials and Methods:** Total of 356 participants were taken according to the inclusion and exclusion criteria from new life phyio, shanthi physio and saravana ortho clinic.The participants were randomly allocated into two groups, dry needling with theraband exercise group and IFT with theraband exercise group. The group A=178 participants and group B=178 participants. All the subjects underwent pretest measurement with NPRS in the beginning of treatment. The study was quasi experimental study and the duration was about 4 weeks of June 2023.

**Results:** Statistical analysis of data showed significant differences not only in the dry needling group but also in the conventional group. The dry needling group was significantly higher than the IFT group, with a p value of <0.0001.

**Conclusion:** Dry needling is more effective than IFT in the piriformis syndrome.

**Key Word:** Dry needling, interferential therapy, exercise, theraband, pain.

## Introduction

The flat, pear-shaped piriformis muscle is situated in the gluteal area of the hip and proximal thigh. The tendon of the piriformis muscle joins the tendons of the obturator internus and the inferior and superior gemellus before inserting on the femur. The muscle abuts the posterior wall of the pelvis and the posterior wall of the hip joint.[1] PS is a non discogenic form of sciatica brought on by piriformis muscle impingement on the sciatic nerve. The literature

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varies in its associations between PS and low back pain and buttocks pain. It can be responsible for 0.3% to 6.0% of all sciatica and low back pain case.[2] Sciatica in the form of piriformis syndrome is brought on by piriformis muscle compression of the sciatic nerve. Due to the wide range of low back and buttock pain diagnoses and the overlapping symptoms of many of them, the diagnosis of piriformis syndrome is difficult to make.[3]The piriformis condition is difficult to diagnose. Pace's sign comprises of discomfort and weakness with resistant hip external rotation and abduction when the patient is seated. 46.5% of people with piriformis syndrome had a positive test result.[4] post traumatic piriformis syndrome may occur in patients who experience lumbar nerve-root compression symptoms and signs after receiving a forceful injury to the buttock.[5] The internal obturator muscle can be surgically released to Dry needling has been linked to a number of clinical benefits, but comprehensive research about its potential physiological mechanisms of action and effects is still missing. The patho physiology of myo fascial trigger points, including the taut band, local ischemia and hypoxia, peripheral and central sensitization.[6] The sciatic nerve (or a portion of it) actually reaches the muscle in 7% to 21% of investigated populations.[7]

Dry needling is a minimally invasive therapy method that is inexpensive, simple to learn with the right instruction, and carries a low risk. Numerous research and two thorough systematic reviews have supported its efficacy.[8] It has been demonstrated that the deep method of dry needling is superior to the shallow one for treating pain brought on by myofascial trigger points. However, therapist advised employing the superficial method, which has also been demonstrated to be beneficial, albeit to a lower amount, over regions with a possible risk of serious side outcomes, such as the lungs and large blood vessels. To determine whether dry needling is successful, more research is required. Additionally, there is a critical need for more research on how myofascial pain develops.[8]

A variety of neuro musculoskeletal pain syndromes can be treated by inserting dry needles close to peripheral nerves and/or neurovascular bundles.[9] However, several position statements by various US State Boards of Physical Therapy have specifically classified dry needling as a "intramuscular" therapy involving the isolated treatment of "myofascial trigger points". The methods used for acupuncture needling, also known as trigger point dry needling or intramuscular stimulation, vary among health professions.[10]

## Aim

To compare the effectiveness of dry needling in patients with piriformis syndrome

## Material and Method

Total of 356 participants were selected according to inclusion and exclusion criteria and the participants were explained about treatment safely and simplicity of the procedure and written consent was obtained Subjects willing to participate were randomly allocated into two groups. Group A=178 participants and group B=178 participants. Dry needling with theraband exercise group and IFT with exercise group. All the subjects underwent pretest measurement with NPRS in the beginning of treatment. The study procedure has been held at shanthi physiotherapy clinic, new life physiotherapy clinic, and saravana ortho clinic.

**Inclusion Criteria:**

- Both men and women
- Age between 20-50
- NPRS Score between 5 to 10
- IT Workers
- Prolonged standing
- Recent hip surgeries
- Subjects who were tested positive FAIR test
- Subjects who were willing to participate in the study

**Exclusion Criteria:**

- Subjects with severe trauma
- Any congenital disorder of spine and lower limb
- Tumor
- Subjects who were not willing to participate in this study.

**Outcome Measures:**

Assessment was performed at baseline (before starting of treatment) and after two weeks of study.

- Numerical Pain Rating Scale

**Procedure**

Total of 356 subjects were included in the study based on inclusion and exclusion criteria. The study duration was 2 to 3 weeks. All the subjects were assessed using numerical pain rating scale. Group A was treated with dry needling technique along with theraband exercises for 20-30 minutes and group B was with interferential therapy along with theraband exercise for 20-30 minutes. Along with that piriformis stretch was also performed for both the group A and B participants.

Numerical pain rating scale: A Respondent uses a whole number to indicate the severity of their discomfort when using the NPRS. A segmented numeric variant of the VAS. The most typical structure is a horizontal bar or line.

**Conventional Group**

This group received dry needling with theraband exercise and piriformis stretch for the duration of 2-3 weeks. The procedure was concentrated on the obturator externus, piriformis, gluteus minimus and superior gemellius muscle. The patient will be in a prone lying position and then the treatment will be given for 30 minutes. The needles will be inserted in the deep and superficial gluteal region with the informed consent to the patient and then the treatment will be started. The treatment will be given for continuous three days in a week for 30 minutes with the exercise prescribed.

**Experimental Group**

This group received interferential therapy with theraband exercise and piriformis stretch. The modality was placed with the informed consent of the patient. The electrodes were placed on the gluteal surfaces and the therapy was given for 15 minutes. The theraband exercise and the piriformis stretch was explained to the patient. During this process the patient were lying prone and the therapy was given. The protocol was clearly informed to the patient that they should not be do any other electrotherapy while participating in this treatment

**Exercise Regime:**

**Piriformis Stretch:**

Lift the knee and raise the affected leg. Reach across your body with the opposite hand, then slowly move the knee towards the shoulder on the other side. For 15 to 30 seconds, maintain the stretch.

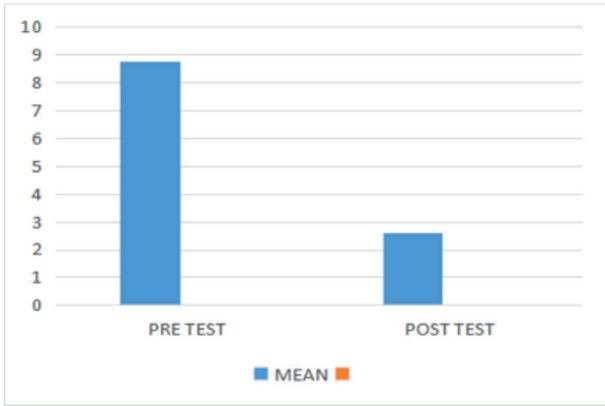
**Theraband Exercise:**

1. Perform the bridge exercise. An elastic band is wrapped across your thighs. If you don't have a circular band, loop your band by tying its ends together. Your feet should be hip distance apart while you lay on your back with your knees bent. Your thigh and buttock muscles should feel resistance from the elastic band, which should be tight. Hold your abdominal and buttock muscles tight during the movement. Without arching your back, raise your hips and back off the floor. Hold for five seconds, and then gradually reposition your spine on the floor. Do three sets in total of 20 repetitions

2. Use a looped band to calmly perform a workout while lying on your side on the ground. Wrap your thighs in the elastic band. Keep your legs together, bend your knees, and contract your buttocks and abdominal muscles. Keep your ankles and feet together as you gradually elevate the knee of your top leg. Hold for five seconds before releasing. Replicate 10 to 20 times, then switch to the other side.

**Data Analysis**

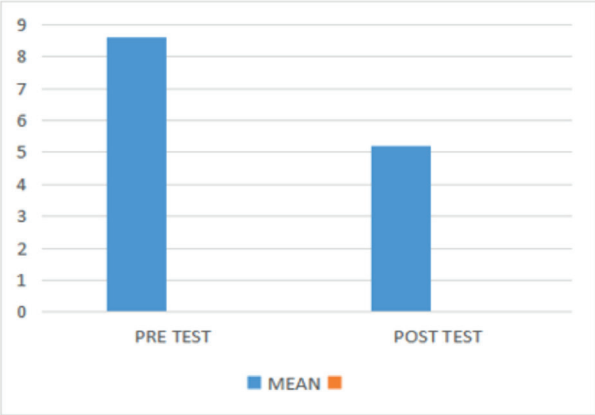
**Dry Needling Group**




**GRAPH 1- PRE AND POST TEST VALUES OF DRY NEEDLING**

INTERPRETATION: Graph no.1 shows the pre and post mean values using NPRS and it shows extremely statistically significant

**Interferential Therapy Group**




**GRAPH 2- PRE AND POST TEST VALUES OF IFT**

INTERPRETATION: Graph no.2 shows the pre and post mean values using NPRS and it shows extremely statistically significant.




**GRAPH 3- POST TEST VALUES OF BOTH THE GROUP**

INTERPRETATION: Graph no. 3 shows both the post values of group A and B and it shows extremely statistically significant.

## Result

The subjects were selected according to inclusion and exclusion criteria.

By using NPRS the post test value in the dry needling group was 2.58 while it was 5.20 in the IFT experimental group. This shows that the dry needling group was significantly higher than the IFT group with a p value of <0.0001. The final result of the study was that the dry needling is more effective than the interferential therapy.

## Discussion

The purpose of this study was to find the effectiveness of dry needling in patients with piriformis syndrome.

The dry needling group consisted of 178 subjects who received dry needling in the piriformis muscle with theraband resistance exercise and consisted of 178 subjects who received Interferential therapy(IFT) on gluteal region with theraband exercise.

The outcome measures were Numerical pain rating scale. This study examined the effects of dry needling in patients with piriformis syndrome. The interventions lasted for two weeks and the 356 subjects of both men and women were taken and divided into two groups. 178 of them underwent a dry needling with theraband exercise and another 178 underwent interferential therapy with theraband exercises. Beneficial effect were significantly greater in dry needling than the IFT. When response were compared between both groups, the result showed a significant difference in dry needling technique than the IFT treatment .statistical analysis of IFT modality by using numerical pain rating scale has a p value of 0.0001 which was considered statistically significant. This leads to the conclusion that the dry needling is statistically significant and advantageous than interferential therapy within a short period of time.

James Dunning et.al stated that Targeting trigger points (TrPs) with in-and-out techniques like “pistoning” or “sparrow pecking” has been shown in several studies to improve pain and/or disability immediately or temporarily; however, because there are no high-quality, long-term trials that support the use of these techniques at exclusively muscular TrPs, the practise should be questioned. Myofascial pain syndrome literature supports the insertion of dry needles into asymptomatic body locations close to or far from the primary cause of pain.[9]

Leonid kalichman, et. al. demonstrated that the deep method of dry needling is superior to the superficial one for treating pain brought on by myofascial trigger points. However, we advise employing the superficial method, which has also been demonstrated to be beneficial, albeit to a lower extent, over areas with a possible risk of serious adverse outcomes, such as the lungs and large blood arteries. Additional research is required to assess the efficacy of dry needling.[8] Manisha Uttam et.al demonstrated that a single session of dry needling, along with gentle stretching and a moist heat pack, was successful in releasing a myofascial trigger in a patient with acute Piriformis syndrome by lowering pain and increasing range of motion. Results for pain and hip joint ROM improved following the use of DN, gentle piriformis stretching, and a wet hot pack.[11]

Jonathan et.al stated that Patrick Stretching and physical therapy techniques have traditionally been the mainstays of PS treatment, with anesthetic and cortico steroid injections into the piriformis muscle origin, abdomen, muscular sheath, or sciatic nerve sheath also being given to resistant patients.[12]

## Conclusion

In conclusion, dry needling appears to be an effective treatment option for patients with piriformis syndrome. Several studies have investigated the effectiveness of dry needling in relieving pain and improving functional outcomes in patients with piriformis syndrome. These studies have consistently shown positive results, with a significant reduction in pain levels and improved mobility and function after dry needling interventions and disability scores after dry needling treatment. When compared to interferential therapy the dry needling with theraband is more effective within a short period of time.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/091/2022/ISRB/SR/SCPT).

**Funding:** This study is a self-funded study

**Conflict of Interest**: The authors state that there is no conflict of interest.

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Original Article

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# To Study the Effectiveness of Dry Needling on Functional Performance with Plantar Fascitiis

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**Abstract**

**Background:** Plantar fasciitis (PF) is a chronic and progressive disease that impairs patients' quality of life and daily activities. PF is caused by repeated tissue injury at the origin of the calcaneus' medial tuberosity. The symptoms include Pain expanding from the heel's medial aspect into the arch of the foot. Pain is frequently worse in the morning, after a period of rest, or after engaging in physical exercise. These signs and symptoms can become paralyzing as the illness advances, reducing the individual's ability to bear weight. According to recent research, the condition should be called fascists because the pathology is more similar to that of tendinosis. The thickness of the plantar fascia increases, as does degeneration

**Purpose:** The purpose of the study to determine the effectiveness of dry needling for the subjects with plantar fasciitis

**Materials and Methods:** 68 subjects in total were chosen based on the inclusion and exclusion criteria. Experimental group (n=34) patients received dry needling of intended sites using a 30 mm needle that was gradually withdrawn after 15 minutes. The conventional group (n=34) received the Ultrasound therapy was applied at 3.0-MHz frequency .Patients taken from the five plus hospital. The study period was from December 2022 to March 2023.

**Results:** Statistical analysis of 6 minute Walk test and NPRS examination post values revealed the constantly significant differences, With the P value of <0.0001.

**Conclusion:** Dry needling with strengthening exercise was found to be comparatively more effective than ultrasound therapy with strengthening exercise

**Key Word**: Plantar fasciitis, dry needling, ultrasound therapy, 6minute walk test, NPRS

## Introduction

The plantar fascia is a connective tissue made up of fibers that maintains the static structure of the foot's longitudinal arch. In response to elevated temperatures loads, The plantar fascia lengthens, thereby serving as an absorber; still its ability to

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lengthen is limited.[1] The structure's maximum probable elongation is around 4%, and failure requires a force of around 1000 N[2]. Plantar fasciitis (PF) is a chronic progressive illness, interferes with patients' everyday activities and quality of life. PF is produced by repetitive tissue injury.[3] The plantar fascia's thickness rises, as does degradation. [4,5]It is a common cause of heel pain in adults.[6,7] 90% of the time, symptoms resolve within 10 months [8], it is irritating for both physicians and their patients[9]. The symptoms include radiating discomfort of the foot. Pain is typically worse in the morning, after rest, or warming up with activities on the medial side.[10] In the feet and ankles, there are numerous structures are involved in the stability and function required to walk and bear weight.[11] muscle tendon is the primary inverter of the foot in plantar flexion. The spring and deltoid ligaments, as well as the tibialis posterior muscle tendon, which connects to the navicular tuberosity, are essential for foot and ankle stability.[12] Plantar fasciitis is a self-limiting natural history and usually resolves within a year. The majority of plantar fasciitis cases have a satisfactory treatment outcome, and various specialists have stated typically respond to conservative treatment. Before attempting more intrusive treatments, individuals with plantar fasciitis should normally try conservative therapies first.[13] Traditional workouts include touch and heel lift[14]. The patients were given directions to perform the physical activities on a daily basis for three months.[14]

As less intrusive options, dry needling and acupuncture target myofascial trigger points [MTPs]. This is a popular method for managing chronic pain that has few adverse effects.[15]

## Aim

The aim is to study the effectiveness of dry Needling for the subject with plantar fasciitis on functional performance

## Material and Method

**Subjects:** Subjects were collected based on eligibility criteria

**Sampling Technique:** Convenient sampling.

**Sample Size:** 68 Samples.

**Inclusion Criteria:**

- The study was conducted in patients with plantar heel pain
- Absence of Raynaud's disease.
- Individuals under the age 35 to 45 complaining of foot pain for over a week
- Having a heel pain on the first step during morning

**Exclusion Criteria:**

- Dermatological disease in the area of needling;
- Injury, trauma, foot ulcer over the foot
- Treatment for plantar heel pain within four weeks prior to the study
- Presence of a chronic medical condition like rheumatoid arthritis, psoriatic arthritis, ankylosing spondylitis, septic arthritis, neurological abnormalities, sciatica, and/ or chronic pain; history of plantar fascia surgery; history of injection therapy in the heel during the previous three months; and known hypersensitivity to metals

**Outcome Measures**

- Numeric pain rating scale (NPRS)[18]
- 6 minute walk test (6MWT)[19]

**Procedure:**

For inclusion and exclusion criteria, patients who were willing to engage in the study were evaluated. The total number of subjects (68) are divided into 34 subjects for the experimental group (Group A), they are given dry needling with strengthening exercises. The control group (Group B) consisting of 34 subjects, are ultrasound therapy with strengthening exercises. NPRS and 6 Minute walk test are used as outcome measures. Both the groups were treated with strengthening exercise.

**Experimental Group (group A)**

The experimental group was given dry needling with strengthening exercises. Patients in the dry-needling group had their intended areas dry-needled with a 0.30-mm needle that was progressive for 30 seconds, moved back and forth in the same place. For possible consequences, patient tolerance and discomfort were assessed. We located plantar foot muscles' myofascial trigger points (MTrP). In all situations, the medial aspect of the heel pad was

respected. After 4 weeks, post-test NPRS and 6 minute walk test scores are collected, tabulated, and statistically assessed.

**Control Group (group B)**

The control group received ultra sonography along with strengthening exercises. The therapy was administered while the patients were lying prone, with longitudinal movements along the entire plantar fascia. The US therapy was used for 8 minutes intermittently at an oscillation rate of 3.0 MHz and an output power of 1 W/cm2. During the applications, gel was placed between the US cap and the skin to ensure conductivity. The patients were given four weeks of treatment. When the episode is over, of the treatment approach, post-test data for the NPRS and the 6-minute walk test are recorded, tabulated, and statistically assessed.

Both the groups were provided with strengthening exercise like towel scrunches, toe curls, seated heel raises and resisted band exercise. The treatment is given for 2-3 days per week and starts with 2-3 sets of 10-15 repetitions for each exercise.

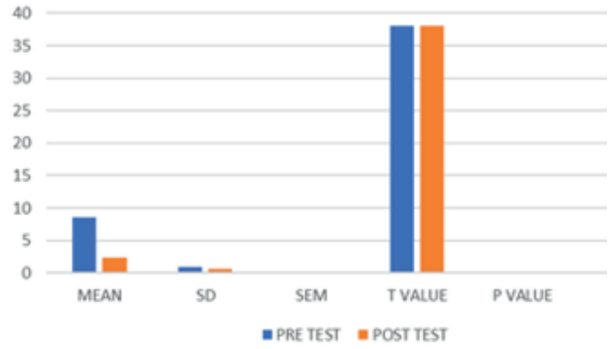
**Clinical Evaluation**

- Numerical pain rating scale [NPRS] for measuring pain, both when standing still and while walking.
- (6MWT) is used to determine functional ability. The individual walked swiftly for six minutes along a 100-foot hallway, recording the distance travelled in total.

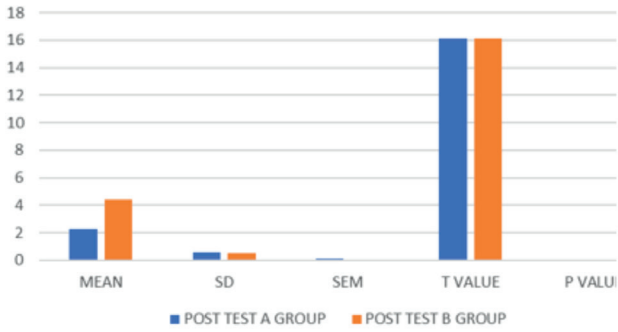
If a person with plantar fasciitis has pain or discomfort in the foot during the test, it can suggest the presence of the condition. During the 6-minute walk test, look for indicators of plantar fasciitis as follows

1. Start by having the individual warm up properly, including stretching exercises for the feet, ankles, and calves.
2. During the walk, observe the person's gait and posture. Look for any abnormalities such as limping, favouring one foot, or changes in stride length.
3. Pay attention to any signs of pain or discomfort expressed by the individual. That may indicate pain in them.
4. After the walk, ask the individual about any pain or discomfort they experienced during the test. Inquire about the specific location, intensity, and duration of the pain

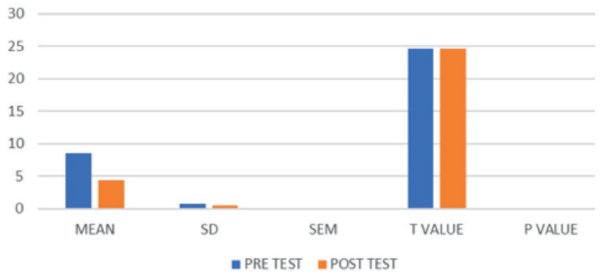
**Data Analysis**



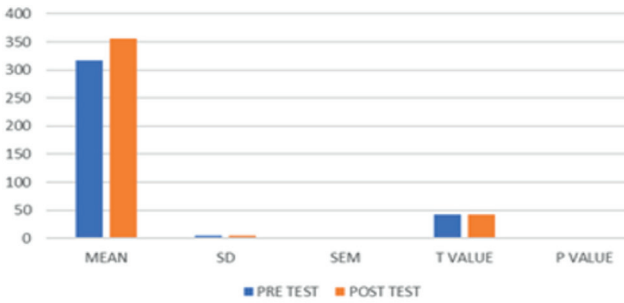

**Graph 1- Pre and post test values of experimental group a using NPRS**



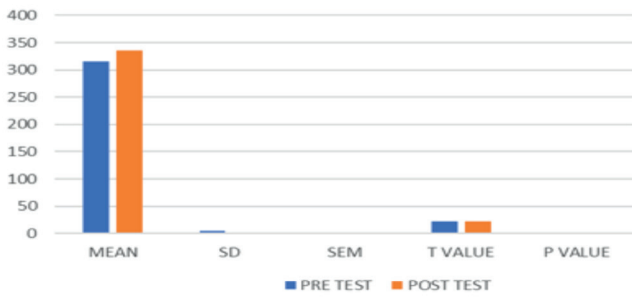

**Graph 2- Pre and post test values of conventional group B using NPRS**



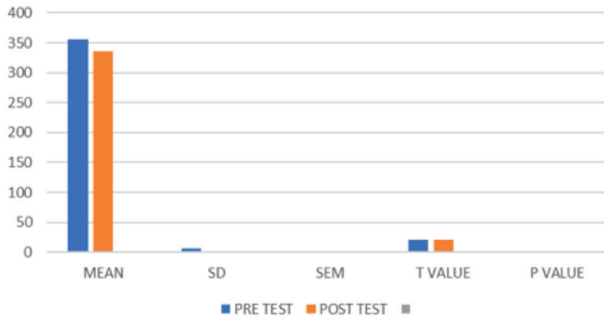

**Graph 3-Comparison of both the post test values of group a and b using NPRS**




**Graph 4- Pre and post test values of experimental Group using 6 minute walk test**




**Graph 5- Pre and post test values of conventional group using 6 minute walk test**




**Graph 6- Comparison of both the post test values of group a and b using 6 minute walk test**

## Result

A statistical comparison of quantitative data between the groups using dry needling and ultrasound demonstrated a statistically significant difference between the two. **Table 1** - the statistical analysis of dry needling by using numerical pain rating scale pre and post values are 8.53 and 7.29 the SD values are 0.83 and 0.58 and P value of <0.0001 and were considered as statistically proved. In **Table 2-** the statistical analysis of Ultrasound therapy by using numerical pain rating scale pre and post values of 8.50 and 0.41 the SD values are 0.79 and 0.50 and P value of <0.0001 and were deemed to have statistical significance.. In **Table 3- includes** the comparison of post test of both. By comparing the both dry needling with strengthening exercise and ultrasound therapy with strengthening exercise, the result with the dry needling with the strengthening exercise is more effective than the ultrasound with strengthening exercise. The post test values of dry needling with strengthening exercise is 2.29 and the post test values of ultrasound therapy with strengthening exercise is 4.42. The SD values of group A is 0.58 and 0.50. The T Value of the post test values is 16.1487 and the P value is <0.0001 and the values are extremely statistically significant. In **Table 4 -** the statistical analysis of dry needling by using 6 minute walk test pre and post values are 316.12 and 356.12 the SD values are 4.58 and 5.00 and P value of <0.0001were deemed to have statistical significance. In **Table 5-** the statistical analysis of Ultrasound therapy by using 6 minute walk test pre and post values of 315.26 and 336.12 the SD values are 4.85 and 1.81 and P value of <0.0001 and were considered as statistically significant. In **Table 6-** By comparing the both dry needling with strengthening exercise and ultrasound therapy with strengthening exercise, the dry needling with the strengthening exercise is more effective than the ultrasound with strengthening exercise. The post test values of dry needling with strengthening exercise is 356.03 and the post test values of ultrasound therapy with strengthening exercise is 336.12. the SD values of group A is 5.28 and 1.81.the T Value of the post test values is 20.8174 and the P value is <0.0001 and the values are extremely statistically significant. These differences indicated that dry needling with strengthening is more effective than the ultrasound therapy with strengthening exercise.

## Discussion

This research was carried out to find the effectiveness of dry Needling for plantar fasciitis on functional performance. The study objective was to evaluate the efficacy of dry needling in the healing process of plantar fasciitis using 6 minute walk test. The discussion may focus on whether there is a correlation between plantar fasciitis and walking performance as measured by the 6-minute walk test. Researchers might explore if individuals with plantar fasciitis exhibit lower walking distances or experience pain or discomfort during the test. The discussion may show how plantar fasciitis can impact functional limitations and endurance, which are key components assessed by the 6-minute walk test. Researchers might discuss if plantar fasciitis affects an individual's ability to walk for an extended duration or maintain a consistent walking pace. Researchers may discuss the appropriateness of using the 6-minute walk test as an outcome measure for plantar fasciitis. They might consider whether the test adequately captures the functional limitations and endurance challenges experienced by individuals with plantar fasciitis. Dry needling has a significant

favorable impact on impairment over time when compared to a comparator intervention, according to moderate- to low-quality data we evaluated.[15] Eftekharsadat B in 2016 conducted a study on A single-blind technique. Despite its minimal effect on ankle joint range of motion, This study discovered that by limiting the severity of heel discomfort, trigger point dry needling.[16] Rathleff et al. (2014) were the only researchers to look at a symptomatic population. It was especially significant because High-load strength training has shown potential benefits in the treatment of degenerative tendon ailments such as achilles and patellar tendinopathy.[17]

## Conclusion

In conclusion, this study provides compelling evidence supporting the effectiveness of dry needling as a treatment for plantar fasciitis. The significant improvements observed in plantar fasciitis symptoms and pain levels following the intervention align with recent research emphasizing the positive impact of pain relief on plantar fascia function. The combination of dry needling with strengthening exercises demonstrates promising results in reducing pain and providing relief for individuals suffering from plantar fasciitis.

### Limitations

Because the findings of this study depend on the remarks made by each of the participants, they can be applied to the age groups that were examined. The study's sample was made up of individuals around the ages of 35 and 45; results could differ depending on the age group. Future studies with individuals who possess various levels of education could be done.

**Ethical Clearance**: Taken from institutional ethical committee (application number: (03/092/2022/ISRB/SR/SCPT)

**Funding**: This study is a self-funded study

**Conflict of Interest**: The authors state that there is no conflict of interest

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Original Article

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# Comparison of the Effectiveness of Trapezius Strengthening Exercise Vs Conventional Physiotherapy on Pain in Patients with Rounded Shoulder

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**Abstract**

**Background:** Rounded shoulders are a fairly common issue that affects both young and old people. One of the most prevalent musculoskeletal irregularities of the shoulder complex that causes discomfort in the shoulder joint is rounded shoulders. Trapezius muscle plays an important role in scapula movement, while the lower trapezius is especially crucial for stabilizing this scapula.

**Purpose:** To evaluate effectiveness of trapezius strengthening exercise vs conventional therapy on pain in patients with rounded shoulders.

**Materials and Methods:** 40 subjects were selected from RENU'S Physiotherapy & Rehabilitation Centre.The study duration was from October 2022 to July 2023 with procedures and evaluation that lasted 2 weeks. The subjects were workers and college students who use smartphones, computers, or laptops during work and leisure time. A simple test was used to check the rounded shoulder posture of these 40 subjects to find the rounded shoulder pain.40 individuals were chosen for the Test-Wall Contact.Further, they were divided into two groups of 20 each according to inclusion and exclusion criteria. They were informed about the procedure, and an informed consent form was obtained.

**Results:** Post-test of NPRS scale in trapezius strengthening group mean was 4.35 and post-test mean of combination group with IFT was 2.25 .

**Conclusion:** Combination of stretching and strengthening with interferential therapy is much more effective and useful for treating complaints of rounded shoulder pain and rounded shoulder posture.

**Key words:** Stretching, Trapezius, Strengthening exercise, Pectoralis minor, Rounded shoulder pain, IFT

## Introduction

One of the most prevalent musculoskeletal malformations of the shoulder complex, rounded shoulders cause pain in the shoulder joint.[1] Combined forward head position and thoracic kyphosis are other names for rounded shoulder pain [RSP].

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Scapular alignment, kinematics and muscle activity are all impacted by improper sitting posture.[2] RSP is frequently brought on by maladaptive posture that worsen with repetitive motion and poor posture. It can be identified by the extended, downwardly rotated, anteriorly tipped scapula posture, as well as the enhanced upper thoracic kyphosis and cervical lordosis.[3] These elements may also cause pain in the upper quadrant.[4] Because rounded shoulders provide the appearance of having a hollow chest when the scapula is lifted, the term "abduction" is used to describe this posture in the literature.[5] The middle and lower trapezius muscles are especially susceptible and will become a rounded shoulder posture, as opposed to serratus anterior, pectoralis minor, pectoralis major and upper trapezius muscle.[6] Long-term smartphone use can cause bad posture, including hunched over posture, rounded shoulders and a slouched back.[7] This is the main cause of rounded shoulder posture. It causes the muscles surrounding the shoulder joint to become weak and shortened, putting more strain on the biomechanical structures, altering muscle balance and changing shoulder alignment .[8,9] The third, fourth and fifth ribs which are close to the sternocostal junction are the origin of the pectoralis minor muscle, which inserts into the coracoid process of the scapula.[10] They aid in increasing scapula or posterior tilting and decreasing internal scapular rotation when the arm is raised.[11,12]

The lower trapezius is particularly necessary for stabilizing the scapula.[13] Trapezius muscles are important for scapula movement. Pectoralis minor shortness is one possible reason causing neck and shoulder pain.[14] Theoretically, posterior scapular stabilizer strengthening and pectoral muscle stretching could help with muscular imbalance, rounded shoulders and normalize scapulohumeral rhythm.[15,16] Stretching in the evening is typically a part of thorough treatment programs for people with shoulders.[17] An earlier study found that strengthening the lower trapezius muscle in relation to the upper trapezius muscle reduced muscular imbalance and enhanced scapular thoracic posture. When the top fiber of the trapezius muscle is short and the lower trapezius muscle is weak, there is a muscular imbalance in the scapulothoracic area, according to cools et al. The lower trapezius and serratus anterior are the only muscles that are engaged during the final third of arm motions in a study of patients with glenohumeral laxity Interferential therapy [IFT] is a well-known treatment for pain.[17]

## Aim

To evaluate effectiveness of trapezius strengthening exercise vs conventional therapy on pain in patients with rounded shoulder.

## Material and Method

This is an experimental study done with 40 subjects with rounded shoulder, aged between 18 to 40 years of both genders from RENU'S Physiotherapy & Rehabilitation Centre, Vellore. Samples were randomly selected and allocated into two groups. one group is for trapezius strengthening[20] subjects and another group for pectoralis minor stretching with IFT[20] subjects.

**Inclusion Criteria:**

- People between age group 18-40
- Both Male and Female people with rounded shoulders.
- People using smartphones, computer or laptops in a sitting position more than 4-7 hrs per day
- People who drive vehicle for more than 3-5 hrs per day
- People who have not received any treatment for shoulder and neck pain in the past 4 weeks.

**Exclusion Criteria:**

- Fractures and dislocation of shoulder joint.
- People with diabetes mellitus, hypertension
- People with neurological deficits
- People with external wound

**Outcome Measure:**

- NPRS.[20]
- Researcher made Questionnaire:

Questions like below were included:

1. On average, how many hours do you use your smartphones during the weekdays?
2. On average, how many hours do you drive a vehicle?

3. On average, how many hours do you use your computer for work during the weekdays?
4. On average, how many hours do you use your computer for work during the weekends?
5. On average, how many hours do you usually use your smartphone during the weekends?

**Procedure**

College students and employees who use smartphones, computers, or laptops for work and leisure were chosen as the 40 subjects. The RSP was determined by using a straightforward test to examine the rounded shoulder posture of 40 individuals. Test-Wall Contact: The participant must stand straight up against a wall to have their posture evaluated. They should be able to simultaneously keep their head, mid-back, and back of their back in contact with the wall. They may have forward shoulders if it is difficult for one or both of their shoulder blades to fully make contact with the wall. A numerical pain rating scale was utilized to assess the shoulder pain rating in the 40 subjects who were chosen based on the RSP test. Samples were randomly selected and allocated in to two groups. one group is for trapezius strengthening[20] subjects and another group for pectoralis minor stretching with IFT[20] subjects.

**Trapezius strengthening:**

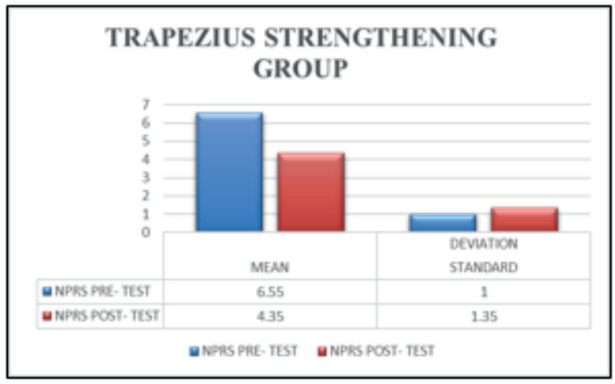
Exercises for the trapezius, such as the wall slide, shoulder abduction to 120 degree ,modified prone cobra,shoulder abduction elbow should be flexed,shoulder external rotation and scapular protraction, were given to the strengthening groups.

**Conventional physiotherapy:**

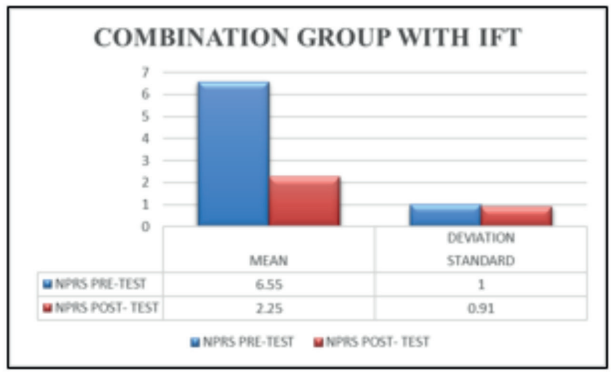
Stretches for the Pectoralis Minor, including the Spine Pec Minor Stretch, Wall Stretch, 4 Point Kneel, Floor Pec Stretch, and Stretch with Foam Roller, were given to the combination group.

IFT was applied close to the uncomfortable area. For four weeks, the therapy was delivered five days a week. Treatment sessions lasted 20 minutes and consisted of 15 repetitions. IFT was administered for 15 minutes each day, five days a week, for four weeks. The pre-test measurements and the post-test measures were both taken.

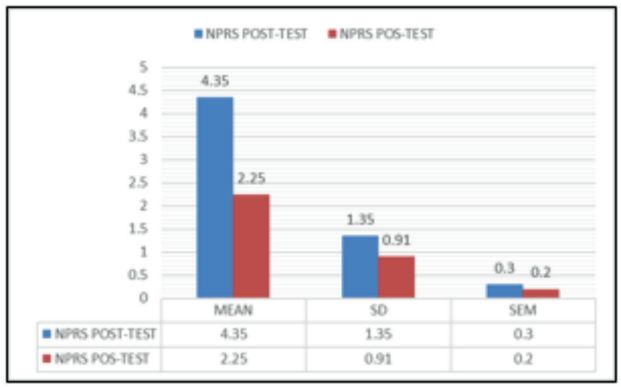
**Data Analysis**




**Graph-1 Comparison Of Pre -Test And Post-Test Of NPRS Scale IN Trapezius Strengthening Group Using Unpaired T-test**




**Graph 2: Comparison Of Pre -Test And Post-Test Of NPRS Scale In Pectoralis Minor Stretching With IFT Group Using Unpaired T-Test.**




**Graph-3** Comparison of post-test values of NPRS scale in trapezius strengthening group and combination group (pectoralis minor stretching and trapezius strengthening) with IFT using paired t-test.

## Result

Total 40 subjects participated and were divided into 20 each of two groups as the Trapezius strengthening group and Combination group. There is a significant improvement in comparison of both the groups.

The NPRS post mean value in the Trapezius group is 4.35 and in the Combination group is 2.25 significantly different in comparing both the groups .

## Discussion

College students and employees with rounded shoulders participated in this study. The information was gathered using a researcher-made questionnaire that asks about the typical number of hours spent operating a car, using a smartphone, computer, or laptop, and their shoulder discomfort numerical pain rating scale, which spans from 0 to 10. Out of 80 participants, 40 were chosen for the intervention and divided into two groups because they experienced moderate to severe shoulder pain during shoulder range of motion. To determine its efficacy, IFT was combined with RSP and Pectoralis minor stretching for hospital management staff and college students in this study. Statistics were used to analyze the data. The major goal of this study is to determine whether the IFT programme, along with Trapezius strengthening and Pectoralis Minor stretching, reduces shoulder pain in participants with rounded shoulders. From graph 3, the study demonstrates that the Pectoralis Minor Stretching with IFT group experienced a substantial reduction in discomfort and an improvement in muscular strength and posture compared to the Trapezius strengthening group. The shoulder joint protrudes outward from the body's center of gravity resulting in a hunched-over posture, scapular elevation, protraction, and downward rotation, as well as a widened angle between the lower neck bone and upper spine. The quality of life of those who have rounded shoulders is impacted by the symptoms, which include pain, poor posture, and discomfort. Incorrect posture, such as a forward-facing neck position, rounded shoulders, and a slouched posture, can result from prolonged smartphone use.[18]

In 2017, Mi-Kyoung Kim et.al came to the conclusion that the effects of a 4-week shoulder stabilization exercise programme that combined a stretching exercise for the pectoralis minor and a stabilization exercise that used an elastic band to enhance balance and maximum shoulder muscle strength in people with RSP. Static balance, dynamic balance, and muscle strength were all enhanced by the shoulder stabilization and stretching activities.[19]

In 2016, Tae-Woon Kim et.al came to the conclusion that exercise programmes utilizing elastic bands, which are readily available and have no time or space restrictions, can be utilised effectively to modify posture. These results show that the study's elastic band workout regimen is efficient at extending the pectoralis major and reversing forward head and rounded shoulder posture.

Ji-hyun Lee et.al (2014) drew the following conclusion: "The shoulder brace and stretching the PM may help correct RSP and restore the length of the PM. "The exercise that involved posterior tilting followed by PM stretching was the most successful at increasing LT muscle activation.

The findings of this study, according to Il-Keun Cho et.al in 2021 demonstrated that lower trapezius strengthening exercises, in addition to general physical therapy(INTERFERENTIAL THERAPY), significantly reduced pain, increased muscle strength, thickness, and improved scapular position in patients with chronic neck pain and rounded shoulders. As a result, it is believed that individuals with round shoulders and chronic neck pain should receive both general physical therapy and lower trapezius strengthening exercises rather than only general physical therapy(INTERFERENTIAL THERAPY).

In 2023 Ahmad H. Alghadir, Amir Iqbal et.al concluded that LTr-M strengthening and PMi-M stretching are more beneficial than PMi-M stretching alone in correcting rounded shoulder posture among young Saudi females. This beneficial effect was achieved due to sustaining the gained length of PMi-M by strengthening the LTr-M simultaneously.

## Conclusion

This study aimed to investigate the effects of trapezius strengthening exercise vs conventional therapy on pain in patients with rounded shoulder. Based on the result, it is noted that Pectoralis minor

stretching and Lower Trapezius Strengthening with IFT are more beneficial than Lower Trapezius strengthening alone in correcting rounded shoulder posture among medical college students and hospital workers. This beneficial effect was achieved due to sustaining the gained length of Pectoralis minor muscle, strengthening the Lower Trapezius muscle simultaneously and placing IFT over the painful region. Stretching, doing warm up exercises before using a computer or laptop, and maintaining good posture while using smartphones and any electronic devices will improve the flexibility of muscles and may prevent the shortening of pec muscles and weakening of trapezius muscles.

**Ethical clearance:** Taken from institutional Ethical committee. ISRB Number: 03/093/2022/ ISRB/SR/SCPT

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**Conflict of Interest:** The authors state that there is no conflict of interest

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Original Article

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# A Study to Compare the Effect of Dry Needling Technique to Mobilization on Pain Reduction in PA Shoulder

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**Abstract**

**Background:** A variety of subacromial space disorders, such as partial thickness rotator cuff tears, rotator cuff tendinosis, calcific tendinitis, and subacromial bursitis, are usually accompanied by shoulder pain, for which dry needling is observed effectively.

**Purpose:** To compare the effectiveness of dry needling technique vs mobilization on pain reduction among PA shoulder patients.

**Materials and Methods:** It's an Experimental study with inclusion criteria of age between 35-60, patient diagnosed of frozen shoulder/adhesive capsulitis, pain for more than a month was included. Patients having a history of inflammatory arthritis and post fracture complications were excluded. Thirty subjects were selected and divided into group A(n=15) and group B(n=15). Interventions were given for 4 weeks, 5 days per week. Pre-test and post-test values were calculated and tabulated using Goniometer and SPADI scale. The entire study was conducted from November 2022 to April 2023.

**Results:** Statistical analysis of pre and post-test values of Range of Motion and SPADI revealed significant differences between experimental and conventional groups, With the P value of <0.0001.

**Conclusion:** The results and the data obtained from this research showed that mobilization was more effective than dry needling technique in subjects with PA Shoulder.

**Key Word:** PA Shoulder, Range of Motion, Goniometer, SPADI

## Introduction

A variety of subacromial space disorders, such as slightly thick subacromial bursitis and calcific tendinitis, the rotator cuff tears, and rotator cuff tendon rupture, are usually accompanied by shoulder pain, which is a common complaint. Dry needling has been observed to reduce pain sensitivity (measured by pressure algometry) both immediately and one week after treatment in numerous trials that looked

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at its impact on individuals with shoulder discomfort. The shoulder's range of motion (ROM) (internal rotation) was also found to change immediately after dry needling in one of these trials, although none of these contained any tests of muscular strength.[1]

With 25% of the general population suffering from shoulder pain, shoulder pain is a serious health concern, for those with shoulder pain conservative treatment is the first line of treatment. Dry needling (TrP-DN) is described as "a professional intervention that uses fine thread-like needles that go through the skin in order to stimulate muscles, connective tissue, and trigger points to treat disorders of the spine.[2]

Physiotherapists are now increasingly using dry needling to treat non-specific shoulder pain, sub acromial impingement, rotator cuff pathology, and shoulder osteoarthritis are only a few of the various muscular disorders that may impact the shoulder. Dry needling induces many central and peripheral changes, including deactivating myofascial trigger points, reducing pain and inflammation, increasing range of motion, and inducing tissue changes.[3]

Pain in the upper extremity's shoulder joint is a common symptom of PA shoulder, a musculoskeletal condition involving the shoulder joint, limited range of motion (ROM), and stiffness in the scapula humeral joint. These symptoms adversely affect the function of the entire upper extremity. Most often, patients complain of limited range of motion (ROM) and subsequent development of shoulder pain.[4]

Although the PA shoulder syndrome's natural course is thought to be favorable, numerous procedures have been required due to the extended duration of pain and incapacity. With good success, manipulation under anesthesia, intra- articular injections, stretching and mobilization, and surgical or arthroscopic release are used.[5] Dry needling of trigger points is done by pricking a perceptible trigger point with a fine, strong thread-like needle. Dry needling of trigger points can be done in two different ways. Surface (up to a depth of 5-10 mm) or deep. TDN can also cause bleeding, infection, pneumothorax, and nerve damage.[6] Pain and trigger point control are the primary uses of dry needling. Several theories have been put out explaining the mechanisms of action for pain treatment with needling, yet it is still unclear what particular mechanisms underlie dry needling.[7]

PA Shoulder pain is frequently treated in the primary care context despite the fact that it can be an unpleasant, incapacitating, and protracted condition.[8] It can either happen spontaneously without a clear predisposing cause or be linked to a range of local or systemic illnesses.[9]

## Aim

The aim of the study is to compare the effectiveness of dry needling technique and mobilization on pain reduction in PA shoulder.

## Material and Methods

This research is an experimental study. The study was conducted with a sample size of 30 participants. The participants were selected from Saveetha Medical College and Hospital and Saicharan Physio Centre, according to inclusion and exclusion criteria. Participants received an extensive overview of the method, and a formal informed consent form was acquired.

**Materials Required:**

Basic assessment kit, goniometer, SPADI scale, couch, dry needling kit.

**Inclusion Criteria:**

- Painful shoulder movements for a month.
- Age between 35 - 60 years
- Diagnosis of frozen shoulder / adhesive capsulitis
- Diabetic patients

**Exclusion Criteria:**

- Patients with inflammatory arthritis
- Post fracture complication
- Neurological involvement
- Cardiac disorder
- Patients with skin disease or allergy
- History of any trauma and surgery.

**Outcome Measure:**

**1. Goniometer-** A goniometer is a device that measures the range of motion of a joint. Goniometry is the study of art and science that determines the joint area of each joint surface. Goniometry requires the use

of a single notation. The neutral zero method using the 0-180 degree system is the most commonly used technique. For the shoulder, it assesses the internal, external, flexion, and abduction of the shoulder. Maintain joints secure in the proper position. Parts of the body are moved within the range of motion. - Identify the final range of motion and final feel of the joint. Skeletons are scanned for relevant landmarks. Goniometer is adjusted relative to landmarks. Measurements are recorded correctly. Each joint's range of motion is measured individually to avoid tricks (simultaneous movements of different joints) and muscle weaknesses that can alter measurements.

**2. SPADI (Shoulder pain and disability index):**

The Shoulder discomfort and Disability Index (SPADI), a 13-item questionnaire is filled out by the patient, assesses the level of discomfort and the difficulty in performing activities of daily living that call for the use of the upper extremities. The disability subscale comprises eight items, whereas the pain subscale has five. Patients are told to choose the number that accurately reflects the level of discomfort and difficulty using the afflicted shoulder. The overall average for the pain scale is 50, but the total score for the disability scale is 80. The overall SPADI score is displayed using percentages. The scale goes from 0 (the best) to 100 (the worst). Greater disability can be seen by higher scores.

**Procedure**

A total of 30 people were selected based on the inclusion and exclusion criteria from the learning environment above. The study was explained to the subjects prior to initiation of the procedure and written informed consent was obtained from all subjects. The subjects included in the study were randomly allocated into 2 groups. There were 15 people in each of the two groups, A and B. Mobilization was given to Group A. Group B received dry needling.

**Group-A (Mobilization)**

1. **Pulley Exercise:**

In this we should set up the pulley system at a height that allows the affected arm of the subject to move comfortably; command the subject to stand facing the pulley system with the affected arm at your side. Then ask the subject to grasp the handle of the pulley with the affected hand. Start with the hand close to your body, palm facing to the body, and elbow bend. Then ask the subject to slowly and smoothly begin to move the hand away from the body while maintaining a relaxed and controlled motion. Allow the pulley to assist you in this movement. The subject should continue moving the hand away from the body until the subject reach a comfortable stretch or the range of motion allows. Then ask him to slowly reverse the movement, bringing the hand back towards the body. This exercise should be repeated for 10 reps for 4 weeks.

2. **Shoulder Flexion Exercise Using Wand:**

For performing this exercise ask the subject to start by holding a stick or broom handle with both hands, palms facing downward. The subject should stand upright with your feet shoulder wide apart. Then ask the subject to keep his elbows straight and arms slightly wider than shoulder-width apart. Ask the subject to slowly raise the stick in front of him, lifting it upward until it is above his head. Instruct the subject to hold the stretched position for 10 seconds initially, feeling the stretch in your shoulder and then slowly lower the stick back to the stretching position. Instruct the subject to repeat the exercise for the 10 reps for 4 weeks.

3. **Wall Climbing Exercise:**

Instruct the subject Stand facing a wall with his feet about shoulder-width apart. Then ask him to extend his affected arm and place his finger tips on the wall at his shoulder level. The fingers should be pointing upward. Then command the subject to begin to walk his fingers up the wall, gradually climbing higher. Ask him to move the fingers as far as he can comfortably reach without pain or discomfort. Once he has reached the comfortable limit, instruct him to hold that position for 10 seconds, feeling a gentle stretch in the shoulder. Then ask him to slowly walk his fingers back down the wall, returning to the starting position. Instruct the subject to repeat the exercise for a total of 10 seconds for 4 weeks.

4. **Pendular Exercise:**

Instruct the subject to stand upright and lean forward slightly bending at the waist. The subject can take the support of his non affected hand on a stable surface, such as a table or chair. Instruct him

to let his affected arm hang down naturally. Then ask him to start by gently swinging his arm in a small back and forth motion. Allow the arm to swing freely from the shoulder joint. Begin with small motion and gradually increase as the subject feels more comfortable. This motion involves swinging the arm forward and backward. Ask the subject to continue the pendulum swinging motion for about 10-15 seconds and the stand up straight and relax his arm by his side. Instruct him to repeat the exercise for a total of 10 repetitions for 4 weeks.

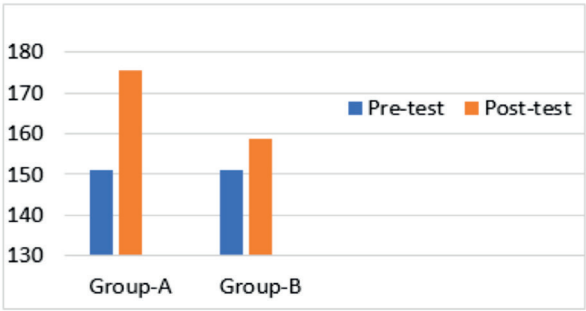
**Group B (Dry Needling technique)**

**Deltoid and Pectoralis Major dry needling:**

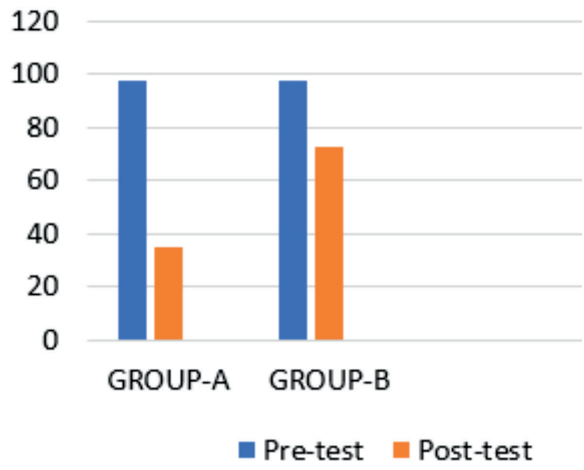
Firstly, we have to make the subject in the sitting position before inserting the needle (s). Then 70% isopropyl alcohol was applied to the region and allowed to dry for at least 10 seconds. The needles are discarded after one time use because reapplying the same needle in different areas will harm the subject by causing any adverse effect like infection. The dominant hand of the therapist is used to hold the needle. The needle is then placed 5 to 10mm deep and held there for 30 seconds. This procedure is repeated for 4 weeks.

**Data Analysis**

Using tabular and inferential statistics, the gathered data was evaluated. The mean and standard deviation (SD) were utilized for all parameters. The statistically significant differences between pre-test and post-test measures were examined using a paired t-test. When utilizing the unpaired t-test to look at significant changes in the experimental group, the significance level of p 0.0001 was determined to be statistically significant.




**Graph-1: Comparison between pre-test and post-test values of goniometry for Group-A and Group-B.**




**Graph-2: Comparison between pre-test and post-test values of SPADI for Group-A and Group-B**

## Results

A statistical analysis of quantitative data revealed a statistically significant difference in values between the (Group A) Mobilization and (Group B) Dry Needling.

Graph-1 Compares the pre-test and post-test values of goniometry for Group-A and Group-B. The mean post-test goniometric values were 175.55 in group A and 158.73 in group B. This indicates that group A had relatively higher goniometric values than group B ($p < 1$). 0.0001.

Graph-2 compares the pre-test and post-test values of SPADI for Group-A and Group-B. The Mean SPADI scores after testing were 35.05 in Group A and 72.25 in Group B. This indicates that the SPADI values in the experimental group were relatively higher than in the conventional group. $p < 0.0001$.

According to the above statistics, it was found that Group-A subjects who received mobilization exercises had a greater impact on pain reduction than Group-B subjects who had dry needling for the deltoid and Pectoralis major in patients having PA shoulder.

## Discussion

This study is to find out the comparison between Mobilization and Dry Needling on pain reduction among PA shoulder patients.

The results of a study by Shane Koppenhaver et.al (2016), entitled "Effects of dry needling to the symptomatic versus control shoulder in patients with unilateral subacromial pain syndrome" showed that participants with unilateral subacromial pain syndrome experienced changes in shoulder range of motion and pain sensitivity after receiving dry acupuncture to the infraspinatus muscle, but not changes in muscle function. These alterations typically happened only in shoulders with symptoms 3–4 days after dry needlestick. [10]

The "Exercises and Dry Needling for Subacromial Pain Syndrome" study, conducted by Jose L. Arias-Buria et.al in (2017), indicated that include two TrP-DN sessions in an exercise program was helpful in reducing disability brought on by shoulder pain in the short, medium, and long terms. The shoulder pain has not significantly decreased.[11]

The "Dry Needling, Acupuncture & Exercise for Adhesive Capsulitis" study by James Dunning et.al (2017), came to the conclusion that no controlled trials have examined the effectiveness of dry acupuncture for individuals with adhesive capsulitis. Electroacupuncture dramatically reduces shoulder discomfort and function in patients with adhesive capsulitis, either by itself or in combination with exercise, according to several randomized controlled trials. For the treatment of adhesive capsulitis, traditional physical therapy regimens include varying degrees of non-recurrent joint mobilization, long-term low-impact fascial stretching, and supervised and/or at-home exercise programs.[12]

The "Short-term Effect of Myofascial Trigger Point Dry-Needling in Patients with Adhesive Capsulitis" study by Varun Kalia et.al (2021), came to the conclusion that DN therapy, coupled with traditional physiotherapy methods, is a viable therapeutic option for AC patients. The results indicate a possible advantage of DN treatment in individuals with AC as they demonstrate significant improvements in shoulder ROM, discomfort, PPT, and function after DN treatment.[13]

The "Gentle thawing of the Frozen Shoulder''study by L.Diercks et.al (2004), showed in terms of functional outcome and recovery time, supervised neglect of idiopathic frozen shoulder syndrome is superior to passive stretching and mobilization and that further research should be done on therapies to get a predictable effect within a short time frame because a 12 month term of impairment is a sensitive problem for most social security system and the people who depend on it.[14]

The "Frozen Shoulder correlation between the response to physical therapy and follow up shoulder arthrography " study by Chi-yin Mao et.al (1997) came to the conclusion that in a study, it was discovered that the adhesion in the acute stage of frozen shoulder, also known as "adhesive capsulitis," was reversible. It was notable that joint space capacity increased, and this improvement in external rotation was related to it. Even when the joint space capacity in chronic patients rose marginally, ROM restoration still took place. In addition to the adhesive capsule, additional tightened soft tissues near the shoulder may also need to be stretched in order for the condition to improve.[15]

The "Treatment of Frozen Shoulder " study by Samina Zahid et.al (2009) came to the conclusion that Inflammation of the long head of the Biceps brachii tendon sheath, which is located in the intertubercular sulcus, is the lesion that causes frozen shoulder. Acupuncture is a useful treatment for frozen shoulders because it is a curable problem.[16]

## Conclusion

In conclusion, this study aimed to compare the effects of mobilization exercises and dry needling on pain reduction in participants with PA shoulder. Two distinct groups were formed, with Group A receiving mobilization exercises and Group B receiving dry needling. The intervention was carried out for a duration of 4 weeks, and the participants' range of motion (ROM) and pain levels were assessed using a Goniometer and the SPADI scale.

The results and data obtained from this research provided compelling evidence. It was statistically established that participants with PA shoulder experienced a clear and noticeable improvement in pain relief after engaging in mobilization activities.

On the other hand, participants who underwent dry needling to the deltoid and pectoralis major muscles did not exhibit the same level of pain

reduction. These findings underscore the efficacy of mobilization exercises as a preferred approach for pain management in individuals with PA shoulder. The specific exercises employed in this study demonstrated their potential to alleviate pain and improve overall well-being.

However, further research is warranted to delve deeper into the mechanisms underlying the observed differences between mobilization exercises and dry needling. Additionally, considering a larger sample size and longer follow-up periods would contribute to a more comprehensive understanding of the long-term effectiveness of these interventions. Overall, this study provides valuable insights that can guide healthcare professionals in selecting appropriate interventions to alleviate pain and improve the quality of life for individuals with PA shoulders.

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/094/2022/ISRB/SR/SCPT).

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**Conflict of interest:** The authors state that there is no conflict of interest.

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Original Article

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# A Study to Compare the Effectiveness of Concentric and Eccentric Training Program for Patients with Lateral Epicondylitis

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**Abstract**

**Background:** Lateral epicondylitis is considered to be the most prevalent overuse injury which affects 1% to 3% of the total population among all age groups and genders. The tendon of extensor carpi radialis brevis gets affected and can be strengthened by resistance exercises. It also affects plumbers, carpenters ,housewives etc. The daily activities are interrupted which increases pain in lateral epicondylitis can be treated conservatively and surgically.

**Purpose:** To compare the effectiveness of concentric vs Eccentric training programs for lateral epicondylitis by reducing pain.

**Materials and Methods:** 68 subjects were selected from Active physio care physiotherapy clinic based on the inclusion and exclusion criteria. The detailed procedure for performing the study was explained to the subjects, and the informed consent form was collected from them before starting the study. The pre and post test values were measured using the numerical pain rating scale (NPRS) and pain rated tennis elbow evaluation (PRTEE). The subjects selected based on the inclusion and exclusion criteria were divided into two groups: concentric group and Eccentric group (n = 34)**.** Study period : November 2022 to April 2023.

**Results**: Statistical analysis of numerical pain rating scale and pain rated tennis elbow evaluation post test result revealed that both groups show similar effect but Eccentric exercise Group (Group B) exceeds Concentric Exercise group (Group A) with p VALUE of $p<0.0001$.

**Conclusion:** When comparing the concentric group to the Eccentric group, the Eccentric group indicates significant effects in improving the strength of the elbow, improving the functional activity and strength of the forearm

**Key Word:** Concentric exercise, Eccentric exercise, lateral epicondylitis, NPRS scale, PRTEE

## Introduction

Lateral Epicondylitis is one the most common overuse injury that affects the lateral epicondyle of the elbow and it is caused by a rupture of extensor tendon of forearm.[1] The tendon of extensor carpi radialis brevis is majorly affected and extensor

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digitorum, extensor carpi radialis longus and extensor ulnaris gets affected in a smaller scale. It is characterized by pain, limited range of motion and decreased functional activity. Lateral elbow tendinopathy (LET) causes discomfort at work or during athletic activity instead of inflammatory or degenerative alterations. LET is accompanied with pain in the lateral epicondyle that is related to poor tendon repair.[2] The prevalence of LET peaks between the age of 30 to 60, and mostly affects the dominant hand. In women the symptoms last longer and are more severe.[3] Patients frequently stop participating in daily activity such as employment and sports because of wide range symptoms they encounter such as pain, loss of function for example due to prolonged healing period ,cost associated with loss of wages and decreased daily activities are frequently high[4]. The discomfort is often restricted to the epicondyle however in more severe cases it may radiate to the shoulder and wrist. Between 1% to 3% of the people have tennis elbow. Instead of being an inflammatory issue it is regarded as overuse injury that started in extensors in the wrist. Sports and work related activities requires a strong grip or repetitive wrist motion.[5] Rather than tennis player the disorder more frequently affects occupations such asplumber, butcher and auto repairmen. Predispositions to the condition are all systemic intrinsic factors. Age may cause histological abnormalities that are comparable to or identical to those of lateral epicondylitis.[6]

Lateral epicondylitis is hyaline degeneration and it is also known as forearm extensor tendinopathy , frequently brought by excessive or repetitive use, forceful extension or direct trauma to the epicondyle. The presence of fibroblasts, vascular hyperalgesia and disorganized collagen are histological indicators of tendon degeneration. Palpable pain at the lateral epicondyle is a sign of lateral epicondylitis such as wrist pain when making a fist, pronating a forearm, turning the wrist, or resisting wrist extension and experiencing pain when passively extending the elbow.[7] Middle finger and wrist pain from resistance to extension, ache when grabbing things. The utilization of patient's history, differential diagnosis, physical examination should be done and information should be collected. The most popular therapeutic exercise program now used to treat tendinapathy incorporates Eccentric activities that mechanically load the uncomfortable or dysfunctional tissue. Ice, low level light treatment, ultrasound and iontophoresis are typical methods for pain relief. The musculotendinous unit is lengthened during Eccentric exercise when a load is applied to it. Eccentric strengthening has been practiced in recent times until recently, little was known about how Eccentric muscle strengthening was carried out with free weights (determined by the 10RM). The patient should be seated with elbow fully extended ,forearm pronated and wrist fully extended.

Flexion for a count for 30 ,then extends the wrist to its fullest extend with the hand on the other hand [6]. Based on patient's repetition maximum load is increased for who execute Eccentric exercise without experiencing the pain or discomfort or pain. Each treatment consists of three sets of ten repetitions.[8]

Warmup : For 2 to 3 minutes move the wrist lightly Sets: 3.Repetitions:10 to 15,The patient is seated in full elbow extension , forearm pronation and wrist in neutral position a concentrated strengthening exercise was carried out using free weights determined by 10RM.[9]

## Aim

To compare the effectiveness of concentric and Eccentric training program for lateral epicondylitis by reducing pain.

## To comparMaterial and Method

**Study type:** Comparative study

**Subjects:** Patients with lateral Epicondylitis

**Sampling technique:** Convenient sampling

**Sampling size:** 68

**Study duration:** 4 weeks

The 68 subjects were selected based on the inclusion and exclusion criteria. The detailed procedure for performing the study was explained to the subjects, and the informed consent form was collected from them before starting the study. The pre and post test values were measured using the numerical pain rating scale (NPRS) and pain rated tennis elbow evaluation (PRTEE). The subjects selected based on the inclusion and exclusion

criteria were divided into two groups: concentric group(Group A,n=34) and Eccentric group (Group B,n =34)

Study period : november 2022 to april 2023.

**Inclusion criteria**

- Both mean and women
- Age 18-45 years
- NPRS score more than 5
- Patients with lateral Epicondylitis

**Exclusion criteria**

- Subjects with recent injury
- Subjects with NPRS score less than 5
- Active infection
- Subjects with no co operation.

**Outcome measures**

**Numerical pain rating scale**

This scale is considered to be one of the most accurate pain outcome measure available. A straight line was drawn on the evaluation sheet with 0 at the start and 10 at the end. The patients were asked to mark on the line based on impression of pain 0 indicating no pain and 10 indicating severe pain[13]

**Pain Rating tennis elbow evaluation**

PRTEE Allows the patient to rate the levels of tennis elbow pain and disability from 0 to 10, and consists of 2 subscale [12]

1. PAIN SUBSCALE (0=No pain,10=worst imaginable)

   Pain=5 item

2. Functional subscale (0=No difficulty, 10=Unable to do)

   Specific activity=6 item

   Usual activity=4

## Procedure

The 68 subjects were selected based on the inclusion and exclusion criteria. The detailed procedure for performing the study was explained to the subjects, and the informed consent form was collected from them before starting the study. The pre and post test values were measured using the numerical pain rating scale (NPRS) and pain rated tennis elbow evaluation (PRTEE). The subjects selected based on the inclusion and exclusion criteria were divided into two groups:Group A Concentric group and Group B Eccentric group.Each group consist of 34 samples.The subjects received Concentric Exercise and Eccentric exercise. Concentric Exercises (Group A) include wrist extension with resistance, pronation with resistance, Supination with resistance.Eccentric exercises(Group B)Include Eccentric wrist extension with Dumbbells or 1 kg weight, Eccentric supination, Eccentric pronation. warm up exercise are given before the treatment.

**Concentric Exercise**

Concentric exercise is performed by applying resistance to the wrist for strengthening the muscles. Resistance is applied for wrist extension, wrist supination, wrist pronation etc. warm up exercises should be given before the treatment.

**Wrist extension:**

- Sit or stand with your forearm supported on a table or your thigh, palm facing downwards.
- Hold a light dumbbell or resistance band in your hand.
- Slowly lift your hand upward, bending your wrist and keeping your forearm stationary.
- Hold for a second, then slowly lower your hand back to the starting position.
- Repeat for 10-15 repetitions, gradually increasing the weight or resistance as tolerated.

**Wrist supination:**

- Hold a 1 kg weight or resistance band in your hand, palm facing upward.
- Keep your elbow bent at a 90-degree angle and your forearm resting on a table or your thigh.
- Slowly rotate your wrist and hand outward, moving from a palm-up to a palm-down position.
- Hold for a second, then slowly return to the starting position.
- Perform 10-15 repetitions, gradually increasing the weight or resistance as you progress.

**Wrist Pronation**

- Similar to the supination exercise, hold a 1 kg weight or resistance band in your hand, palm facing downward.
- Keep your elbow bent at a 90-degree angle and forearm supported on a table or your thigh.
- Slowly rotate your wrist and hand inward, moving from a palm-down to a palm-up position.
- Hold for a second, then slowly return to the starting position.
- Perform 10-15 repetitions, gradually increasing the weight or resistance over time.

**ECCENTRIC EXERCISES**

Eccentric exercises can be particularly effective in the rehabilitation of lateral epicondylitis, as they help to strengthen the tendons and promote healing. Here are some eccentric exercises that target the muscles and tendons involved in lateral epicondylitis. warm up exercises should be given before the session.

**Eccentric Wrist Extension:**

- Sit or stand with your forearm supported on a table or your thigh, palm facing downwards.
- Hold a lightweight or resistance band in your hand.
- Use your unaffected hand to assist in lifting the weight.
- Slowly lower the weight by extending your wrist against the resistance.
- Allow the affected wrist to return to the starting position with the assistance of your unaffected hand.
- Repeat for 10-15 repetitions, gradually increasing the weight or resistance as tolerated.

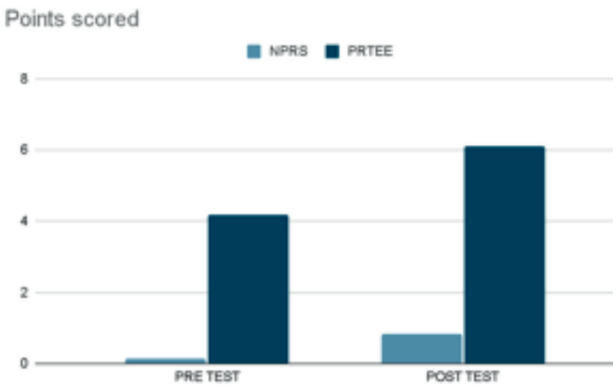
**Eccentric Wrist Pronation:**

- Hold a 1 kg weight or resistance band in your hand, palm facing downward.
- Keep your elbow bent at a 90-degree angle and forearm supported on a table or your thigh.
- Use your unaffected hand to assist in rotating your wrist and hand inward.
- Slowly release the resistance and allow your wrist and hand to return to the starting position.
- Repeat for 10-15 repetitions, gradually increasing the weight or resistance over time.

**Eccentric Supination:**

- Hold a 1 kg weight or resistance band in your hand, palm facing upward.
- Keep your elbow bent at a 90-degree angle and forearm supported on a table or your thigh.
- Use your unaffected hand to assist in rotating your wrist and hand outward.
- Slowly release the resistance and allow your wrist and hand to return to the starting position.
- Perform 10-15 repetitions, gradually increasing the weight or resistance as you progress

**Data Analysis**



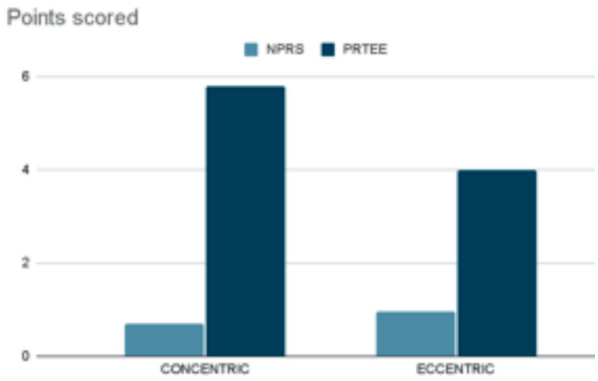

**Graph No 1:**

Pre-test and Post-test values of concentric group using NPRS and PRTEE (Group A)




**Graph No 2**

Represents pre and post test values of Eccentric training Group B




**Graph No 3**

Represents post test values of concentric and Eccentric group A and B.

## Result

Statistical analysis of quantitative data showed statistically significant difference not only Eccentric group but also in Concentric group. The numerical pain rating scale post-Test MEAN value in the Concentric group was 5.8 (4.65) while it was 6.7 (3.9), in Eccentric exercise program for lateral epicondylitis. The Pain Rating tennis elbow evaluation for Concentric Exercise group A is 58.88, Whereas for Eccentric exercise Group is 65.29. This indicates that score was comparatively higher in Eccentric group with P VALUE $p<0.0001$. Statistical analysis of numerical pain rating scale and pain rated tennis elbow evaluation post test result revealed that both groups show similar effect but Eccentric exercise Group (Group B) exceeds Concentric Exercise (Group A)

## Discussion

The goal of the present study is to compare the effectiveness of concentric and Eccentric training program for lateral epicondylitis and also to assess the effectiveness in terms of reducing pain and improving the function. This comparison is demonstrated with duration of 4 weeks. The outcome results were measured by NPRS scale and PRTEE scale before and after treatment. Beneficial effects were significantly greater in Eccentric Exercise than the Concentric exercise. when the response was compared between both groups, the result showed a significant difference in Eccentric group than concentric group. In concentric group pre-intervention mean of NPRS was 8.06. After treating the subject with Concentric Exercise the mean value of NPRS is decreased to 6.97 which shows statistically significant difference between the groups. In Eccentric group the pre-Test value is 7.97, After treating the subject with Eccentric Exercise the mean value of NPRS is decreased to 6.79 which shows statistically significant difference between the groups based on the statistical analysis, both groups showed improvement in NPRS. However, subjects who received Eccentric exercise showed better improvement in NPRS than the subjects in the Concentric group.

In an early study by SeoYeon Yoon et al 2021, eccentric exercise along with adjuvant therapy had positive outcomes in terms of reducing pain and enhancing muscle strength. Comparisons between eccentric exercise and other exercises revealed that eccentric exercise had favorable effects on pain relief, but there was no statistically significant difference between the groups in terms of muscular strength or function. We could not be confident in the calculated effects and recommended beneficial effects of eccentric exercise on LET with insufficient evidence because of the small number of included studies and different eccentric exercise characteristics. Future research with the ideal eccentric exercise device and protocol are advised, as well as a study design that isolates the demonstrated Eccentric exercise.[10]

M Padasala et al., 2020 Study findings concluded that group B eccentric-concentric training combined with supinator strengthening gave better response and is more effective than eccentric-concentrating of wrist extensors with static stretching in reducing pain and increasing grip strength in lateral epicondylitis.[11]

A early study by Magnus Peterson et al., (2014) stated that Eccentric graded exercise reduced pain and increased muscle strength in chronic tennis elbow more effectively than concentric graded exercise.[12]

## Conclusion

The collected data was statistically analyzed using an unpaired t-test. When comparing the concentric

group to the Eccentric group, the Eccentric group indicates significant effects (p 0.0001) in Improving the strength of the elbow and improving the functional activity. Eccentric exercise are more effective in strengthening the extensor muscles of forearm.

**Ethical Clearance:** ISRB: This research has been approved by ISRB committee.

Application Number:03/095/2022/ISRB/SR/SCPT

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Effects of Isometric Training Vs Aerobic Exercise Program along with Ultrasound for Osteoarthritis of Knee

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**Abstract**

**Background:** Knee osteoarthritis (OA), commonly known as degenerative joint disease, is frequently brought on by wear-and-tear and articular cartilage loss that occurs over time. It comes in two categories: primary and secondary, and it most frequently affects the elderly. Articular degeneration caused by primary osteoarthritis has no discernible underlying etiology.

**Purpose:** To compare the effectiveness of isometric training and aerobic exercise programs along with ultrasound for OA knee patients.

**Materials Required:** 52 subjects were selected from the prem physiotherapy clinic according to inclusion and exclusion criteria during the period of November 2022 to July 2023. They were divided into two categories: Group A(n=26) and Group B(n=26).The pre and post-test values were measured by Numeric pain rating scale (NPRS) and WOMAC questionnaire. Group A received conventional treatment that is isometric training along with ultrasound and Group B received aerobic exercise along with ultrasound. Both training programs were given for 4 weeks, weekly 5 days.

**Results:** A statistically important distinction <0.0001 between groups A and B was found via statistical analysis of information that was quantitative**.**

**Conclusion:** Isometric training along with ultrasound of group A were proven to be more successful than group B aerobic exercise along with ultrasound in reducing pain.

**Keywords:** Osteoarthritis, Ultrasound, Aerobic exercise, Isometric training

## Introduction

Osteoarthritis (OA) of the knee is the most prevalent condition among older individuals. As population ages on average, knee OA is growing more prevalent. A number of factors, such as age, weight, and joint injury from repetitive motions like squatting and kneeling, contribute to the development

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of osteoarthritis (OA) in the knees. Leptin, cytokines, mechanical stressors, and other factors can all contribute to knee OA. In patients with knee discomfort, OA of the knee should not be assumed to be the cause of the pain. Both primary (idiopathic) and secondary osteoarthritis of the knee exist. Post-traumatic, congenital/malformation, postoperative, metabolic, hemochromatosis, chondrocalcinosis, and endocrine issues are some of the secondary causes of knee osteoarthritis.[1]

The prevalence is around 10%. Men are less likely than women to suffer knee OA. Both men and women experiencethis, with men older than 55 having a lower incidence of knee OA than women. Knee OA, which normally proceeds slowly over a period of 10 to 15 years and causes difficulty in daily activities, affects all three compartments of the knee joint: the medial, lateral, and patello femoral joint. In the past, it was believed that inflammation had nothing to do with articular cartilage loss and was instead predominantly brought on by the "wear and tear" of aging.[2]

Therapeutic ultrasound (US) is known to reduce edema, relieve discomfort, increase range of motion (ROM), and hasten tissue repair. The US has been used to treat various musculoskeletal conditions. Muscles are contracted during isometric activities without joint movement. In people with osteoarthritis, these exercises can help increase muscle strength and stability around the knee joint, which can lessen symptoms and enhance functional outcomes[3]. Aerobic exercise programs have a broader impact on overall cardiovascular fitness, weight management, and joint mobility. They can provide systemic benefits and contribute to overall well-being. Ultrasound therapy, when used in conjunction with exercise, may help alleviate pain, reduce inflammation, and promote tissue healing. Education and home activities are also part of exercise interventions.[4] In general, treatments have been more effective at reducing pain than in reducing disability. Exercise can help with many of the issues that contribute to disability. Exercise, including both aerobic and strength training, has been studied as a treatment for knee osteoarthritis, with mixed results.[5]

Targeting particular muscle groups with isometric workouts helps strengthen the quadriceps, hamstrings, and calf muscles.[7] These muscles can be strengthened to help support the knee joint and ease pain.

## Aim

The aim of this study is to evaluate the efficacy of isometric training vs aerobic exercise program along with ultrasound for knee osteoarthritis patients.

## Methods

An experimental study conducted on 52 subjects with early knee osteoarthritis age between 45-65 was taken from prem physiotherapy clinic from November 2022 to July 2023. Convenient sampling was used in this study.

**Inclusion Criteria:**

- Both male and female are included.
- Both the gender diagnosed unilateral Osteoarthritis knee.
- Grade 2 and 3 according to ARC grading.
- Postmenopausal women.

**Exclusion Criteria:**

- Hip, knee, ankle surgery in affected leg.
- Any malignancy in the affected leg.
- Tumors involved leg.
- Any neurological or balance impairment in the involved leg.
- Lower limb replacement.

**Outcome Measures:**

Assessment taken before and after 4 weeks of study

- Numerical pain rating scale (NPRS)
- Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)

**Procedure**

52 subjects were divided into two categories: Group A (n=26) and Group B(n=26). The pre and post-test values measured by NPRS scale and WOMAC questionnaire. Group A received conventional treatment that is isometric training along with ultrasound and Group B received aerobic exercise along with ultrasound. Both training programs were given for 4 weeks, weekly 5 days.

**Control Group: (group A) Conventional Treatment**

- **Ultrasound**

Continuous ultrasound at the frequency of 3MHZ. This group was given continuous mode and a transducer area of 5cm$^2$ were administered to the knee for 12minutes per session, five days per week over the period of 2 weeks.

- **Straight leg Raises:**

The patients were asked to lie on their back with one leg straight and the other bent. Lift the straight leg slowly off the floor, hold for a moment, and then slowly bring it down. Start with a few repetitions and gradually increase over time. Repeat with the other leg.

- **Pillow Squeeze:**

Pillow squeeze: Ask the patient to squeeze the knees together, Squishing the pillow between them. Hold for 5 seconds. Relax. Do two sets of 10 repetitions. Switch legs after each set.

- **Seated Hip March:**

Ask the patient to sit up straight in a chair. Kick the left foot back slightly,then keep the toes on the floor.Lift the right foot off the floor,knee bent. Hold the right leg in the air for 3 seconds. slowly lower the foot to the ground. Do two sets of 10 repetitions. switch legs after each set.

- **Side Leg Raise:**

Ask the patient to stand and hold the back of a chair for balance. place the weight on the left leg. Stand tall and lift the right leg out to the side. keep the right leg straight and outer leg muscles tensed. Hold 3 seconds,then slowly lower the leg. Do two sets of 10 repetitions.switch legs after each set.

- **Static Quadriceps:**

Ask the patient to place the small rolled towel underneath one knee. then the patient to position himself lying on the back with the knees straight. pull the toes up towards you. tighten the muscles at the front of your thigh, and press the back of the knee onto the towel. Hold for 5 secs and relax. repeat for 10 times. switch to the other leg.

- **One leg Balance:**

Ask the patient to stand behind the kitchen counter without holding on, and slowly lift one foot off the floor. ask the patient to stay balanced for 20 seconds without grabbing the counter, repeat this move twice,then switch to the other sides.

- **Supine Heel Slides:**

Ask the patient to lying down on the back with the legs straight, then bend the knee and slide the heel up towards your buttocks, then slide the heel back down. dont lift your heel up off the bed and dont let your knee roll inward. follow up to 10 repetitions, two to three times per day. Then do this exercise with other leg..

- **Protocol:**

The subjects were instructed to perform each exercise twice, for a total of ten repetitions, 4-5 times a week.

**Experimental group: (group B) Aerobic Exercise Program Along With Ultrasound**

- **Ultrasound**

Continuous ultrasound at the frequency of 3MHZ. This group was given continuous mode and a transducer area of 5cm$^2$ were administered to the knee for 12minutes per session, five days per week over the period of 2 weeks.

- **Walking:**

Ask the patient to stand and ask the patient to start walking slowly with short distances and gradually increase the duration and intensity over the time. 3 repetitions, two times per day.

- **Cycling:**

Ask the patient to start the cycling slowly in static position. If you start to feel a pain in knees, then stop it immediately. Initially start the program for 5 minutes session a day. After you do the cycling with successfully with no pain, increase the duration to 7 minutes. Then gradually increase the duration of the time.

- **Water Aerobic:**

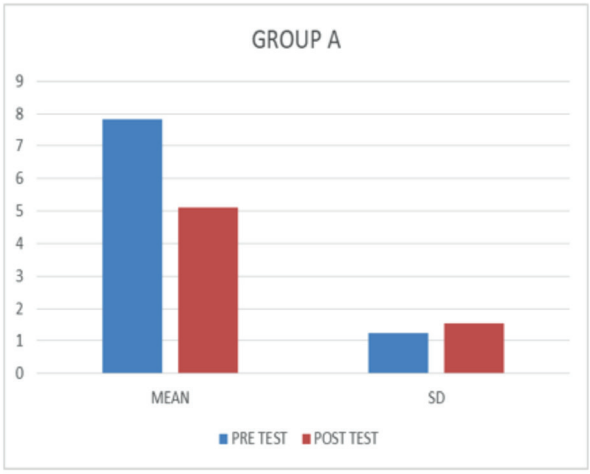
Ask the patient to start off walking in shallow water, around waist height. Lengthen your spine and

walk by putting pressure on your heel first and then your toes. Instead of walking on your tiptoes. Keep the arms at your side in the water, and move them as you walk. Continue walking for 5 to 10 minutes.

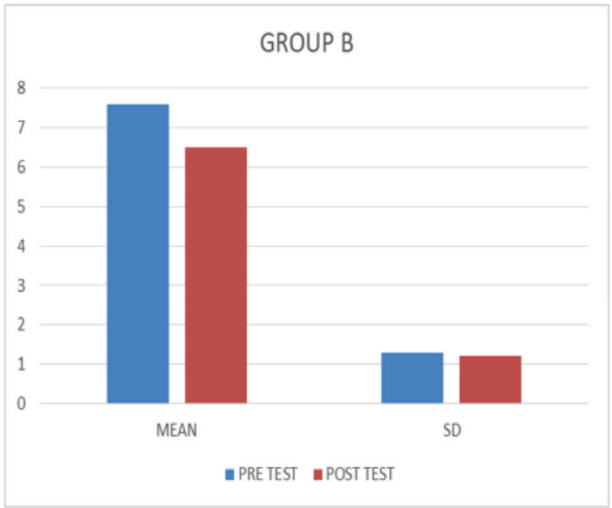
**Protocol:**

The subjects were instructed to perform each exercise twice, for a total of ten repetitions, 4-5 times a week.

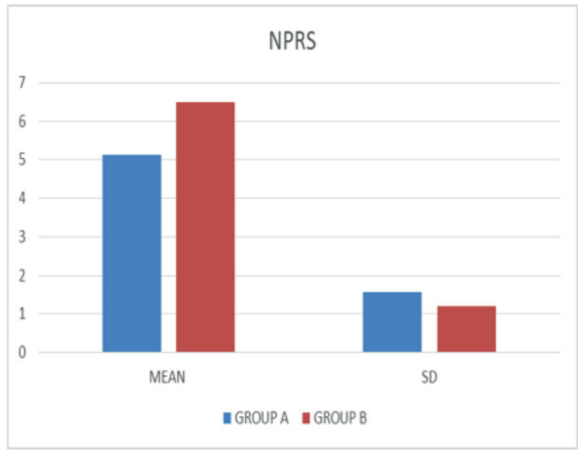
**Data Analysis:**



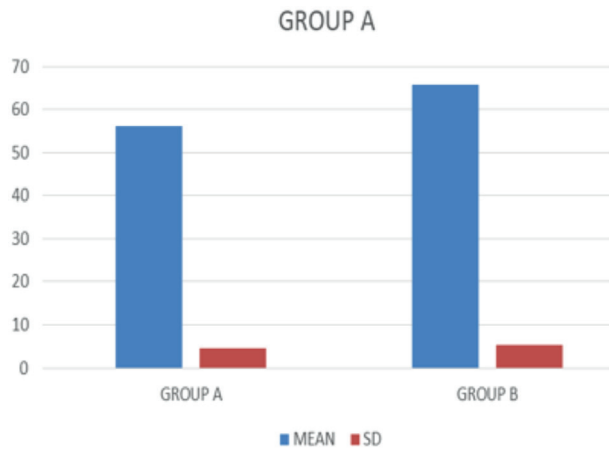

**Graph 1- Shows the pre and post test values of NPRS in group A**



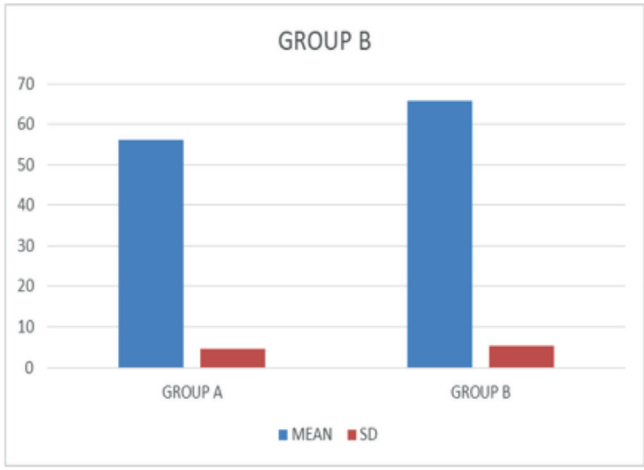

**Graph 2 - Shows the pre and post test values of NPRS in group B**




**Graph 3 - Shows the post test values of NPRS for both the group.**




**Graph 4 - Shows the pre test and post test values of WOMAC in group A**




**Graph 5 - Shows the pre test and post test values of WOMAC in group B**




**Graph 6 - Shows the post test values of group A and group B using WOMAC**

## Results

A statistically significant difference between groups A and B as well as within each group was found by statistical analysis of quantitative data.

The post-test values of NPRS in both the groups. The post-test value with a mean and SD of 5.12 and 1.56 in group A and 6.50 and 1.21 in group B with t value of 3.5814 with significance.

The post- test values of WOMAC for both the groups. The post-test value with a mean and SD of 56.19 and 4.58 in group A and 65.69 and 5.34 in group B with t value of 6.8848 with significance.

And this suggests that group A performed considerably better than group B. This strongly suggests that Isometric training is effective in improving knee strength and in reducing pain and thus improves quality of life and function in OA.

## Discussion

The most common condition of aged people is osteoarthritis of knee and one of the primary causes of disability . Knee OA is becoming more common as the population average age rises. It happens when cartilage of knee joint breaks down, causes bones to rub together. The friction makes knees hurt, becomes stiff and swell. Clinical symptoms include joint stiffness, pain, and dysfunction, but pain is the most common complaint among patients. Knee osteoarthritis is divided into two types: primary (idiopathic) and secondary. . People who have knee-osteoarthritis, Strength training, range of motion exercises, and cardiovascular activities are given. Education and home activities are also part of exercise interventions. In general, treatments have been more effective at reducing pain than in reducing disability. Exercise can help with many of the issues that contribute to disability. Exercise, including both aerobic and strength training, has been studied as a treatment for knee osteoarthritis, with mixed results. The goal of the study was to determine how Isometric training with Ultrasound affected individuals with OA knees. Research studies stated Isometric training exercises have significant improvement in patients with knee osteoarthritis.

KN Subramanian et al 2023 conducted study among 340 OA Knee patients and are randomized into two groups. Case group (Group A) and Control group (Group B). quadriceps strengthening is tied up with a better prognosis in patients with moderate OA knee[1]. In this study 52 subjects were taken and divided into two groups. Isometric training along with ultrasound (Group A) and Aerobic exercise program along with ultrasound (Group B) and concluded that Isometric training is effective in reducing pain and improves muscle strength in OA knee patients.

Anwer S et al 2014, conducted study among 42 subjects and were allocated into two groups. Experimental group (n=21) and control group (n=21) concludes that isometric quadriceps exercise is effective in reducing pain[3]. Similarly, in this study Isometric training along with ultrasound group has beneficial effects on quadriceps muscle strength, pain, and functional disability in patients with osteoarthritis of the knee.

Sengul A, et al 2022 conducted study among 30 subjects. The subjects were randomly divided into two groups according to the type of performing the quadriceps isometric exercises as group 1 (performing in knee extension) and group 2 (performing in knee flexion) and concluded that exercises performed in knee extension were found to be more effective in reducing joint stiffness[4]. Similarly this study concluded that quadriceps muscle strengthening maintains beneficial effects in patients with knee OA such as significant reduction of knee pain and improvement of knee function

## Conclusion

In conclusion, this study provides robust evidence supporting the efficacy of Isometric training and Aerobic exercise with conventional therapy as a management strategy for osteoarthritis knee. The significant improvements observed in muscle strength, pain levels, stiffness, knee alignment, and postural stability highlight the positive impact of this combined approach on function and overall well-being in individuals with knee osteoarthritis. The findings suggest that Isometric training, when integrated with conventional therapy, surpasses the effectiveness of conventional therapy alone in terms of pain reduction, functional restoration, and improved quality of life. By targeting muscle strength, aligning the knee joint, and enhancing postural stability, this comprehensive approach addresses the multifaceted aspects of osteoarthritis knee management

**Ethical clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/096/2022/ISRB/SR/SCPT)

**Funding:** This study is a self-funded study.

**Conflict of interest:** The authors state that there is no conflict of interest

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Original Article

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# Efficacy of Modified Progressive Resistance Training on Knee Strength in Women with Early Onset of Knee Osteoarthritis

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**Abstract**

**Background:** The synovial joint capsule, subchondral bone, and joint cartilage are all impacted by the gradual degenerative condition known as OA. This research work is designed to check the efficacy of modified progressive resistance training for OA knee patients.

**Purpose:** To compare the effectiveness of modified progressive resistance training and conventional treatment on knee strength in early onset knee OA.

**Materials and Methods:** 370 subjects were screened for study from GNK physiotherapy clinic according to inclusion and exclusion criteria from november 2022 to june 2023. Patient's authorization was acquired after the procedure was completely clarified to them. They were divided into two categories: Group A (n=185) and Group B (n=185). The pre and post-test values measured by WOMAC questionnaire and MMT. Group A received conventional treatment that is strengthening and stretching exercises and Group B received modified progressive resistance training using Thera band along with conventional treatment. Both training programs were given for 4 weeks, weekly 5 days

**Results:** A statistically important distinction <0.0001 between groups A and B was found via statistical analysis of information that was quantitative**.**

**Conclusion:** Modified progressive resistance training using Thera band of group A were proven to be more successful than group A Traditional therapy

**Key Words:** Osteoarthritis, Knee, Thera band, Resistance, Strengthening exercises.

## Introduction

Osteoarthritis is a progressive, degenerative joint condition that affects about 60% of people over 50.[1] The knee's tibiofemoral joint, specifically the medial section, is commonly impacted by OA, causing pain, stiffness, and difficulties with daily activities. Early OA shows symptoms like joint pain, stiffness,

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and soreness. It affects the knee joint's structure and function, impeding movement and exercise capability.[2]

According to some research, decline in tibio-femoral motion is a probable cause for the progression of cartilage degeneration at the knee, which frequently occurs before degenerative changes. Particularly in elderly persons where their cartilage could be resistant to heavy loading, chronic kinematic changes might result in degenerative changes in the cartilage.[3]

Patients with EOA are able to take part in an RT program without spotting an adaptive decline in their total MVPA scores levels. RT has been shown to increase energy expenditure in adults, improve muscular strength and physical function in OA of the knee patients, and decrease pain, making it a crucial component of treatment.[4]

Strengthening the function of patient's lower limbs is crucial for enhancing their quality of life. This objective can be accomplished by strengthening muscles and improving limb function through exercising with resistance.[5] The best workout for increasing muscle strength is resistance training. Hence this research is hypothesized to analyze the results of modified progressive resistance training for OA knee.,

## Aim

The aim of this study is to evaluate the efficacy of modified progressive resistance training for OA knee patients

## Materials and Methods

An experimental study conducted on 370 subjects with early knee osteoarthritis age between 35-45 was taken from GNK physiotherapy clinic and the study has been conducted from November 2022 to June 2023.Convenient sampling was used in this study.

**Inclusion Criteria:**

- Based on the American College of Rheumatology's specified medical and imaging standards.
- Females age between 35-45
- At least two episodes lasting for 10 days in the previous year.
- Kelgren Lawrence grade 0 or 1 or 2 osteophytes only
- Meniscal pathology
- Postmenopausal women

**Exclusion Criteria:**

- Knee surgery or physical treatment (within the last 12 months)
- Lower limb replacement within the last six months
- Administration of steroid into the joint
- Heart and lung diseases

**Outcome Measures:**

Assessment taken before and after 4 weeks of study

- Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC)
- Manual muscle testing

**Procedure**

370 subjects were divided into two categories: Group A (n=185) and Group B (n=185). The pre and post-test values were measured by WOMAC questionnaire and MMT. Group A received conventional treatment that is strengthening and stretching exercises and Group B received modified progressive resistance training using Thera band along with conventional treatment. Both training programs were given for 4 weeks 5 days in a week for 30 minutes.

**Control Group: (Group A) Conventional Treatment**

- **Straight Leg Raises:**

The patients were asked to lie on their back with one leg straight and the other bent. Lift the straight leg slowly off the floor, hold for a moment, and then bring it gently down. Start with a few repetitions and gradually increase over time. Repeat with the other leg.

- **Quadriceps Sets:**

The patients to take a seat on a chair with their back straight and extend one leg in front of you. Tighten the muscles on the front of their thigh and hold for a few seconds. Relax and repeat for several repetitions. Switch to the other leg and repeat.

- **Hamstring Curls:**

The patients were asked to stand behind a chair and hold onto it for support. Slowly bend one knee and bring foot up toward their buttocks, as if they were trying to kick their own buttocks. After a brief period of holding, lower the foot back down. The other leg, and repeat.

- **Wall Squats:**

The patients were instructed to stand with their feet approximately shoulder-width apart and their backs against a wall. By folding the knees, as if they were seating back into a chair, one can slowly slide down the wall. Keep the knees aligned with the toes and hold the posture for a moment before standing up again. Start with a partial squat and gradually work toward a deeper squat as the strength improves.

- **Step Ups:**

Use a step or a sturdy platform. Step up with one leg and bring the other leg up to meet it. Step back down with the same leg and repeat for several repetitions. Switch to the other leg and repeat.

- **Mini Squats:**

Patients were asked to stand with their feet shoulder-width apart and slightly turned out. Slowly lower the body into a partial squat, keeping the knees aligned with their toes. Remain for a short while before standing back up. Continue to repeat multiple times.

- **Calf Raises:**

Patients were asked to stand behind a chair or use a wall for support Lifting their heels off the ground, they stand up onto their toes. Hold for a few seconds while bringing their heels back down. Continue to repeat multiple times

- **Hamstring Stretch:**

Stretching increases possibilities for motion and maintains flexibility. When it was time to stretch their hamstrings, the patients were instructed to lie down. Bedsheet is wrapped around their right ankle. The straight leg was raised using the sheet. Lower the leg after 20 seconds of holding. the legs changed then.

- **Calf Stretch:**

The patients were asked to use a chair as a balance aid. Stepping back with their left leg gently straightened behind them, they bend their right leg. The left heel exerted downward pressure. It should feel stretched. Maintain for 20 seconds. The legs changed after two repetitions.

- **Protocol:**

The subjects were instructed to perform each exercise twice, for a total of ten repetitions, 4-5 times a week.

**Experimental Group: (Group B) Modified Progressive Resistance Training**

- **Quadriceps Strengthening:**

The patient were asked to sit in a chair and Thera band is placed in their ankle and other end is knotted to lateral side with the help of adjacent couch's rod placed over there. Then the patient is asked to perform knee extension.

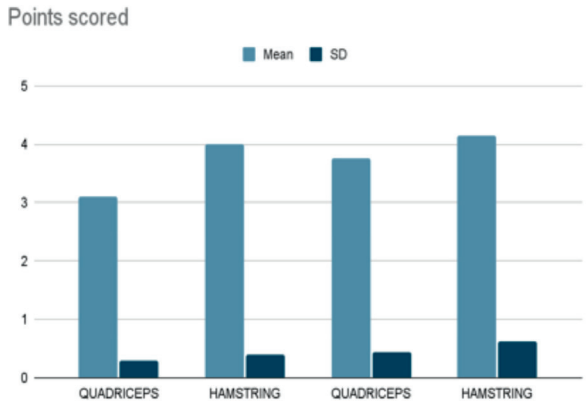
- **Hamstring Strengthening:**

The patient should be positioned prone, and the Thera band should be applied is placed by using the same procedure. Then the patient is asked to perform knee flexion. All the colors of the resistance band can be used and additional weights are added for progression. The exercises mentioned in the conventional group were also performed along with these exercises.

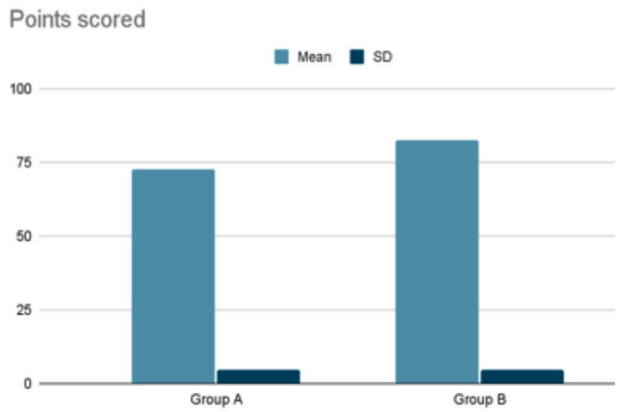
- **Protocol:**

The subjects were instructed to perform each exercise twice, for a total of ten repetitions, 4-5 times a week.

**Data Analysis:**




**Graph 1- shows the post test values of quadriceps and hamstring for both the groups**




**Graph 2: Post test values of group A and B using WOMAC.**

## Results

A statistically significant difference between groups A and B as well as within each group was found by statistical analysis of quantitative data.

The post-test values of manual muscle testing for quadriceps muscle in both the groups are mentioned subsequently. The post-test value with a mean and SD of 3.1 and 0.3 in group A and 3.76 and 0.43 in group B with t value of 17.28 with significance of 0.001 for quadriceps muscle.

The post-test values of manual muscle testing for hamstring muscle in both the groups are mentioned subsequently. The post-test value with a mean and SD of 4.00 and 0.39 in group A and 4.14 and 0.63 in group B with t value of 2.57 with significance of less than 0.001 for hamstring muscle using T test calculator.

The post- test values of WOMAC for both the groups are mentioned subsequently. The post-test value with a mean and SD of 72.61 and 4.55 in group A and 82.34 and 4.64 in group B with t value of 20.4 with significance using T-test calculator.

And this suggests that group B performed considerably better than group A. This strongly suggests that modified progressive resistance training is effective in improving knee strength and reducing pain and thus improves quality of life and function in OA.

## Discussion

There is evidence that muscle impairment has a role in the onset of OA knee. The innate bracing for the knee joint is provided by the lower leg muscles. The quadriceps muscle has been seen to be weak. Risks associated with American Academy of Orthopaedic Surgeons said that knee joint structural deterioration is a factor. In order to stop degeneration from progressing further, genu varum must be treated as soon as possible. The modified progressive resistance exercise was used in this study to increase muscular strength. The benefit of this exercise was that it increased joint space in OA patients and prevented further deterioration of the medial condyle when the Thera band was tied to the lateral side. The goal of the study was to determine how modified progressive resistance training with thera bands affected individuals with OA knees. Research studies stated that elastic band exercises have significant improvement in patients with knee osteoarthritis.

Mei Hua Jan, Jiu jeng Lin concluded that patients with knee OA benefitted from greater and low-resistance workouts, which improved function and decreased pain. Despite the fact that the advantages of high-resistance strength training tend to outweigh those of low-resistance strength training by a small margin.[5]

NavidKalani, Shahnazshahrbanian shows that Theraband resistance training combined with medication treatment had beneficial benefits on knee sufferers' pain and quality of life osteoarthritis.[6]

Favero M et al stated the idea behind OA has undergone a significant transformation in the last ten years. This is connected to the advancement of increasingly sophisticated imaging methods like MRI, which can spot changes in the structure and makeup of an of every joint tissue in addition to bone and cartilage.[7]

Kogilavani Krishnan, Fariba Hossein Abadi stated in comparison between aquatic and Theraband exercises on pain and endurance that effective and advantageous choices to reduce pain intensity include Aquatic Exercises and Theraband exercises. In discomfort, adequate TBE is probably a straightforward substitute for hydrotherapy.[8]

Ji Yeong Yun and Jong Kyung Lee came to the conclusion that the Theraband exercise program offered patients who had undergone total knee arthroplasty an additional benefit above the traditional CPM exercise.[9]

Emmanuel Gomes Ciolac et al (2015) stated that resistance exercise partially corrected impairments in lower limb loading, working and equilibrium. These findings may imply that resistance training may be a key strategy to combat the widespread mobility issues in this population.[10]

JN Farr (2010) stated that Patients with early-onset knee OA might take part in an RT program without seeing a compensating decline in their total MVPA levels. As RT has been shown to enhance adult consumption of energy, it is an effective treatment for those with OA of the knee, to improve muscular strength and physical performance, and to lessen discomfort essential element in knee OA treatment.[11]

One of these advantages of exercising is that thera band that is affordable and feasible to carry it wherever you go and practice the activity.There have not been any reported adverse consequences from employing this kind of workout for them is therefore it is recommended for individuals with knee arthritis.

## Conclusion

The study shows that modified progressive resistance training combined with conventional therapy is effective for managing knee osteoarthritis. It resulted in significant improvements in muscle strength, pain levels, stiffness, knee alignment, and postural stability. This combination was more effective than conventional therapy alone in improving function and overall well-being in people with knee osteoarthritis. However, further research and long-term follow-up studies are needed to validate and assess the lasting effects of this approach.

**Ethical Clearance:** The ISRB committee of a private hospital and institution in Chennai has provided its clearance for the conduct of human research that complies with all applicable national laws, institutional regulations. (Application Number 03/097/2022/ISRB/SR/SCPT).

**Funding:** This study is a self-funded study.

**Conflict of Interest:** The authors state that there is no conflict of interest

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Original Article

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# Efficacy of Cervical Spinal Stabilization Exercise on Reducing Pain for People with Cervical Spondylosis

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**Abstract**

**Background:** The synovial joint capsule, subchondral bone, and joint cartilage are all impacted by the gradual degenerative condition known as OA. This research work is designed to check the efficacy of modified progressive resistance training for OA knee patients**.**

**Purpose:** To compare the effectiveness of cervical stabilization exercises and conventional physiotherapy exercise in reducing pain for patients with cervical spondylosis.

**Materials and Methods:** The study took place in Eyan Physiotherapy Centre, Sriperumbudur, A total no of 40 subjects were recruited for this study through the purposeful sampling method. All subjects were recruited based on the inclusion and exclusion criteria. The recruited subjects were assigned to two groups (Group A: 20 Subjects) underwent Cervical Stabilization Exercise and (Group B: 20 Subjects) underwent Conventional Exercise. All individuals are assessed for pain using Algometer as a pre-test prior to the intervention and again after 6 weeks of intervention. The entire study process was performed from November 2022 to April 2023.

**Results:** This study states that cervical stabilization exercises are found to be more significant and more effective in reducing pain compared to conventional therapy. The comparison of post mean value of Algometer of both the groups. Group-A(Cervical Stabilization Exercise) was 4.30 and Group B(Conventional Exercise) was 3.65 which shows gradual increase with p value <0.0001 statistically significant.

**Conclusion:** This study recommended that clinicians consider incorporating cervical stabilization exercises into the treatment plan for individuals with cervical spondylosis. The evidence supporting the efficacy of cervical stabilization exercise in reducing pain in individuals with cervical spondylosis.

**Key Word:** cervical spondylosis, cervical stabilization, conventional, exercise, pain, reduction**.**

## Introduction

The term "cervical spondylosis" describes a wide range of gradually degenerative changes that affect all of the structural components of the cervical spine, such as the intervertebral discs, facet joints, joints of Luschka, ligamenta flava, and laminae. It is

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a characteristic sign of aging and often appears after the fifth decade of life.[1]

Neck discomfort, stiffness, and, in cases where neural structures are compressed, radicular symptoms, are all signs of cervical spondylosis.[2]

The second most prevalent complaint after low back pain is neck pain, which is a widespread issue. Healthcare professionals must identify symptomatic cervical spondylosis and offer evidence-based, economical therapies due to the disease's considerable burden of illness, which is accompanied by significant impairment and financial expense.[3]

Exercise plans for treating neck pain vary in terms of length, training frequency, intensity, and method of exercise. Previous research has indicated that isometric workouts and strength training help reduce neck discomfort.[4,5,6] Neck stabilisation exercises (NSE) were established as a rehabilitation regimen, however, to reduce discomfort, maximize function, and avoid future damage.[7,8,9]

The cervical spine is the most intricate region of the spine, and so are the muscles of that region. The condition can lead to neck pain, stiffness, and reduced neck mobility, affecting an individual's daily activities and overall quality of life. Cervical stabilization exercises involve targeted exercises that aim to strengthen the deep neck flexors, including muscles such as the longus colli and longus capitis. These muscles play a vital role in maintaining proper alignment and stability of the cervical spine. By strengthening these muscles, cervical stabilization exercises aim to improve spinal stability, reduce excessive cervical spine movement, and alleviate pain and functional limitations associated with cervical spondylosis.The specific exercises included in cervical stabilization exercise programs may vary, but commonly prescribed exercises inlude chin tucks, deep neck flexor exercises, and isometric neck exercises.[10]

Conventional therapy exercises are an integral component of physical therapy for individuals with cervical spondylosis. These exercises target pain reduction, improved flexibility, enhanced strength, and postural alignment. By incorporating a variety of exercises into the therapy program, individuals can experience pain relief, improved function, and enhanced overall well-being. Conventional therapy exercises offer a safe and effective intervention for managing cervical spondylosis and optimizing the quality of life for individuals affected by this condition. Conventional therapy exercises aim to address various aspects of the condition, including pain reduction, improved flexibility, and enhanced strength and stability. They are typically performed in a controlled manner, with an emphasis on proper form and alignment. The specific exercises included in conventional therapy programs for cervical spondylosis may vary, but they often target the neck, shoulders, and upper back muscles. [11]

## Aim

To compare the effectiveness of cervical stabilization exercises and conventional physiotherapy exercise in reducing pain for patients with cervical spondylosis.

## Material and Method

The study included 40 participants with Cervical spondylosis. The individuals were randomly assigned to one of two groups: the experimental group (n = 20), who received Cervical spine stabilization exercise, and the conventional group (n = 20), which received Conventional therapy. All individuals were assessed for pain using an algometer as a pre-test prior to the intervention and again after 6 weeks of intervention.

**Inclusion Criteria:**

- Adults aged 40-65 years.
- Clinically diagnosed with cervical spondylosis based on radiographic findings.
- Experiencing neck pain of at least moderate intensity.
- Willingness to participate in a supervised exercise program for a duration of 8 weeks.

**Exclusion Criteria:**

- History of cervical spine surgery.
- Presence of any other significant musculoskeletal or neurological condition.
- Recent trauma or injury to the cervical spine.
- Severe comorbidities that may limit participation in exercise therapy.

**Outcome Measures:**

An algometer is a device used in clinical and research settings to objectively measure pressure pain thresholds (PPTs).

**Procedure**

The recruited subjects were assigned to two groups. (Group A: 20 Subjects) and (Group B: 20 Subjects) underwent pre-test analysis on the pain assessment tool using Algometer to analyze the impact of the interventions on the overall quality of life for Cervical spondylosis Patients. After the pre-test analysis, Group A received Cervical stabilization exercises for 3 sessions per week for the period of 6 weeks, Whereas Group B received Conventional Exercise Therapy for 3 sessions per week for the period of 6 weeks. After 6 weeks, the Post-test analysis was carried out, and the data were tabulated through SPSS.

**Exercise Protocol for Cervical Stabilization**

**Exercise 1: Deep Neck Flexor Exercise**

Purpose: Strengthen the deep neck flexor muscles to enhance cervical stability and improve postural alignment.

**Instructions:**

1. Begin by lying on your back on a firm surface with knees bent and feet flat on the floor.
2. Gently tuck your chin inwards, aiming to create a double chin appearance without lifting the head or neck off the surface. Hold this position for 5 seconds, focusing on activating the deep neck flexor muscles.
3. Relax and repeat for 10 repetitions.
4. Progressively increase the duration of the hold up to 10 seconds as the exercise becomes easier.

**Exercise 2: Isometric Neck Extension Exercise**

Purpose: Strengthen the muscles in the back of the neck to improve cervical stability.

**Instructions:**

1. Sit or stand with your spine in a neutral position, shoulders relaxed. Place your palms against the back of your head, fingers interlaced. Push your head gently backward into your palms, resisting the movement with your palms.
2. Hold the contraction for 5 seconds while maintaining a stable neck position.
3. Relax and repeat for 10 repetitions.
4. Progressively increase the duration of the hold up to 10 seconds as the exercise becomes easier.

**Exercise 3: Cervical Retraction Exercise**

Purpose: Promote postural alignment and improve neck muscle control.

**Instructions:**

1. Sit or stand with your spine in a neutral position.
2. Gently retract your head by bringing your chin straight back without tilting it up or down. Hold the retracted position for 5 seconds, feeling a stretch at the base of your skull.
3. Relax and repeat for 10 repetitions. Progressively increase the duration of the hold up to 10 seconds as the exercise becomes easier.

**Exercise 4: Scapular Retraction Exercise**

Purpose: Strengthen the muscles between the shoulder blades to improve postural alignment and reduce strain on the neck.

**Instructions:**

1. Sit or stand with your spine in a neutral position, shoulders relaxed. Squeeze your shoulder blades together by pulling them toward your spine.
2. Hold the contraction for 5 seconds while maintaining a stable neck position.
3. Relax and repeat for 10 repetitions.
4. Progressively increase the duration of the hold up to 10 seconds as the exercise becomes easier.

**Exercise 5: Shoulder Shrugs**

Purpose: Improve shoulder and neck muscle control and relieve tension in the upper trapezius muscles.

**Instructions:**

1. Sit or stand with your spine in a neutral position.
2. Lift both shoulders towards your ears, squeezing them up as high as possible. Hold the shrug for 5 seconds, feeling the tension in your upper trapezius muscles.
3. Relax and repeat for 10 repetitions.
4. Progressively increase the duration of the hold up to 10 seconds as the exercise becomes easier.
5. It is important to note that each exercise should be performed with proper technique and within a pain-free range of motion. If any exercise causes pain or discomfort, it should be modified or discontinued. It is recommended to start with low repetitions and progress gradually as the exercises become easier.
6. Incorporating these cervical stabilization exercises into a regular exercise routine, under the supervision and guidance of a healthcare professional, can contribute to improved spinal stability, reduced pain, and enhanced functional abilities in individuals with cervical spondylitis.

**Exercise Protocol for Conventional Physiotherapy:**

The following exercise protocol outlines a set of exercises commonly used in conventional physiotherapy for individuals with cervical spondylosis. These exercises aim to improve neck flexibility, strengthen supporting muscles, and enhance posture and range of motion. It is important to note that this protocol should be implemented under the guidance of a qualified healthcare professional, such as a physical therapist, who can assess the individual's specific needs and tailor the exercises accordingly.

**Exercise 1: Neck Range of Motion Exercises**

Purpose: Improve neck mobility and flexibility.

**Instructions:**

1. Sit or stand with your spine in a neutral position.
2. Perform gentle neck movements in different directions, including flexion (chin to chest), extension (looking up), lateral flexion (ear to shoulder), and rotation(turning head from side to side).
3. Perform 10 repetitions in each direction, moving within a pain-free range of motion.
4. Gradually increase the range of motion as tolerated.

**Exercise 2: Shoulder Rolls**

Purpose: Mobilize and strengthen the shoulder girdle muscles.

**Instructions:**

1. Sit or stand with your spine in a neutral position.
2. Roll your shoulders forward in a circular motion, completing 10 repetitions.
3. Reverse the motion, rolling your shoulders backward for another 10 repetitions.
4. Maintain relaxed and controlled movements throughout.

**Exercise 3: Upper Trapezius Stretch**

Purpose: Stretch and relieve tension in the upper trapezius muscles.

**Instructions:**

1. Sit or stand with your spine in a neutral position.
2. Gently tilt your head to the side, bringing your ear closer to your shoulder.
3. Hold the stretch for 15-30 seconds, feeling a gentle stretch in the upper trapezius muscle.
4. Repeat on the opposite side.
5. Perform 3-5 repetitions on each side.

**Exercise 4: Deep Breathing with Chin Tucks**

Purpose: Promote relaxation, improve posture, and enhance deep neck flexor muscle activation.

**Instructions:**

1. Sit or stand with your spine in a neutral position.
2. Take a deep breath in, expanding the diaphragm.
3. As you exhale, gently tuck your chin inwards, creating a double chin appearance without lifting the head or neck.

4. Hold this position for the duration of the exhalation.
5. Relax and repeat for 10 repetitions, coordinating deep breathing with chin tucks.

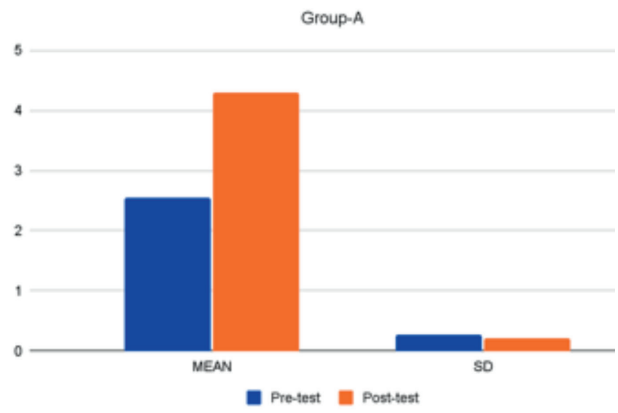
**Exercise 5: Postural Exercises**

Purpose: Improve postural awareness and alignment.

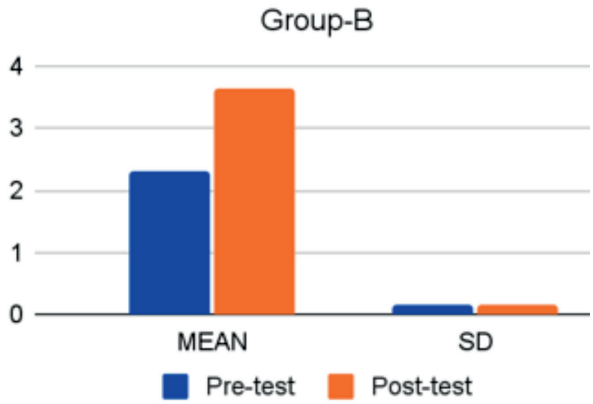
**Instructions:**

1. Sit or stand with your spine in a neutral position.
2. Engage the core muscles by gently drawing the belly button towards the spine.
3. Imagine lengthening the spine and lifting the crown of the head towards the ceiling.
4. Maintain this tall and aligned posture for 10-15 seconds.
5. Relax and repeat for 5-10 repetitions throughout the day, especially
6. during prolonged sitting or sedentary activities.
7. It is important to perform these exercises with proper technique and within a pain-free range of motion. If any exercise causes pain or discomfort, it should be modified or discontinued. It is recommended to start with low repetitions and progress gradually as the exercises become easier.

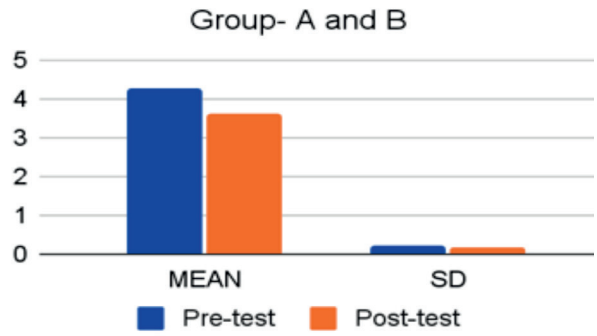
**Data Analysis**




**Graph 1: Comparison between Pre-test and Post-test values of Algometer for Group A Cervical Stabilization Exercise**




**Graph 2: Comparison between Pre-test and Post-test values of Algometer for Group B conventional therapy**




**Graph 3: Comparison between Pre-test and Post-test values of Algometer for Group A Cervical Stabilization Exercise and Group B Conventional Exercise.**

## Result

The study showed a statistically significant p-value of less than 0.0001.Statistical analysis was done for all the collected data using a paired t-test. The test shows significant effects (p 0.0001) in both groups. A statistically significant difference between Group A (Cervical Stabilization Exercises) and Group B (Conventional Exercise Program) as well as within each group was found by statistical analysis of quantitative data. Using the Algorithm, the pain assessment tool (Cervical Stabilization Exercise) group A's post-test mean was 4.30, whereas the conventional exercise group B's was 3.65. This demonstrates that Group A (Cervical Stabilization Exercise) received a higher Algometer score than Group B (Conventional Exercise Program).

## Discussion

The results of this study demonstrated that both cervical stabilization exercises and conventional physiotherapy led to a significant reduction in pain intensity, improved range of motion, and decreased functional disability in individuals with cervical spondylosis. However, when comparing the two interventions, it was observed that the group receiving cervical stabilization exercises showed greater improvements in pain reduction and functional outcomes compared to the conventional physiotherapy group.

In a previous study Yi-Liang Kuo states that preliminary evidence shows significant changes in neck pain, control of deep cervical flexors, and physical impairment measures among university violin players with nonspecific neck pain who underwent a cervical stabilization exercise program. Similarly in this study involving cervical spondylosis patients revealed that cervical spinal stabilization exercise was more effective compared to conventional therapy.[10]

In a previous study Roshni G found that various interventions, such as cervical traction, asanas, manual therapy, acupuncture, and more, effectively reduced pain and improved cervical range of motion in those with cervical spondylosis. Similarly in this study comparing cervical stabilization exercises and conventional therapy for cervical spondylosis revealed greater effectiveness in the former.[11]

## Conclusion

In conclusion, this study supports the effectiveness of cervical stabilization exercises in reducing pain and improving function in cervical spondylosis. These exercises offer better results than conventional physiotherapy, but individualized treatment plans should consider patient preferences and conditions. Further research is needed to explore long-term effects beyond the 3-month follow-up period.

**Ethical Clearance:** Taken from institutional ethical committee (Application number: 03/ 098/ 2022/ ISRB/ SR / SCPT)

**Funding:** Self

**Conflict of Interest:** Nil

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Original Article

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# Comparative Study on Myofascial Release Technique and Muscle Energy Technique in Reducing Pain and Improving Functional Activity for People With Chronic Low Back Pain: Experimental Study

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**Abstract**

**Background:** Chronic Low Back Pain is a complex and multifactorial condition, often associated with muscular imbalances, trigger points, and myofascial restrictions. MRT focuses on releasing myofascial restrictions, while MET utilizes muscle contractions to normalize muscle length and improve joint mobility. Both techniques have shown promising results individually.

**Purpose:** To compare the effectiveness of myofascial release technique and muscle energy technique in reducing pain and improving functional activity in individuals with chronic low back pain.

**Material and Method:** This is an experimental study done using purposive sampling technique with inclusion criteria of age between 30 to 55, Patients who were diagnosed with chronic low back pain (Duration of at least 12 weeks). patients with history of Fractures and Musculoskeletal conditions were excluded. The sampling size of the study is (n=90) subjects for a period of 6 weeks [February 2023 to March 2023].

**Results:** The results revealed significant improvement of functional activity in patients with chronic low back pain.

**Conclusion:** This study finally concluded that MRT is more effective than MET in reducing pain and improving functional activity for individuals with Chronic Low Back Pain.

**Keywords:** low back pain, Myofascial Trigger Release, Muscle Energy Technique, Numerical Pain Rating Scale, Oswestry Disability Index.

## Introduction

Numerous people throughout the world deal with Chronic Low Back Pain (CLBP). It could potentially lead to a serious loss in quality of life as well as a significant impairment. Many people throughout the world suffer from the common and debilitating ailment known as Chronic Low Back Pain (CLBP).[1,2] Lower back discomfort that is persistent or recurrent and lasts for at least a year is a sign.[3] CLBP can have a negative effect on a person's functional abilities, general health, and quality of life, which can

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lead to decreased productivity, increased health care costs, and emotional suffering. Recent studies have shown that people with LBP experience pain and the resulting disability for a longer amount of time than people with other types of pain. Non-specific back pain is more common in young people and may be a major factor in the development of adult LBP.[5] Enhancing patient function and assisting with a restoration to the patient's preferred level of daily activities are the main objectives of treatment for LBP. Although a variety of treatment approaches are employed, many practice recommendations promote a biopsy Cho-social approach, which places a greater emphasis on self-management, psychological support, and physical therapy and less on the use of drugs and surgical procedure.[4] They have the capacity to activate, leading to pain in the immediate area as well as discomfort referred to other areas of the body. These trigger points are located and treated using a variety of manual techniques in myofascial trigger release.[5,6] Medical professionals regularly employ a manual therapy technique called Muscle Energy Technique (MET) to aid in the restoration of balance, flexibility, and functionality in muscles and joints. It is a non-invasive technique that necessitates active participation from the patient and is based on the ideas of reciprocal inhibition and neuromuscular facilitation. Musculoskeletal problems are corrected by MET by carefully controlling the contraction of a patient's chosen muscles against resistance from the therapist or their own body.[7,8] These contractions are performed at varying intensities and durations to target tight or restricted muscles, improve joint mobility, and lessen discomfort. Based on a person's needs and the muscles or joints being worked on, MET techniques can alter. The therapist might employ a method known as post-isometric relaxation (PIR), in which the patient contracts a muscle against resistance for a brief period of time before letting go and obtaining increased flexibility. There are many benefits to MET. It can improve the flexibility, strength, and stability of muscles while relieving pain and addressing musculoskeletal imbalances. It can help with joint mobility as well.[10] Myofascial Release Technique (MRT) and Muscular Energy Technique (MET) are two manual therapy methods often employed in the treatment of CLBP.[1,2] The relative effectiveness of various medications in reducing pain and boosting functional activity is unknown. So, the goal of this study is to evaluate and compare the efficacy of MRT and MET in treating persons with CLBP.

## Aim

To evaluate the efficiency of muscular energy technique and myofascial release technique in treating chronic low back pain and enhancing functional activity.

## Material and Method

This is an experimental study done using purposive sampling technique with inclusion criteria of age between 18 to 60, Patients had been diagnosed with chronic low back pain (Duration of at least 12 weeks). Exclusion criteria with history of fractures. Excluded if having musculoskeletal conditions. The sampling size of the study is (n=90) subjects for a period of 6 weeks [February 2023 to March 2023].

**Inclusion criteria**

- Age between 30-55 year
- Diagnosed with chronic low back pain (duration of at least 12 weeks)
- Both male and female
- No previous surgical intervention for low back pain
- Willingness to participate and provide informed consent

**Exclusion criteria**

- Acute low back pain or other acute musculoskeletal conditions
- Known fractures, tumours, or infections in the spine
- Pregnancy
- Neurological deficits or radicular symptoms.
- Any contraindications for manual therapy techniques

**Outcome Measure**

Assessment was performed at baseline (before starting pf treatment) and after six weeks of study.

1. Numerical pain rating scale (NPRS)[13,5,6].
2. Oswestry disability Index (ODI) [14,10,15,11]

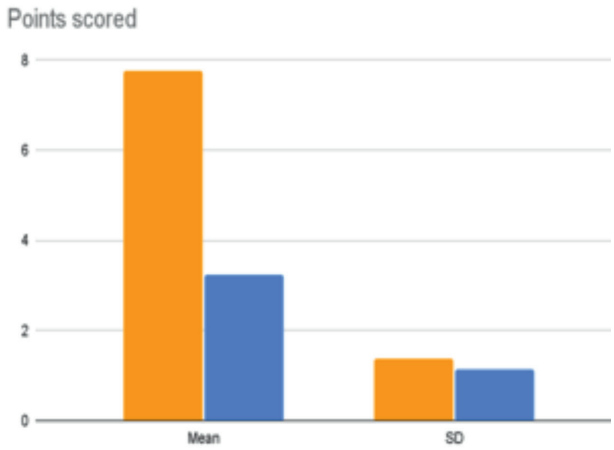
**Procedure**

The intentional sampling technique was used to enlist a total of 90 participants for this investigation. Based on the inclusion and exclusion criteria, every subject was chosen for the study form Sri Rani multi-speciality clinic. All subjects received information sheets about the study protocols prior to the study's start, and their informed consent was obtained. pre-test analyses on the Oswestry Disability Index (ODI) and Numerical Pain Rating Scale (NPRS) were conducted on the recruited subjects, They were randomly divided into two groups (Group A: 45 subjects) and (Group B: 45 subject). This analysis was done to determine how the interventions affected the patient's overall quality of life while they were suffering from chronic low back pain. After the pre-test analysis, Group A received Myofascial Trigger Release (MTR) for 5 sessions per week for 4 weeks, whereas Group B received Muscular Energy Method for 5 sessions per week for 4 weeks. Using SPSS, the data were tabulated after the Post-test analysis, which took place after 4 weeks. Group A performing Myofascial Trigger Point Release (MTR) techniques in reducing pain and improving functional activity in chronic low back pain involves a systematic approach that combines assessment, treatment planning, and precise execution. Here are the general steps to perform MTR for chronic low back pain. Conduct a detailed history taking to gather information about the patient's pain, including location, intensity, and aggravating/alleviating factors. Palpate the low back muscles, including the paraspinal muscles, gluteal muscles, and hip rotators, to locate trigger points. Position the patient comfortably, usually lying supine, prone, or in a side-lying position on a treatment table. Ensure that the muscles being targeted are relaxed and accessible for treatment. Myofascial trigger point release executions to locate the specific trigger points in the targeted muscles by palpation. Apply direct pressure with your fingers, thumbs, or specialized tools to the trigger point. Start with a moderate pressure and gradually increase to a tolerable level of discomfort, ensuring it does not exceed the patient's pain threshold. Stretching and mobilization are after releasing the trigger point, incorporating stretching or mobilization techniques to promote.

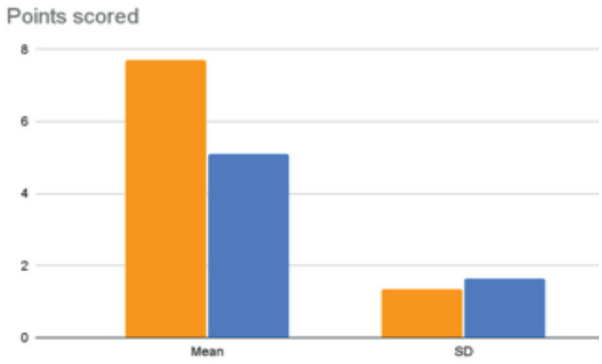
Group B performing muscle energy techniques (METs) in reducing pain and improving functional activity in chronic low back pain involves a systematic approach that integrates assessment, treatment planning, and execution. Here are the general steps to perform METs for chronic low back pain. Conduct a thorough history taking, including pain location, intensity, duration, and aggravating/alleviating factors. Identify any relevant contributing factors such as muscle weakness, postural abnormalities, or biomechanical dysfunctions. Position the patient comfortably, usually lying supine or prone on a treatment table. Ensure proper alignment of the spine and pelvis to facilitate the desired muscle contraction and joint mobilization. Instruct the patient to perform a specific muscle contraction against resistance in a controlled manner. Choose the appropriate muscle energy technique, such as reciprocal inhibition or post-isometric relaxation, based on the assessment findings and treatment goals. Apply gentle resistance, manually, to oppose the patient's muscle contraction. Maintain the contraction for approximately 5-7 seconds, ensuring that the patient reaches a maximal effort without pain. Repeat the muscle energy technique for the targeted muscles and joints, typically performing 3-5 repetitions in a treatment session. Monitor the patient's response to each repetition, assessing changes in pain intensity and functional activity. Further relaxation and lengthening of the muscles. Guide the patient through gentle stretching exercises targeting the muscles that were treated.

**Data Analysis**

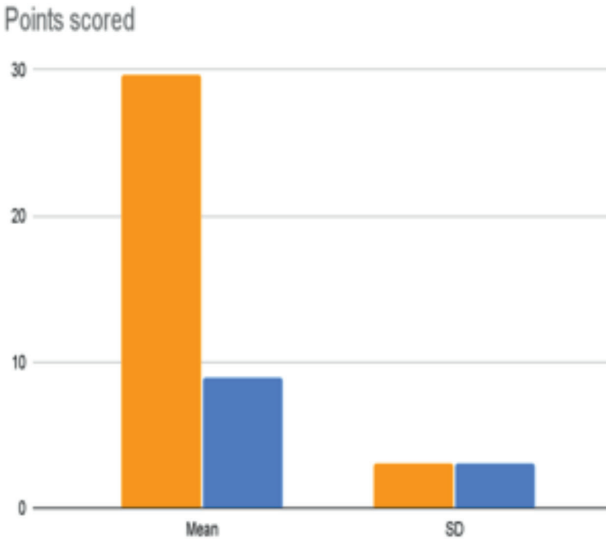
Pre-test and post-test values of myofascial trigger release and muscle energy technique are analysed using the Numerating pain rating scale and Oswestry disability index.



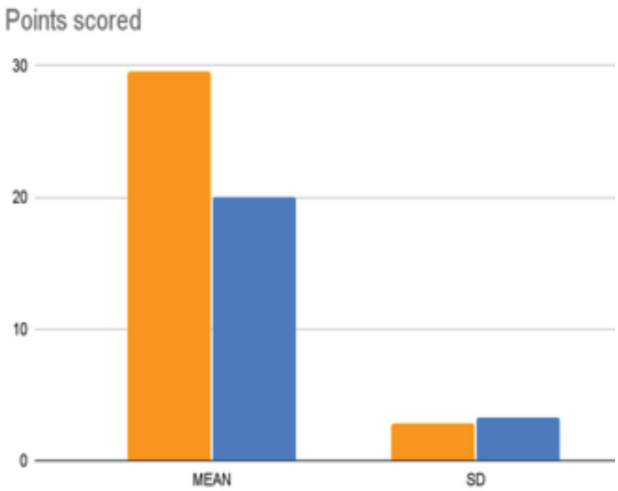

**Graph-1: Comparison between pre-test and post-test values of NPRS for MTR**



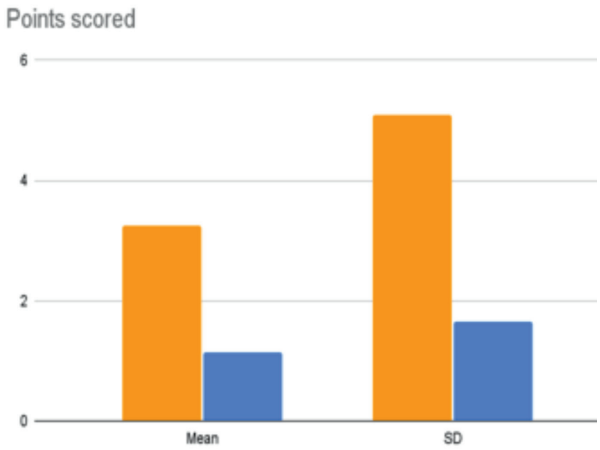

**Graph-2: Comparison between Pre-test and Post-test values of NPRS for Group B MET**



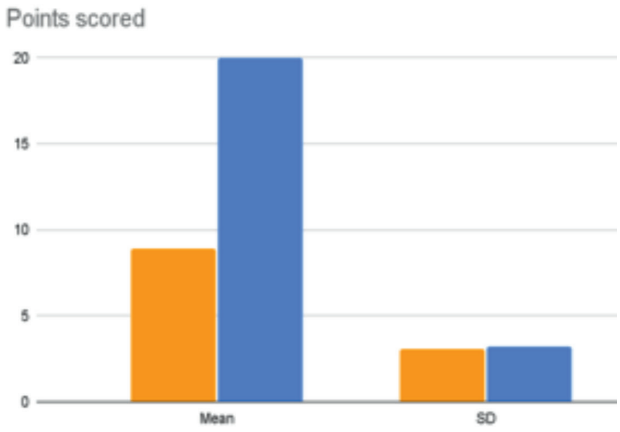

**Graph-3: Comparison between Pre-test and Post-test values of ODI for Group A MTR**




**Graph-4: Comparison between Pre-test and Post-test values of ODI for Group B MET**




**Graph-5: Comparison between Post-Test Values of MTR and MET for NPRS**




**Graph-6: Comparison between Post Test Values of Myofascial Trigger Point Release and MET for ODI**

## Result

All 90 subjects completed the study successfully; pre-test and post-test values of NPRS for MTR and MET and ODI for MTR and MFR were presented in the following graph 1,2,3. Statistical analysis shows there is a significant improvement from pre-intervention to the post.

## Discussion

For people with Chronic Low Back Pain (CLBP), this study compared how well the Muscle Energy Method (MET) and Myofascial Release Technique (MRT) reduced pain and improved functional activity. The outcomes of this study have significance for clinical decision-making and treatment strategies

for chronic low back pain and offer useful insights into the relative efficacy of these two manual therapy methods. The results of this study showed that MRT and MET were both beneficial in easing pain and enhancing functional activity in those with chronic low back pain.[3] The drop in scores on the numeric pain rating scale (NPRS).[13,5,6] showed that participants in both groups had much less pain than before. The unique mechanisms of each approach are responsible for this decrease in the severity of the pain. Myofascial Trigger Release focuses on identifying and releasing myofascial restrictions that may contribute to pain and functional limitations in chronic low back pain. By continuously applying pressure to trigger points or tense bands in the damaged muscles, MRT aims to encourage relaxation, improve blood flow, and restore optimum tissue function. The results of this study are consistent with the idea that MRT is a very successful treatment for chronic low back pain.[7]In terms of functional activity, participants in the MRT group also showed greater improvements compared to the MET group.[9] Functional outcomes showed that people who had MRT had a more significant improvement in their functional abilities, as measured by tools like the Oswestry Disability Index (ODI).[11,12] This shows that MRT might be more effective at restoring functional activity in people with CLBP.

## Conclusion

In conclusion, the findings of this study demonstrate that myofascial release technique (MRT) is superior to muscular energy method (MET) in lowering pain and enhancing functional activity for those with chronic low back pain (CLBP). MRT's focus on releasing myofascial restrictions and improving tissue mobility may contribute to its superior efficacy. It is crucial to take into account some of this study's potential shortcomings. The generalizability and long-term implications of the findings may be influenced by the study's sample size and length. The specific processes of MRT, including the removal of myofascial limitations and increased tissue mobility, may be a factor in how well it enhances functional activity.

**Ethical clearance:** Taken from the institutional ethical committee. ISRB number -03/ 060/ 2022/ ISRB/ SR/ SCPT

**Funding:** Self

**Conflict of Interest:** No conflict of interest during this research.

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Original Article

DOI: https://doi.org/10.37506/vswsgt23

# Effectiveness of Maitland Manual Therapy Approach Mobilization with Aerobic Exercise in Patients with Chronic Low Back Pain

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**Abstract**

**Background:** Low back pain is the most common type of musculoskeletal pain and various treatments are given to treat it. Mobilization and aerobic exercise has very good effect in relieving pain and disability. This study focuses to evaluate the combined effect of mobilization and aerobic exercise program in patient with chronic LBP.

**Methods:** The study designed used was a pretest and post test experimental study. Samples are taken with convenient sample method. N=10 with a duration of 12 weeks. Posterioanterior mobilization and high intensity exercises where given and data's were calculated and the results were obtained by two outcome tools –VAS and OSW questionnaire. the data colected from (12/01/2023 to 10/03/2023) with gardern city university physiotherapy out patient department.

**Results:** The pre test mean value of VAS is 7.1 and the post test mean value is 5.8.The mean difference of pre test and post test value of VAS measurement is 1.9.The pre test mean value of OSW questionnaire is 41% and the post test mean value is 21%. The mean difference of pre test and post test value of OSW questionnaire is 20%.

**Conclusion:** Maitland mobilization with high intensity aerobic exercise was effective in reducing pain and disability and also in the improvement of range of motion for low back pain. This study can be used as treatment protocol in the field of physiotherapy to treat the patient with chronic low back pain

**Keywords**: Maitland mobilization, high intensity exercises, low back pain, pain management Prolonged immobilization after a surgical procedure for patients with shoulder dysfunction.

## Introduction

Low back pain is a most frequent type of musculoskeletal pain. Low back pain is defined as pain and discomfort localized below the costal margin and above the inferior gluteal folds with or without leg pain. Chronic low back pain refers to pain persisting for 12 weeks or more.

As part of WHO study, LBP was detected in 15.4% of the population under survey in urban area, and 23.4% of the population in rural areas. Low back pain is a common musculoskeletal symptom that may be either acute or chronic; it may be caused by a variety of diseases and disorder that affect the lumbar spine.[1]

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The LBP occurs due to certain risk factors like occupational, Age, Alcohol and drug abuse, family history, gender, level of activity, obesity, poor posture alignment, previous back injury, psychosocial and spiritual factors, smoking. The individual with LBP suffers with stiffness in spine and pain that radiates from the low back to buttock down the back of the thigh and into the calf and toes. The patient have difficulty in standing which affects their activities of daily living and results in disturbance of functional independence.[2]

Mobilization is a method of restoring or maintaining joint movement. An indication for mobilization is pain, muscle spasm and Restriction of joint range of motion. Mobilization helps in relieving the pain, increasing circulation of synovial fluid and also maintains extensibility and tensile strength of the articular and peri-articular tissue, improving tissue nutrition.

Aerobic exercise is a sub maximal rhythmic repetitive exercise of large muscle group during which the needed energy is supplied by inspired oxygen. High intensity form of exercise acts on most of the body system therefore it might be effective in changing clinical symptoms and aerobic exercise is more effective in pain reduction. [2,3,4]

The active physiotherapy program focused on improving functional capacity though strengthening and coordination exercises and understanding proper ergonomics. Instrumental training was completed using training machines and devices. The goal was to focus on muscle reconditioning by progressing a constant load to the trunk. The aerobic exercise program consisted of 1 hour classes, including a 10 to 20 minute warm-up, followed by twenty to 30 minutes of specific trunk and leg exercise and a 15 minute cool-down. This study was able to reveal that the effect of exercise improves general function and perception of pain and disability by acting on the central core. All 3 treatments proved to be equally successful in reducing pain intensity, frequency, and disability during daily tasks; however, after the first 6 months those partaking in the physiotherapy program showed a relapse towards pre-study levels. Physiotherapy, along with instrumental training, cost about 4 times more than an aerobic exercise program, leaving aerobic exercise as being both effective and economical.

## Methodology

The study designed with a pretest and posts test experimental study with a convenient sample size of 10 male patients between age group of 18-45. The community based setup of study was conducted for 12 weeks, which includes male's patients with more than 3 months of low back pain. This study excluded patients with Inflammatory or tumor problem, osteoporosis of spine, cardio vascular disease, spinal infection, severe respiratory diseases, pregnancy, prior low back surgery, spinal deformity and rheumatic joint disease. Treadmill apparatus is used for testing, and patient is evaluated with Visual Analogue Scale, Oswestry Disability Questionnaire.

The patient position for the mobilization intervention was prone on a treatment table with a small pillow under the abdomen. First apply PA pressure to the spinous process of each lumbar vertebra using 1or 2 small amplitude movement (grade l). The PA mobilization intervention consisted of graded oscillation applied to the most painful lumbar segment. Three bouts of 40-sec oscillation were applied to this segment at rate of approximately 1 to 2 Hz and at the highest amplitude tolerated without the reproduction of symptoms. Following mobilization of the most painful segment,2 bouts of 40-seconds oscillations (up to grade 1,2) administered to each of the remaining lumbar vertebral levels. The total time for the PA mobilization intervention was approximately ten minutes.

An excellent method to increase blood flow to the muscles in your back is through aerobic exercise. This helps the damaged muscle tissues repair themselves and reduces stiffness. Additionally, it promotes the synthesis of neurotransmitters, which can assist in the body's defence against pain and lessen your reliance on painkillers. By reducing stiffness and improving blood flow to the spinal structures, aerobic exercise can reduce back pain by increasing the quantity of nutrients that reach the spine. Exercise walking is different from regular walking in that it moves more quickly while still softly working the muscles. Exercise walking has the benefits of being easier on the spine than jogging, needing little to no equipment (other than a decent pair of shoes), and being accessible almost anywhere. Ankle or wrist weights can be worn to increase the exercise's level of force. Walking

can be done indoors (in a market or on a treadmill, for example) or outdoors (in a park or around the neighbourhood). Exercise can both provide grateful relief from lower back pain and cause additional discomfort. Exercises that put too much strain on the muscles in and around your lumbar (lower) vertebrae should be avoided. Exercise with low impact can increase heart rate without jarring the vertebrae or exacerbating back pain, making it a better choice for people with back pain.

The patients participated in a program of aerobic exercises that was individualized according to the patient's initial fitness assessments. High-intensity aerobic exercise was supervised individually. The subjects exercise intensity has been prescribed on karvonen formula. We used heart rate reserve to calculate training zones based on both maximum and resting heart rate using a range of 50-85%. Each exercise session begins with 10-15 min warm-up period. Then treadmill walking and stair climbing at 70-85% of age predicated maximal heart rate, three days per week duration 30min per session. Then session ended with 5 min of stretching. During the 12 week exercise program, exercise intensity was increased from 70 to 85% and exercise duration was increased from 30-45 min per session.

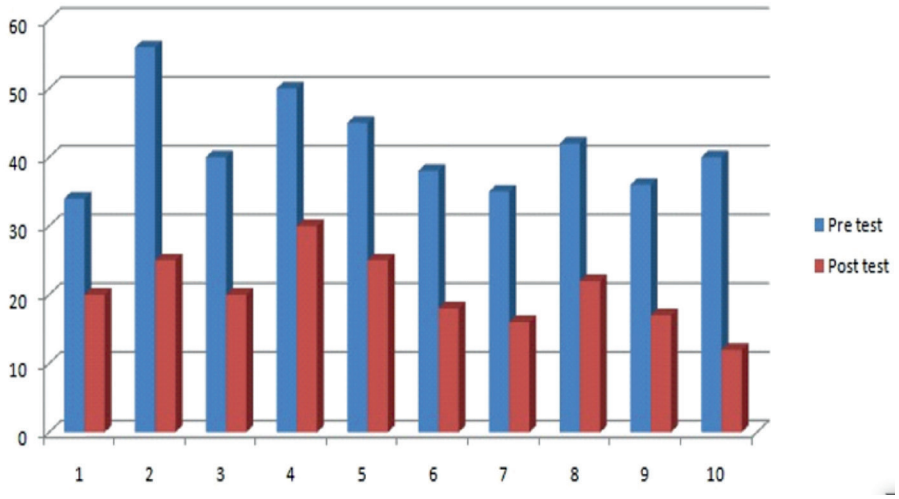



**Table 1: VAS Score Pre and Post Test Values**

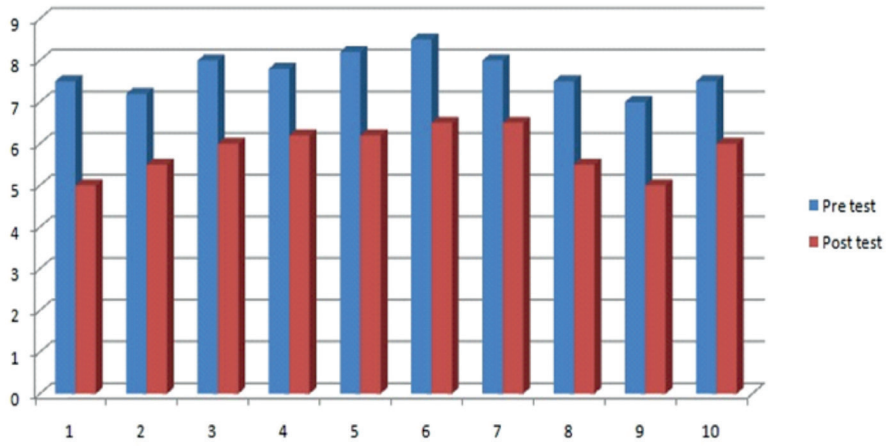



**Table 2: OSW Questionnaire Pre Test and Post Test Mean Values**

## Results and Discussion

The data's was calculated and the results were obtained by two outcome tools –VAS and OSW questionnaire. The VAS was used to measure the intensity of pain in low back pain. The pre test and post test values of VAS were analyzed and the mean value was obtained. The pre test mean value of VAS

is 7.1 and the post test mean value is5.8. The mean difference of pre test and post test value of VAS measurement is 1.9

The OSW questionnaire was used to measure disability in low back pain. The pre test and post test values of OSW questionnaire were analyzed and the mean value was obtained. The pre test mean value of OSW questionnaire is 41% and the post test mean value is 21%. The mean difference of pre test and post test value of OSW questionnaire is 20%. Thus, the greater difference in mean in both the outcome tools proved the effectiveness of mobilization with high intensity aerobic exercise in low back pain.

The aim of this study was to find out the effect of mobilization with high intensity aerobic exercise in chronic low back pain to reduce pain and disability. High intensity aerobic exercise results in increasing the release of endogenous opiates and breaks down the adhesions which causes disability. Demitris chatzitheodorae stated that high intensity aerobic exercise is effective in relieving pain as it acts on the whole body system.

In low back pain, guidelines (as stated above) promote the avoidance of bed rest, and the continuation with activities as usual . The aim of physical treatments is to improve function, and to prevent disability from getting worse. In chronic low back pain, exercise therapy has become a first-line treatment and should be routinely used. Should recovery be slow in patients with risk factors for developing persistent disabling pain, early supervised exercise therapy can be considered. If low back pain persists for more than 12 weeks, physical treatments that encompass a graded activity or exercise programs that focus on improvements in function, are recommended. In fact, in low back pain greater than 12 weeks, exercise is a first-line treatment that should be considered for routine use. All recent clinical practice guidelines endorse exercise therapy in persistent low back pain . Yet access to structured exercise programs remains erratic.

Most of the researchers from these studies had different hypotheses as to why aerobic exercise was found to be a valuable treatment option. Sculco et al9 believed in the potential of both positive physical and psychological benefits associated with aerobic exercise. There are multiple other studies that also demonstrated a reduction in depression, anger, anxiety, and total mood disturbance. Similarly, Dogan at al5 believed that the differing attitudes a specific person has regarding disability can affect their perception of pain and efforts to seek different treatment options. Researchers also mentioned the increased importance of positive effects in cardiopulmonary fitness level as it affects pain severity, disability status, spinal mobility, and psychological status. Kell et al17 felt that too many programs focus on core strengthening and neglect a whole-body workout. The researchers in this study aimed to mimic programs used by athletes during a preparatory phase of training.(4) Their goal was to provide significant stress to all large muscle groups to enhance overall health of the musculoskeletal system and increase physical function. Wu et al11 believed in 3 main purposes of exercise treatment for LBP: enhancing tolerance of waist movements, relieving pain, and changing the attitude or belief of pain. They found that the major strategies of exercise for clinical effects are back specific and general exercises. Murtezani et al18 acknowledged that those with LBP should refrain from specific back exercises and focus on overall physical activities. It is important to focus on functional reconstruction of the back and surrounding structures to relieve pain, spasms, stiffness, and disability.

Low back pain results in limited spinal range of motion especially spinal extension. When posterior-anterior mobilization force is applied to the lumbar spine; greater translation occurs at spinal level resulting in reducing pain and increase the range of motion. According to Goodsell et al, spinal PA mobilization technique found to be effective in improving the lumbar extension and ultimately reduce low back pain. In this study after 12 weeks, exercise group shows greater improvement on pain intensity in comparison with basic values (7.5-7.2 vs 5.0-5.5) and disability (34-56 vs 20-25).

## Conclusion

From the above study the Maitland mobilization with high intensity aerobic exercise was effective in reducing pain and disability and also in the improvement of range of motion for low back pain.

This study can be used as treatment protocol in the field of physiotherapy to treat the patient with chronic low back pain.

**Limitations:**

This study is done with small sample size, and the duration of the study is less.

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Original Article

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# Correlation between Foot Transverse Arch Index and Foot Posture Index in Identifying Foot Arches in Healthy Population

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**Abstract**

**Background:** Medial longitudinal arch of foot plays a crucial role on maintaining ankle during weight bearing activities. In previous studies arch index derived from foot print shows a negative correlation with the navicular height. There are no other studies have correlated mathematically derived foot print values with standing arch height measurements with an acceptable equation. This study correlates arch index and foot posture index to identify foot arches.

**Methods:** subjects with high arch have taken for the study**.** The study type is observational study was done on sample size n=60,foot arch index and foot posture index was evaluated with the samples.

**Findings:** a r- value of 0.333, there is a Negative correlation between Arch index and Foot posture index in low arched foot. There is no significant correlation, and the a r- value of 0.173, there is a low positive correlation between arch index and foot posture index in high arched foot.

**Interpretation:** Among high arched foot and low arched foot, Foot Posture Index and Arch Index is correlated, according to Pearson's correlation, only high arched foot shows low positive correlation between Foot Posture Index and Arch Index. Flatfoot shows negative correlation.

**Keywords: pes cavus,** Pes planus, foot arch index, foot posture index

## Introduction

The ankle and foot complex play a critical role in maintaining erect posture, as also in adaptation to supporting surfaces, in correcting postural sway in single limb stance, in shock absorption and in transition of ground reaction force. [(1)] The structure of foot is critical to affect the load absorbed by the bones in the foot and force transferred to proximal components of lower extremity when performing exercise with weight bearing on foot.[(1)] Medial longitudinal arch is the largest arch of the foot and most important crash of foot from a clinical point of view. The bony share, ligaments and muscular tones all play an important role in supporting arches. [(2)]

Based on the structure of medial longitudinal arch, three types of foot have been proposed (i) the normal foot (ii) high arched foot or supinated foot or pescavus (iii) low arched or pronated foot or pesplanus [(1-3)] Measurement of height of arch of foot deserves immense importance as far its clinical

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aspects are concerned and for this purpose since middle of part century several neither were used by pioneer researchers.[3]

Practically the height of medial longitudinal arch provides acceptable outlook of arch height. Some researchers have classified the foot arch type by only visual impression which was practised until last century.[4,5,6] Few of them carried on such a classification based on palpation of naviculartuberosity[7]. In late nineties researchers approached with the help of radiography in parallel with footprint. Radiological parameters like 'talar height', 'navicular height' and recently the 'normalized navicular height' obtained from standing weight bearing lateral view of x-ray foot were accepted to predict arch height [8-11].

Procurement of and processing the footprint being easier and cheaper, is more acceptable for patient than radiography is still important in establishing arch height [12-13]. Footprint obtained on a graph sheet by conventional ink is better than an electronic footprint obtained by a special software system[14]. The concept of arch index was first described by Cavanagah et al (1987).

A six item criterion reference took the Foot Posture Index which wasdeveloped in response to a requirement for a quick, easy and reliable method for measuring foot position in variety of clinical settings.[15 Razeghi and Batt [15]discuss the current measures (2002) available based on foot morphology and classify according to four categories : visual assessment, anthropometric values, footprint measures and radiographic appraisal to date, there are only two foot posture measures – the arch index[16] and the rear foot angle[17] for which normative data are available. The FPI is the only approach that captures information about standing foot posture in multiple foot segments without a requirement for complex measurement techniques.

## Materials and Methods:

The arches form is created similarly to a spring; it supports the weight of the body and cushions the shock caused by movement. The flexibility of the foot provided by the arches makes it easier to perform regular locomotor activities like walking and running. The energy-saving spring hypothesis of the foot's arch has emerged as a key concept in explanations of the mechanical behaviour and evolutionary history of the foot. The passive-elastic labour the arch performs that would otherwise be performed by active muscle accounts for the majority of the metabolic energy saved by the arch. The taller of the two horizontal arches is the medial arch. It consists of the first, second, and third metatarsals as well as the calcaneus, talus, navicular, and three cuneiforms. Its summit is located at the superior articular surface of the talus, and its two extremities, or piers, are the heads of the first, second, and third metatarsal bones anteriorly and the tuberosity on the plantar surface of the calcaneus posteriorly, on which it rests when upright.

The Tibialis posterior tendon, which is spread out in a fan-shaped insertion and prevents excessive tension of the ligament or such an amount of stretching as would permanently elongate it, supports the ligament inferiorly and strengthens it medially by blending with the deltoid ligament of the ankle joint. The plantar aponeurosis, the tiny muscles in the bottom of the foot, the tendons of the Tibialis anterior and posterior and Peronaeus longus, as well as the ligaments of all the associated articulations, all contribute to supporting the arch.

When upright, the lateral arch, which is the flatter of the two longitudinal arches, is on the floor. It is made up of the cuboid, the fourth and fifth metatarsals, and the calcaneus. Its peak is located at the talocalcaneal articulation, and its main joint is the calcaneocuboid, which has a unique locking mechanism and only permits a small range of motion. The two strongest ligaments, the long plantar and the plantar calcaneocuboid, as well as the Extensor tendons and the short muscles of the little toe, maintain the integrity of this arch, which is characterised by its solidity and slight elevation. The arches are complete at the posterior part of the metatarsus and the anterior part of the tarsus, but they exhibit more characteristics of half-domes in the middle of the tarsus, whose concavities are directed downward and medially, so that when the medial borders of the feet are positioned in apposition a complete tarsal dome is formed. The interosseous, plantar, and dorsal ligaments, the short muscles of the first and fifth toes (especially the transverse head

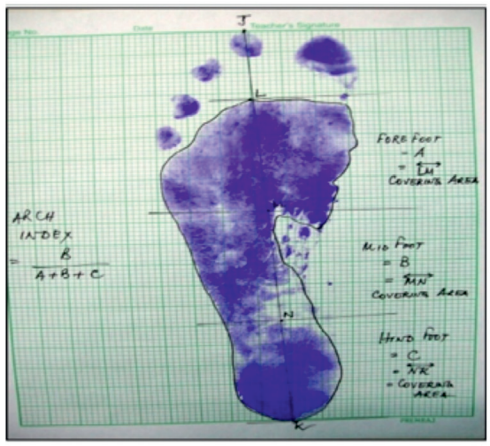
of the Adductor hallucis), and the Peroneous longus, whose tendon extends across between the piers of the arches, all work together to reinforce the transverse arches.

The FPI-6 is a quick, accurate diagnostic instrument that rates foot posture using predetermined criteria and a straightforward scale. It is used to determine how pronated, normal, or supinated a foot is. It is a measurement of standing foot posture and should not be used in lieu of a gait analysis when time and resources permit. However, compared to many of the static weightbearing and non-weightbearing goniometric measures presently used in clinic, it is a more reliable method. The FPI findings assist in choosing the best interventions to use with your patient, such as gait training, strengthening, stretching, or manual therapy. The Foot Posture Index findings aid in selecting the right orthotic for the patient.

The study done targeted with High arched and flat foot people with a Sample size n= 60. Convince sample method is used to select samples from the population. Study design was observational study with foot marking reading evaluation. Materials used are Foot posture index - Conventional ink and Graph sheet . The study Period is for one week. Patients with high arched foot and flat foot. Patients diagnosed with Hallux valgus, plantar fasciitis, Neuropathic foot, Hammer toe, Club foot are excluded from the study.

Arch index is obtained by conventional ink which was rubbed on the subject's right foot and he or she was instructed to stand still on the centimetre calibrated graph sheet with the ink rubbed whole feet. The standard imprint of 50% of body weight bearing right foot was taken.

Following description of literature, in the foot print the linear distance of the centre of the heel (say point K) and tip of second toe (axis of foot (say point J)) was measured. Next perpendicular kind warp drawn tangential to most anterior point of foot print, excluding the toes. Their point of intersection was marked (say point L). The kind LK was divided in three equal parts perpendicular to foot axis. The anterior, middle and posterior areas were marked as A,B,C respectively. Their areas were determined in square centimetre. Formula for arch index is Arch index = B÷[A+B+C] .




The subject was asked to stand still in a relaxed double limb support stance, arms by the sides and looking straight ahead. Prior to settling into the required stance, it was helpful for the subject to do spot marching. The subject was instructed not to try to look downwards during the assessment, as this would affect foot posture. The subject was required to stand for approximately 2 minutes for the test to be conducted. The tester had uninterrupted access to all aspects of the leg and foot.

The FPI consists of six validated, criterion-based observations of the rearfoot and forefoot of a subject standing in a relaxed position. The rearfoot is assessed via palpation of the head of the talus, observation of the curves above and below the lateral malleoli and the extent of the inversion/eversion of the calcaneus. The observations of the forefoot consist of assessing the bulge in the region of the talonavicular joint, the congruence of the medial longitudinal arch and the extent of abduction/adduction of the forefoot on the rearfoot . Each of the six parts of FPI-6 are evaluated on a scale from -2 to +2. Assessment of foot posture was carried out as stated below and the score was noted in the FPI-6 score sheet. All six items of FPI-6 were evaluated according to the procedure mentioned in The Foot Posture Index User Guide and Manual [22].

| | |
|---|---|
| 0 to +5 | - neutral foot |
| +6 to +9 | - slight foot pronation |
| +10 to +12 | - increased foot pronation |
| -1 to -4 | - slight foot supination |
| -5 to -12 | - increased foot supination |

**Table 1: Pearson Correlation Test**

| Variable | Mean | Std. deviation | N | R-value | Significance |
|---|---|---|---|---|---|
| Arch index (flat foot) | 0.3020 | 0.029 | 30 | -0.333 | 0.072 |
| Foot Posture Index.(flat foot) | 8.30 | 1.291 | 30 | | |

With a r- value of 0.333, there is a Negative correlation between Arch index and Foot posture index in low arched foot.. There is no significant correlation.

**Table 2: Pearson Correlation Test :**

| Variable | Mean | Std. Deviation | N | R-value | Significance |
|---|---|---|---|---|---|
| Arch Index(high arced foot) | .24013 | .142694 | 30 | 0.173 | 0.361 |
| Foot Posture Index(High arched foot) | -4.17 | 2.019 | 30 | | |

With a r- value of 0.173, there is a low positive correlation between arch index and foot posture index in high arched foot.

## Result and Discussion

In low arched foot there is no significant correlation between arch index and foot posture index and in high arched foot there is low positive correlation between arch index and foot posture index.

This study was performed to determine the correlation between Foot Posture Index and Arch Index in abnormal foot arches identification. The result shows that there is no statistical significant correlation between foot posture index and arch index in high arched foot.

Hylton B Menz says that foot posture can be reliably classified as high, normal, low using arch index tool.

Cavanagh and Rodgers defined each foot with cutoff scores. A score of or above 0.28 is indicative of flat foot. A score of or below 0.21 is indicative of high arched foot. Hylton B Menz said that there are some misclassifications although Cavanagh and Rodgers correlated arch index foot categories with arch index scores obtained. There wap a tendency for examiner to categorise participants as having higher arches than AI scores indicated. Hylton says that the degree of contact is particularly indistinct in medial arch region, pm that the examiners might have assumed that slight contact area was no contact thereby offsetting AI classification towards a higher arch. This maw ad the reason for negative correlation between FPI and AI.

According to Thamilvaani Manaharan, Amir Feisal Merican a women need not necessarily have a pair Hylton foot arches between their right and left feet. This conclusion will imply to males too. Thus, in our study only right foot arch index and foot posture index was taken. This may be the reason for negative correlation between FPI and AI in finding abnormal foot arches.

In this study both flexible flat foot, flexible flat foot with shortened achilles tendon and rigid flat foot were examined for foot posture index and arch index scores. However, in flexible flat foot the arch is further lowered in weight bearing position for both foot posture index and arch index. Powers et al 1995 says that FPI is strongly affected by the shape of the soft tissue and provides limited information about bony structures of medial longitudinal arch. This will also add the reason for negative or low positive correlation for FPI and AI.

## Conclusion

Among high arched foot and low arched foot, Foot Posture Index and Arch Index is correlated, according to Pearson's correlation, only high arched foot shows low positive correlation between Foot Posture Index and Arch Index. Flatfoot shows negative correlation.

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Original Article

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# A Study to Compare the Efectiveness of Tibio Femoral Joint Mobilization Versus Maitland Mobilization in Patellofemoral Pain Syndrome

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**Abstract**

**Background and need of research**: Abnormal patellar biomechanics and patellar arrangement result in patello-femoral pain syndrome. The initial course of treatment for non-operative management is physical therapy. Therefore, it is necessary to compare the effectiveness of Tibio femoral joint mobilisation with Maitland mobilisation in treating patellofemoral pain syndrome.

**Methods**: Sample where collected from YMT college of Physiotherapy. Group A consists of 20 female and 10 Male subjects of age group 30 to 40 years Tibiofemoral mobilization was given while Group B Maitland Mobilization having 17 female and 13 male subjects. The study was conducted during the month of March 2023 to June 2023. Each group attended five therapy sessions a week for a total of 6six weeks. As pre and Post outcome assessments, the NPRS scale, Knee range of motion and KUJALA Score Questionnaire were utilised,both before and after the treatment. patients with patellofemoral pain syndrome, ranging in age from 25 to 40, were both male and female. Tibiofemoral mobilisation was used in Group A's conventional therapy while Maitland mobilisation was used in Group B's conventional therapy. Each group attended five therapy sessions a week for a total of six weeks. As pre- and post-outcome assessments, the visual analogue scale, knee range of motion, and KUJALA score Questionnaire were utilised. both before and after the treatment, in the sixth week.

**Result:** The intragroup comparison of the NPRS, knee range of motion, and KUJALA patellofemoral scale among the 30 patients in each group was statistically highly significant with p=0.001 for both groups. In contrast to the Maitland mobilisation in Group B, the Tibiofemoral mobilisation in Group A demonstrated a Highly Significant improvement.

**Conclusion**: Tibiofemoral mobilisation combined with traditional therapy is more effective at reducing pain, enhancing range of motion, and improving functional ability in PFPS after six weeks.

**Keywords**: Patellofemoral Pain syndrome, KUJALA Patellofemoral scale, Maitland mobilization, Tibiofemoral mobilization.

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## Introduction

The patellofemoral pain syndrome (PFPS), which accounts for around 25% of orthopaedic diagnoses, is one of the most common musculoskeletal conditions of the knee. Knee pain is frequently caused by patellofemoral pain syndrome (PFPS), especially in physically active females.[4-5] The patellofemoral joint is loaded by activities including stair climbing or descending, squatting, running, and kneeling, which cause anterior knee discomfort that manifests as stiffness, soreness, or both.

Walking up or down stairs, climbing or descending hills, lunging, squatting, running, biking, and prolonged sitting with the knee bent 90 degrees all serve to increase symptoms.[6,7,8,9] Muscle imbalance between the vastus medialis oblique (VMO) and vastus lateralis (VL) is caused by abnormal biomechanic,which results in patellar maltracking or malfunctioning.In comparison to the VL muscle, the VMO muscle functions. Patellar maltracking results when it malfunctions, such as when recruitment of the VMO relative to the VL is delayed It is quite challenging to cure PFPS[10]

The majority of patients benefit from conservative interventions.[11-15] There is little information on the effects of Maitland and tibiofemoral mobilisation in PFPS patients. To ascertain the effect of TFJ and Maitland mobilisation on pain, the current study was designed in PFPS patients.

When performing a tibiofemoral posterior glide, the patient is lying on their back, flexing their knee as comfortably as possible. The thumb is used as a grade 1 distraction to drive the tibia posteriorly. Posterior glide aids in expanding the range of flexion.

When doing a tibiofemoral anterior glide on a patient who is resting on their stomach, a tiny pad is placed beneath the lower femur to prevent patellar compression. To stabilize one side of the joint, the therapist applies gliding force with the hand on the proximal tibia in an anterior orientation. The force may be delivered to the medial or lateral tibial plateau.

According to Maitland (1985), mobilisation, which is characterised as a passive movement, is a frequent kind of treatment for people with a variety of neuromusculoskeletal problems. It accomplishes two main goals: In addition to easing discomfort and regaining functional mobility, it aims to preserve normal joint range of motion through activities like passive swinging and ongoing stretching.[17,18] The preservation of normal joint range of motion is the second goal.

With the patient's knee flexed, the Maitland-Patellofemoral movement is performed. erapist stands next to patient's knee while they both sit on the edge of the couch. The therapist's right palm is cupped around the patella. The superior margin of the patella is forced up against the heel and ulnar border of the left hand. The force is applied to maintain the patient's lower leg in the desired degree of flexion. From this starting posture, the therapist can develop a variety of oscillatory movement orientations.

**Need of Study:**

Patellofemoral pain syndrome (PFPS) is a common condition associated with overuse injuries of the lower extremity. It is caused by abnormal biomechanics and abnormal arrangement of patella. Physical therapy (PT) is the first-line treatment program as non-operative management. Therefore, there is increase in need to compare the effectiveness of tibio femoral joint mobilization versus Maitland mobilization in patellofemoral pain syndrome

## Material and Methods

An experimental study was performed on 30 patients of Patellofemoral pain syndrome in two groups of both male and female of age between 25-40 years, using convenient sampling method. Patients fulfilling the inclusion criteria are positive findings on doing apprehension test and having complaint for past 30 days. And excluding patients having deformities, soft tissue injuries, fracture, dislocation of patella, Patella alta signs of any intra -articular derangement of the kneejoint such as effusion and meniscal tear.Patients fulfil the inclusion criteria as those Clinical assessment positive on using apprehension test having complaint for past 30 days. Excluding patients having any deformities, any soft tissue injuries, fractures, dislocations of patella, Patella Alta, previous knee surgeries, Symptoms or signs of any intra-articular derangement of the knee joint, such as effusion and meniscal tear.

The patients were sampled into two group Group A received Tibiofemoral Mobilization with Conventional therapy and Group B received Maitland mobilization with conventional therapy Each subject of the study was treated 6 weeks, 5 times a week.

Conventional therapy treatment given to the subjects of both the group was in the form of Hot packs followed by stretching to gastrocnemius soleus, hamstring, tensor fascia lata and Iliotibial band, VMO Muscle Strengthening was done using wall squat with $40^0$ -$60^0$ knee flexion with hip adduction. Hip abductor strengthening, High sitting quadriceps strengthening. Each set consisted of 15 repetitions with 10sec hold.

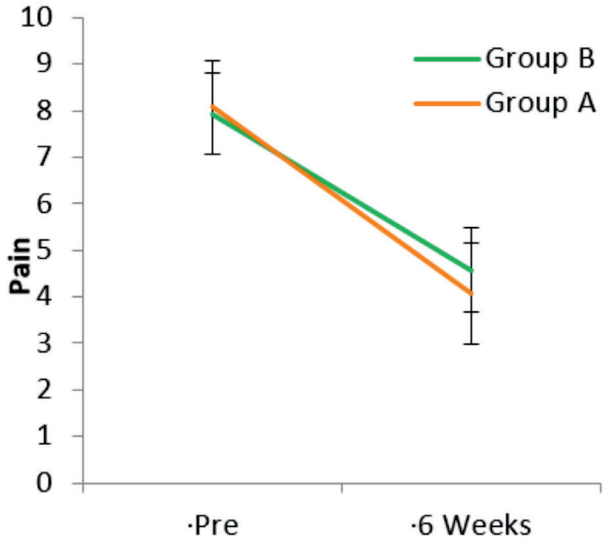
Patient in group A received Tibiofemoral Mobilization Anterior glide done in patient in prone position and Posterior glides in supine position, with grade 1 distraction to push tibia to increase the range. Posterior glide helps in increasing flexion range. Anterior glide helps in increasing extension range

Patient in group B received Maitland mobilization, It is done with patellofemoral movement in knee flexion.

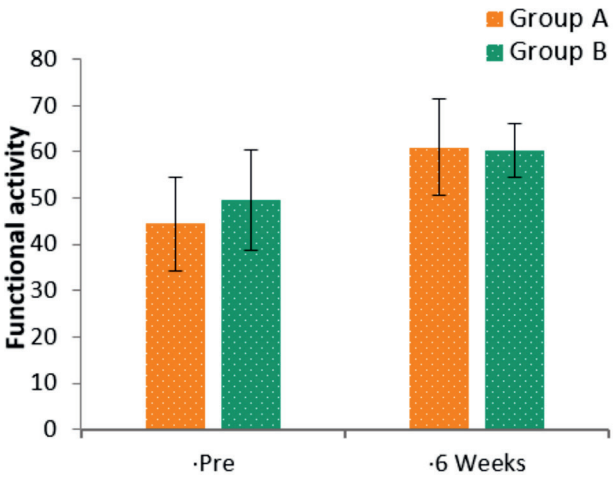
There are three variables used Pain intensity using NPRS score, Range of Motion of knee using Universal Goniometer as tool and Functional activity using Kujala Score questionnaire 13 item with 3-5 options for pain severity, symptoms and specific activities was used. The total sum of the scale's ranges 0-100,0= greatest limitation of the knee function and 100= the greatest ability to perform most knee flexion.

## Result

All statistical analysis was done using SPSS 22.0, and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables. Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Leven`s test for homogeneity of variance has been performed to assess the homogeneity of variance.




**Graph No.: 1**




**Graph No.: 2**

All the 60 patients were analyzed on the 1st day and completion of training at 6weeks. Graph No 1shows there was significant improvement in terms of NPRS score but on comparing intergroup Group A show significant improvement p<0.001 than group B.Table 1 shows for knee flexion range 1 shows there was significant improvement in terms of VAS score but on comparing intergroup Group A show significant improvement p <0.001 than group B. Table :2& 3 show for knee flexion range & extension range both group A & B show significant improvement but on comparing Group A show significant improvement than Group B Table:4 comparing the functional activity using Kujala scale Group A show strongly significant than group B with p<0.001

**Table 1 : Comparison of outcome variables in two groups studied at 6 weeks of assessment**

| Variables | Group A | Group B | Total | P Value |
|---|---|---|---|---|
| Pain | | | | |
| Pre | 8.07±1.01 | 7.93±0.87 | 8±0.94 | 0.587 |
| 6 Weeks | 4.07±1.08 | 4.57±0.9 | 4.32±1.02 | 0.056+ |
| Difference(95%CI) | 4.00(3.41-4.58) | 3.36(2.96-3.78) | 3.68(3.32-4.04) | – |
| P value | <0.001** | <0.001** | <0.001** | – |
| Flexion | | | | |
| Pre | 110.23±7.48 | 116.17±8.78 | 113.2±8.62 | 0.007** |
| 6 Weeks | 124.23±4.69 | 125.4±5.49 | 124.82±5.09 | 0.380 |
| Difference | 14.00(11.98-16.01) | 9.23(6.56-11.91) | 11.62(9.87-13.36) | – |
| P value | <0.001** | <0.001** | <0.001** | – |
| Extension | | | | |
| Pre | 4.7±1.47 | 5.17±1.74 | 4.93±1.61 | 0.266 |
| 6 Weeks | 3.7±1.39 | 4.4±1.07 | 4.05±1.28 | 0.033* |
| Difference | 1.00(0.56-1.44) | 0.77(0.35-1.18) | 0.88(0.58-1.18) | – |
| P value | <0.001** | 0.001** | <0.001** | – |
| Functional activity | | | | |
| Pre | 44.43±10.13 | 49.63±10.81 | 47.03±10.71 | 0.059+ |
| 6 Weeks | 61±10.44 | 60.37±5.82 | 60.68±8.39 | 0.773 |
| Difference | 16.57(13.01-20.12) | 10.73(7.25-14.21) | 13.65(11.11-16.18) | – |
| P value | <0.001** | <0.001** | <0.001** | – |

Student t test (Unpaired) for Between group and student t test(paired) for within group analysis

**Results are presented Mean** ±SD (Median)

## Discussion

The purpose of the study was to investigate the effectiveness of Tibiofemoral mobilization versus Maitland Mobilization in Patellofemoral Pain syndrome. Current study show that females are affected more than the males.1Both groups showed significant within-group improvement in the pain levels (VAS), Range of motion and KUJALA score. The improvement in pain levels and KUJALA score could be due to strengthening of quadriceps muscle as reported by Palak Ramanial et al **Palak Ramanlal Mistry et al** 29.

The tibiofemoral mobilization technique is low-amplitude passive movements that produce traction and gliding at the joint surface, i.e. joint play movements. According to **Holden et al** 23 stated that , afferent inputs from the surrounding tissues alter motor regulation at joint dysfunction which can be responsible for the weakness of the muscle. Mobilisation of dysfunctional and restricted joint generates arthrokinetic reflex which removes the inhibition and improves the strength of the muscle.

According to Sonya Arshad et al 30 Maitland A patellar mobilization can be used to recover the flexibility of the patellofemoral joint, and passive repetitive gliding to the first resistance is used to improve nutrition, blood flow, and lubrication with in the joint that helps develop mobility.

Hence both Tibiofemoral and Maitland mobilization shows improvements in Intra groups but on comparing in Inter groups Tibiofemoral mobilization is more effective because the findings of Alsulaimani et al shows that repetitive passive joint gliding movement improves nutrition, blood flow, and joint lubrication further restores mobility. It also helps to normalize the joint kinematic, gliding and rolling movement.

Also, according to the **Ishrat Fatimah** et al 25 a study on tibiofemoral mobilization on PFPS and found that TFJ mobilization with hip and knee stretching and strengthening exercises effectively reduced pain intensity, improved ROM in Patellofemoral pain syndrome patients. D4 Juhn et al also states that exercising programs require between 3-6 weeks or more to achieve the goal. These findings are in support of the results of the current study.

The intragroup comparison of the NPRS, knee range of motion, and KUJALA patellofemoral scale among the 30 patients in each group was statistically highly significant with p=0.001 for both groups. In contrast to the Maitland mobilisation in Group B, the Tibiofemoral mobilisation in Group A demonstrated a greater Highly Significant improvement.

## Conclusion

This study provide evidence to support the use of 6 weeks of conventional therapy with Tibiofemoral mobilization is more effective than that of Conventional therapy with Maitland mobilization in improving pain, range of motion and functional activity in patients with Patellofemoral pain syndrome.

**Clinical Implication:** The current study has limitation of finding the effectiveness of conventional therapy. Also controlled studies and long-term observation are necessary.

**Source of Funding**: Self

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