

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 mobility¹. 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 population². 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 injuries³.

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 stiffness⁴. 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 disorders⁵.

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 popularity⁶.

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 performance⁷. 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 results⁸.

Another essential aspect of knee OA management is strength training, which has gained approval from the American College of Rheumatology⁹. 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 injury¹⁰.

Transcutaneous Electrical Nerve Stimulation (TENS) has emerged as an effective pain management technique for knee OA¹¹. 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 management¹².

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 available¹³.

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 needed¹⁴.

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 severity¹⁵.

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

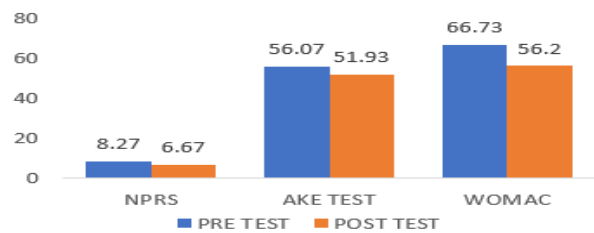


Fig 4: Group A paired T-Test

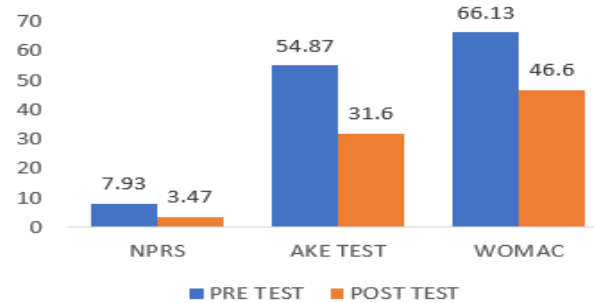


Fig 5: Group B paired T-Test

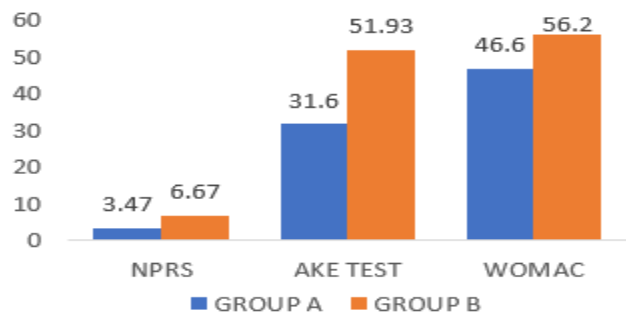


Fig 6: Unpaired T-Test

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 patients¹⁸.

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 flexibility¹⁹.

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 knee²⁰.

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.

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