International Journal of Physical Education and Sports Sciences
Vol.21, Issue No. 2 June-2026, ISSN 2231-3745

Impact of instrument-assisted soft tissue mobilization on quadriceps flexibility and muscle strength in elderly patients with knee osteoarthritis

Arun Thachil[1]*, Dr. Joseph E[2]

1 Research Scholar, Department of Physiotherapy, Sunrise University, Alwar, Rajasthan, India

thachilarun@gmail.com

2 Assistant Professor, Department of Physiotherapy, Sunrise University, Alwar, Rajasthan, India

Abstract: Thirty healthy persons with unilateral knee osteoarthritis were randomly allocated to two groups: one receiving sham operations and the other utilising tools for soft tissue mobilisation. Knee pain is believed to stem from both physiological and psychological factors. A potential biological factor that could intensify knee pain is the weakness of the quadriceps muscles, as indicated by existing research. Recent studies suggest that more robust quadriceps can impede the structural decline of the knee. The intervention involved the integration of exercise therapy with IASTM, conducted over a two-week period. The timed assessments utilised to evaluate functional performance included the 6-minute walk test (6MWT) and the up-and-go test (TUG). Substantial enhancements in functional performance were observed in both groups post-treatment, as indicated by the 6MWT ($P < 0.001$) and TUG ($P = 0.003$) assessments, based on a mixed ANOVA. A notable effect ($P = 0.002$, $P < 0.001$, $P < 0.001$, and $P < 0.001$) was observed on physical functioning, role limitations due to physical challenges, energy/vitality, discomfort, and the overall SF-36 score, which showed considerable enhancement. Following treatment, the IASTM cohort exhibited enhancements in role limitations due to emotional challenges, while the sham cohort saw an exacerbation of these restrictions ($P = 0.005$). Both cohorts exhibited notable enhancements ($P < 0.001$) on the LAI questionnaire post-therapy. When integrated with exercise therapy, both placebo treatments and IASTM enhanced functional outcomes and quality of life. The IASTM cohort exhibited a significantly more pronounced upward trend in both the 6MWT and TUG assessments, demonstrating a clear interaction effect on the limits of emotion-driven roles. The findings indicate that while exercise alone can enhance quality of life and daily functioning, its efficacy is significantly increased when integrated with KOA therapy regimens; IASTM may further elevate these results, improving both function and quality of life.

Keyword: Arthritis of the Knee Physical therapy Life Satisfaction in Relation to Physical Function

INTRODUCTION

One unpleasant musculoskeletal ailment is knee osteoarthritis (KOA) caused by the gradual degradation and wear and tear of joint cartilage over time. Globally, KOA is associated with

disability and disproportionately affects the elderly. Osteoarthritis affects over 250 million people worldwide, or about 4% of the total population. Effects of KOA in Pakistan, which accounts for 28.0% of the city dwellers and 25.0% of the country folk.

Age, genetic Factors that increase the likelihood of developing KOA include trauma, gender, and acquired abnormalities. The prevalence of osteoarthritis is higher in the obese population. Osteoarthritis develops when articular cartilage is damaged or overused, which may happen in joints. Knee osteoarthritis (KOA) is characterised by persistent knee discomfort, stiffness upon waking, and impairments in functional ability. Additionally, restricted range of motion in the joints, crepitus, Key indicators of knee osteoarthritis (KOA) include osseous enlargement.

One of the leading causes of immobility worldwide is osteoarthrosis, which is defined by the breakdown of the connective tissue that lines the joints (Allen et al., 2015).

Obesity and repetitive stress on tissues that bear weight are the main culprits behind knee osteoarthritis. Knees and other weight-bearing joints are the most common sites of osteoarthritis. Everyday activities put the knee through a number of changes in biomechanical force patterns (Vincent et al., 2012). [22]. Osteoarthritis affects 18.0% of men aged 65 and above and 9.6% of women aged 65 and up, according to the World Health Organisation (Woolf et al., 2003). Knee osteoarthritis is more common in those who are biomechanically overweight and who have sedentary lifestyles.

Knee joint motions are facilitated in order to facilitate the knee's precise and fluid ambulatory dynamics, The quadriceps and hamstrings are the main muscles that play a role. Potentially contributing to the development of knee osteoarthritis is having tight hamstrings (KOA) due to the increased stress on the knee joint, less mobility, and compensatory movements that worsen the condition. As a whole, KOA is associated with less hamstring flexibility. Patellofemoral syndrome, which may worsen osteoarthritis and other forms of joint compression, might develop as a consequence of decreased flexibility may cause discomfort and restrictions in physical function.

METHODS

Research Framework

A double-blind, parallel-randomized clinical trial design was employed in this study to evaluate the effectiveness of IASTM against a sham intervention both pre- and post-treatment. The functional tests (6MWT and TUG) and quality of life evaluations (SF-36 and LAI questionnaire) were conducted using patients with KOA.

Participants

There were originally 32 people were initially included in the study, however 3 were later eliminated for individual reasons; as a consequence, 30 individuals were determined to have unilateral KOA, and these individuals successfully finished all stages. Using G*Power and pilot data, we determined the sample size with the following parameters: alpha = 0.05, beta = 0.2, and mean effect size = 0.28. The results indicated that 28 persons would be an adequate sample size adequate, with additional participants added to account for any dropouts.

The prerequisites for participation Those who met the following criteria were considered: age 40 and above, independent walking capacity, mild knee osteoarthritis (grades 2 and 3 according to Kellgren-Lawrence), and with a BMI between 18.5 and 29.9. The following conditions were not considered for participation: a history of disorders ache that is already present and affects the lower back or lower limbs in the lower back, injections into joints within the last six months, severe deformity in the lower limb, need for knee replacement surgery, a difference in leg length of more less than 1.5 cm, or using nonsteroidal anti-inflammatory drugs (NSAIDs) or other analgesics often has for at least two weeks prior to procedure.

Two blocks, one designated as an experimental group and the other as a control group, within the four-block randomisation framework. The randomisation procedure was executed by a person external to the research team. The experimental group received code 1, while the control group was assigned code 0, with both codes enclosed in sealed envelopes. The research employed a double-blind methodology to guarantee that neither the subjects nor the assessors were aware of their group assignments. Appointments at the clinic were arranged on separate days to prevent participants from interacting with each other. In contrast to the sham group, which had merely superficial contact, the IASTM group benefited from therapeutic techniques accompanied by appropriate pressure. Furthermore, the assessor was unaware of the

responsibilities allocated to each group of participants. The Ethics Committee of Tarbiat Modares University sanctioned the study following the acquisition of signed informed consent from all subjects. The Iranian Registry of Clinical Trials classified this research as IRCT20201128049511N3 Clinical Trials.

Outcome Measures

Prior to and after the examination, participants completed extensive evaluations. Investigate the efficacy of IASTM in assisting patients with KOA. Two functional assessments included the Timed Up and Go (TUG) and the 6-Minute Walk Test (6MWT). The 6MWT is an essential instrument for evaluating mobility in KOA patients, as it quantifies the distance traversed on a level, solid surface within six minutes, providing insights into aerobic capacity and endurance. Cones delineated the commencement and conclusion of a 10-meter corridor, while a chair was positioned centrally in the room for participants to take a break if necessary. Every individual completed the 6-minute journey without pausing for a respite. The TUG test assesses functional mobility, balance, and lower extremity strength by counting the number of times an individual rises from a chair, traverses three meters, pivots, returns to the chair, and sits down again.

In addition to the functional tests, participants were also asked to rate their subjective quality of life. A large number of We used the SF-36 to assess factors pertaining to quality of life as it relate to health. These included bodily functions, limitations in role due to physical or mental health issues, vitality and energy, psychological well-being, social functioning, discomfort, and general health. A higher score on the 36-item assessment, which is based on a 100-point scale, indicates a life satisfaction. In particular, the LAI questionnaire measured the degree of discomfort, the maximum distance that could be covered on foot, and how much of an impact KOA had on daily tasks The most severe case of KOA is indicated by a score of 14 out of a possible 24 on the LAI. The Persian translations of both polls demonstrated their dependability and validity.

Data Analysis

In order in order to ascertain whether A Shapiro-Wilk test was conducted since the data was found to have a normal distribution. Due to the fact that every single piece of data was distributed normally, we ran separate t-tests at the beginning to see whether there were any early differences between the two groups. The effectiveness of the therapy was assessed using

a mixed-subject analysis of variance (a component inside the patient, such as before and after therapy, and a factor between the subjects, such as treatment compared to a control group). A partial eta squared value of 0.138 was used to indicate a large impact size, 0.06 to indicate a medium effect size, and by and large, 0.08 to indicate a small effect size 0.01, with an alpha level of 0.05.

RESULTS

Every one of the thirty participants made it through the whole course of therapy. Table 2 includes descriptive statistics for all variables, whereas Table 1 includes demographic data.

Table 1. Basic Population Statistics

Variables	IASTM Group (N = 15)	Placebo Group (N = 15)	P-Value
Sex			-
Female	13	12	
Male	2	3	
Age, (y)	57.73 ± 8.54	58.27 ± 7.36	0.277
Body Mass Index, kg/m ^{2}	27.46 ± 2.95	27.59 ± 2.82	0.856

Table 2. Results of Quality of Life Questionnaires and Functional Tests, Mean ± SD with 95% confidence intervals

Variables	IASTM Group		Sham Group	
	Before	After	Before	After
6 MWT, (m)	357.27 ± 52.22 (328.34 - 386.19)	400.53 ± 54.85 (370.15 - 430.91)	353.40 ± 68.58 (315.42 - 391.38)	371.80 ± 60.36 (338.37 - 405.23)
TUG, (s)	8.66 ± 1.01 (8.06 - 9.22)	7.97 ± 1.06 (7.38 - 8.56)	8.71 ± 1.25 (8.01 - 9.40)	8.51 ± 0.95 (7.98 - 9.04)
Total LAI score	9.00 ± 2.54 (7.58 - 10.41)	5.86 ± 1.89 (4.81 - 6.91)	7.66 ± 3.55 (5.69 - 9.63)	6.10 ± 3.21 (4.31 - 7.88)
Physical functioning	46.66 ± 18.28 (36.53 - 56.79)	49.66 ± 17.87 (39.76 - 59.56)	51.00 ± 19.83 (40.01 - 61.98)	53.66 ± 19.03 (43.12 - 64.20)
Role limitations (physical)	55.00 ± 25.24 (41.02 - 68.97)	62.08 ± 17.43 (52.42 - 71.73)	54.16 ± 17.62 (44.40 - 63.92)	62.08 ± 16.10 (53.16 - 71.00)
Role limitations (emotional)	59.44 ± 20.86 (47.89 - 70.99)	68.33 ± 19.21 (57.69 - 78.97)	72.77 ± 14.24 (64.88 - 80.66)	68.88 ± 15.89 (60.08 - 77.69)
Energy/vitality	40.13 ± 17.26 (30.58 - 49.69)	47.08 ± 17.17 (37.57 - 56.59)	47.91 ± 19.14 (37.31 - 58.51)	51.66 ± 16.78 (42.37 - 60.96)

Mental health	54.33 ± 19.16 (43.71 - 64.94)	57.33 ± 15.90 (48.52 - 66.14)	60.08 ± 17.93 (50.15 - 70.01)	62.33 ± 13.21 (55.01 - 69.64)
Social functioning	74.16 ± 12.90 (67.01 - 81.31)	76.00 ± 9.99 (70.46 - 81.53)	68.33 ± 16.94 (58.94 - 77.71)	69.16 ± 15.57 (60.54 - 77.79)
Pain	45.33 ± 19.95 (34.28 - 56.38)	58.66 ± 15.75 (49.94 - 67.38)	53.33 ± 16.08 (44.42 - 62.23)	64.33 ± 17.12 (54.84 - 73.81)
General health	54.16 ± 17.78 (44.31 - 64.01)	55.83 ± 22.09 (43.59 - 68.06)	53.33 ± 19.46 (42.55 - 64.11)	58.33 ± 25.29 (44.32 - 72.34)
Total SF - 36 score	53.64 ± 16.09 (44.72 - 62.55)	58.93 ± 12.87 (51.80 - 66.06)	57.95 ± 14.56 (49.88 - 66.02)	61.04 ± 13.00 (54.20 - 68.60)

There was no discernible difference between the two sets of data in terms of pre-treatment condition across all variables, according to the independent t-test results ($P > 0.05$). An increase in length in the 6MWT and a reduction in TUG time for the two sets of participants indicate improvements post-treatment, as shown by the significant time effect in in the mixed ANOVA findings for the functional tests, the TUG test ($P = 0.272$, $\eta p^2 = 0.003$) and the 6MWT ($P < 0.001$, $\eta p^2 = 0.386$) performed significantly. In the IASTM group, the upward trend in performance was more pronounced, as seen in Photo 1.

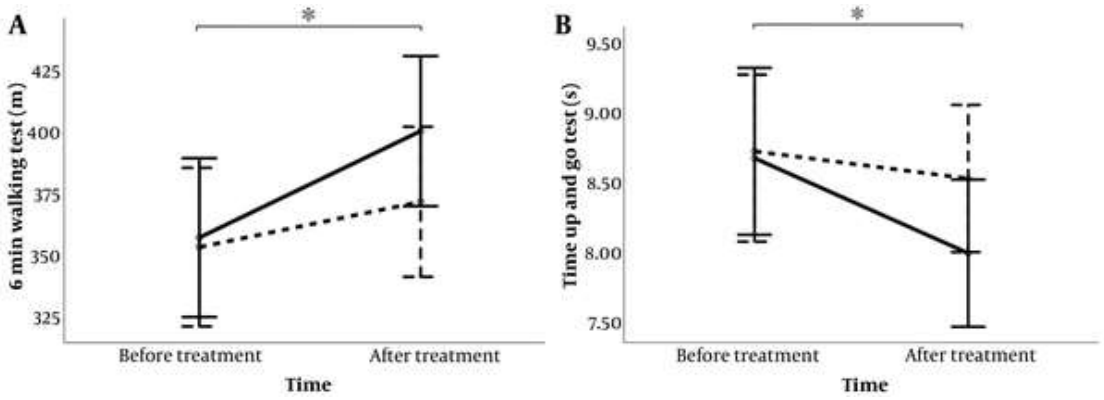

Figure 1. Results of a timed up-and-go test (TUG) and a 6-minute walk test (6MWF) in a mixed-effects analysis of variance *Means a major result.

In the SF-36, the mixed ANOVA findings revealed that several subgroups exhibited notable temporal effects: The subsequent elements were evaluated: physical functioning ($P = 0.002$, $\eta p^2 = 0.292$), participation restrictions due to physical challenges ($P < 0.001$, $\eta p^2 = 0.367$), vitality/energy ($P < 0.001$, $\eta p^2 = 0.369$), discomfort ($P < 0.001$, $\eta p^2 = 0.544$), and total score ($P < 0.001$, $\eta p^2 = 0.551$). Both cohorts saw enhancements in their scores following treatment. Furthermore, the interaction between time and group regarding emotional role limitations was

significant ($P = 0.005$, $\eta p^2 = 0.251$), indicating an elevation in the IASTM group post-treatment and a reduction observed in the control group. A pronounced temporal effect was indicated by the markedly reduced scores on the LAI questionnaire post-therapy ($P < 0.001$, $\eta p^2 = 0.873$) among the two groups of participants.

DISCUSSION

To determine if IASTM combined with exercise therapy improved functional results Considering the quality of life for those with KOA, this research contrasted the two groups while using a control group that received a sham intervention. IASTM, or instrument-assisted soft tissue mobilisation, is a method for accelerating tissue healing by stimulating fibroblasts and removing scar tissue from soft tissues with the use of an instrument.

There were significant improvements in functional performance, according to the findings as measured by the 6MWT and TUG tests linked to knee mobility during weight-bearing, multi-joint everyday tasks. Although functional capacity was greatly enhanced by both treatments, Figure 1's trend indicates that exercise therapy in conjunction with IASTM is superior to exercise treatment on its own. It has corresponds with prior research in which the advantages of IASTM for reducing pain and enhancing mobility, and strengthened muscles have been highlighted. The available research suggests that intra-articular soft tissue mobilisation (IASTM) has the potential to increase mobility and decrease pain by increasing blood flowlessening the stiffness and tissue viscosity. Apparatus used in IASTM have the ability to alleviate pain by influencing pain receptors and promoting the healing process of inflammation. Combining IASTM It seems that functional activities are enhanced with exercise. Additionally, improvement was also shown in the exercise-only group. Exercise prescription is necessary for KOA patients as part of their rehabilitation regimen, as shown by these exercises, which are conducted over the course of two weeks in four sessions.

Integrated An instrument is used in Assisted Soft Tissue Management (IASTM) to remove scar tissue from soft tissues and activate fibroblasts, which initiate the healing process. IASTM is practical, doesn't need any particular expertise, and each treatment session just takes a short amount of time. Prior According to research, IASTM increases mobility. and function of injured soft tissues, both in the short term and over the long term, and to reduce discomfort. Following anterior cruciate ligament surgery, the patient had a two-week rehabilitation program that included the use of IASTM and kinesio tape. The results showed a return of lower-leg muscle strength and range of motion discomfort was reduced, patients were able to

go back to their regular routines and even return to sports without any issues. As a result, kinesio tape may aid in the rehabilitation process by enhancing the effectiveness of weaker muscles during strengthening and stretching exercises immediately after IASTM.

Based on the results, it seems that Research has shown that when performed correctly, For individuals dealing with knee pain syndrome, instrument-assisted soft tissue mobilisation has the potential to alleviate pain and functional impairment. There is strong evidence from a number of studies that instrument-assisted soft tissue mobilisation may help people with knee pain and functional impairments discomfort. It would be helpful for future studies to evaluate the treatments' long-term effectiveness. Anyone suffering from knee pain may benefit from the results of this study.

CONCLUSIONS

This study's findings indicate that the integration of IASTM with exercise therapy significantly enhances functional performance in individuals with KOA. This is corroborated by enhancements observed in the TUG and 6MWT assessments. Both interventions proved to be beneficial; however, the IASTM cohort had more pronounced outcomes, indicating a greater impact on activities of daily living, which is critically significant for the aged. Instrument-assisted soft-tissue mobilisation (IASTM) is a technique that utilises instruments for the removal of scars and the activation of fibroblasts to enhance the healing process. IASTM is effective, requires no specialised knowledge, and each treatment session is brief. Findings from The IASTM group exhibited minimal advancement, but the SF-36 and LAI evaluations indicated enhancements in various domains related to emotional role limitations in contrast to the alternative group. Exercise therapy constitutes an essential component of the treatment protocol for KOA patients, since both cohorts shown significant enhancements overall. Continued application of IASTM could yield even more significant outcomes, as evidence indicates superior improvements within the IASTM cohort.

Reference

1. Teslim, Onigbinde & Akindoyi, Oyebukola & Faremi, Funmilola & Okonji, Adaobi & Oniyangi, Shuaib & Olaitan, O. 'Lanre. (2013). An Assessment of Quadriceps Flexibility of Subjects with Knee Osteoarthritis and Their Age Matched Control. Clinical Medicine Research. 2. 10.11648/j.cmr.20130206.12.

2. Kim, Do & Lee, Jae & You, Joshua. (2018). Effects of instrument-assisted soft tissue mobilization technique on strength, knee joint passive stiffness, and pain threshold in quadriceps shortness. Journal of Back and Musculoskeletal Rehabilitation. 31. 1-8. 10.3233/BMR-170854.

3. Gunn, Leanna & Campbell Stewart, Jill & Morgan, Brittany & Metts, Steven & Magnuson, Justin & Iglowski, Nicholas & Fritz, Stacy & Arnot, Catherine. (2018). Instrument-assisted soft tissue mobilization and proprioceptive neuromuscular facilitation techniques improve quadriceps flexibility better than static stretching alone: a randomized clinical trial. Journal of Manual & Manipulative Therapy. 27. 1-9. 10.1080/10669817.2018.1475693.

4. Ikeda, Naoki & Otsuka, Shun & Kawanishi, Yozo & Kawakami, Yasuo. (2019). Effects of Instrument-assisted Soft Tissue Mobilization on Musculoskeletal Properties. Medicine & Science in Sports & Exercise. 51. 1. 10.1249/MSS.0000000000002035.

5. Osailan, Ahmad & Aljamaan, Abdulaziz & Talha, Khalid & Alhindi, Meshari. (2021). Instrument assisted soft tissue mobilization (IASTM) versus stretching: A comparison in effectiveness on hip active range of motion, muscle torque and power in people with quadriceps tightness. Journal of Bodywork and Movement Therapies. 27. 10.1016/j.jbmt.2021.03.001.

6. Pal CP, Singh P, Chaturvedi S, Pruthi KK, Vij A. Epidemiology of knee osteoarthritis in India and related factors. Indian J Orthop. 2016 Sep;50(5):518-522.

7. Heidari B. Knee osteoarthritis prevalence, risk factors, pathogenesis and features: Part I. Caspian J Intern Med. 2011 Spring;2(2):205-12.

8. Anandkumar S, Sudarshan S, Nagpal P. Efficacy of kinesio taping on isokinetic quadriceps torque in knee osteoarthritis: a double blinded randomized controlled study. Physiother Theory Pract. 2014 Aug;30(6):375-83.

9. Muraki S, Akune T, Oka H, Ishimoto Y, Nagata K, Yoshida M, Tokimura F, Nakamura K, Kawaguchi H, Yoshimura N. Incidence and risk factors for radiographic knee osteoarthritis and knee pain in Japanese men and women: a longitudinal population-based cohort study. Arthritis Rheum. 2012 May;64(5):1447-56.

10. Malemud CJ. Cytokines as therapeutic targets for osteoarthritis. BioDrugs. 2004;18(1):23-35.