Comparative analysis of instrument-assisted soft tissue mobilization and traditional physical therapy on pain and functional outcomes in knee osteoarthritis patients

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: Athletes frequently confront the daily obstacles and training interruptions caused by patellofemoral pain syndrome. The therapist in group A applied the treatment area at a 45-degree inclination, followed by 30 gentle strokes from the instrument's tip to the implant. Part B engaged in three rounds of PNF stretching, incorporating a 10-second interval between each round, after an 8-second duration of prolonged isometric contraction of the hamstring at about 50% of maximal strength prior to release. Every patient participated in a 30-minute session thrice weekly for a period of six weeks. The outcome metrics including the WOMAC, which gauges the health status of KOA patients, AKT, which analyses hamstring flexibility, and VAS, which measures pain intensity, are two of these evaluations. A statistically significant interaction ($p < 0.001$) was identified in the study concerning treatments and various metrics throughout time. After a period of 6 weeks, both treatments demonstrated significant improvements; however, group A (IASTM) exhibited markedly superior outcomes in hamstring flexibility, pain reduction, and general well-being ($p < 0.001$) relative to group B (PNF). Engaging in PNF and IASTM stretching resulted in enhanced hamstring flexibility, less discomfort, and improved overall well-being. The IASTM method demonstrates more benefits than PNF stretching in terms of mobility, alleviation of discomfort, and promotion of community health. The IASTM technique might be used by physical and manual therapists when addressing individuals desiring significant enhancements in these areas.

Keyword: Leg pain, osteoarthritis of the knee, hamstrings, manual treatment, and stretches

INTRODUCTION

One prominent medical settings, the most common reason for knee discomfort is patellofemoral pain syndrome (PFPS). environments. This ailment is often marked by pain felt in the front of the knee while engaging in certain types of physical activity, such as walking, jogging, leaping, and stair climbing. Advancements in patellofemoral pain altered patellofemoral trajectory and elevated localised joint stress are the first symptoms of patellofemoral pain syndrome (PFPS). The course of this disease is affected by a number of factors, the most important of which is an abnormal patellar motion trajectory. Lower limb force line issues are common with this condition, and they may have many causes, such as abnormal anatomy of the lower limbs, weaker lower limb muscles, uneven tone around the knee, or injuries sustained while playing sports. According to Sinaei et al., PFPS symptoms might be caused by a lack of biceps femoris muscular strength, a delay in medial femoral muscle activation, and an imbalance between the lateral and medial femoral muscles. According to the research shown earlier, the main cause of knee pain is an imbalance in the tone of the muscles around the joint. This study aims to find a conservative treatment that may help people with patellofemoral pain syndrome (PFPS) overcome their dystonia imbalance. Instrument-Assisted Soft Tissue Mobilisation (IASTM) will be used in the study.) treatment and compression exercise for decreasing the signs and symptoms of these problems individuals.

The specialised devices used in IASTM treatment are used to externally manipulate and mobilise the body's soft tissues; this procedure is non-invasive. This research looked at the efficacy of using the fascial knife to treat myofascial pain and aberrant tension. The five most common kinds of knives are: Types M, A, S, C, and B stand for Big M, Shark, Hook, Probe, and Bat, respectively each serving distinct practical purposes based on their specific shapes.

This technique facilitates rapid diagnosis and excision of fascial adhesions, so efficiently averting fibrosis of soft tissues and deterioration of muscles. A method for treating joint problems, fascial knife technology is sometimes called the fascial spatial balance technique. Screening, inspection, and the use of a specialised knife technique to apply pressure to the skin are all part of this approach. The whole process is risk-free and painless. This therapy has the potential to greatly improve the range of motion in the joints by focussing on the high-stress fascia. By reducing strain on the tendons and muscles around the knee joint, this study aimed to improve knee mobility with IASTM therapy.

Methods

Study design & setting

The study was a clinical trial that used a randomisation and single-blind design in Islamabad, Pakistan, at the RHS Rehabilitation Centre. From July 2019 to June 2020, researchers from Riphah International University's Faculty of Rehabilitation and Allied Health Sciences carried out the study with the approval of the university's Research and Ethical Committee (REC) (Ref# Riphah/RCRS/REC)-01055).

Participants

Participants were chosen utilising a non-probability purposive selection method from a demographic of individuals aged 35 to 50 years who met specific criteria: grade 1 or 2 knee osteoarthritis (KOA) as defined by Kellegren and Lawrence standards; and a hamstring tightness measurement exceeding 20° on the active knee extension test (AKET). Injuries or surgeries to the lower limbs during the past six months, neurological manifestations, a taut iliotibial band, adductor muscles, or sartorius affected by other musculoskeletal disorders were all criteria for exclusion, along with any deformities or fractures of the hips or knees in the study.

Sample size

The sample size Given the modest effect size of and the alpha error margin of 0.05, 0.24, n = 60 was estimated using G Power. A power of 0.95 was chosen for (1-β) in order to reduce the danger of β mistake. After 63 patients were determined to be eligible, sixty people were divided into two groups at random: group A, which was given the IASTM, method (n = 30), or group B, which received the PNF technique (n = 30). After n = 3 patients from Group A lost follow-up, a total of 57 people were examined at the end of the experiment.

Statistical methods

The tables and graphs illustrating the study's results were generated by descriptive statistics, encompassing frequency, percentage, mean, dispersion, and variance. A two-way mixed ANOVA utilising partial eta squared ($\eta p2$) as the measure of effect size was employed to analyse the interaction between treatment conditions and assessment levels. Parametric tests were deemed appropriate for the data, hence this test was employed. We employed independent t-tests for intergroup comparisons and paired-sample t-tests for intragroup comparisons to evaluate temporal changes. Cohen's d was employed to assess the magnitude of the influence. The threshold for significance was established at $p < 0.05$ for data analysis in SPSS version 28.

RESULTS

The mean The study The mean age of the participants was 45.14 ± 4.67 years, with a body mass index (BMI) of 28.53 ± 5.65 kg/m². A total of 57 individuals participated; 14 were male (24.6% of the total), and 43 were female (75.4% of the total). Grade 1 knee osteoarthritis

(KOA) was identified in all 30 participants based on the Kellegren and Lawrence criteria, while 27 were classified with grade 2 KOA. Data points one and two depict the allocation of BMI and KOA classification among the groups, respectively.

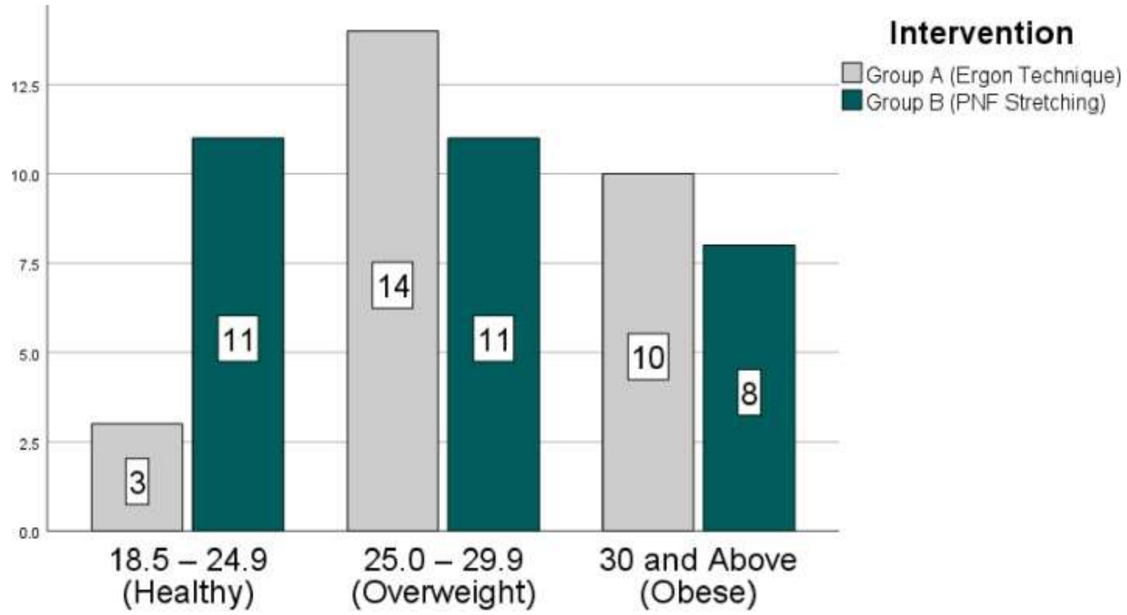

Figure 1. Frequency distribution (BMI).

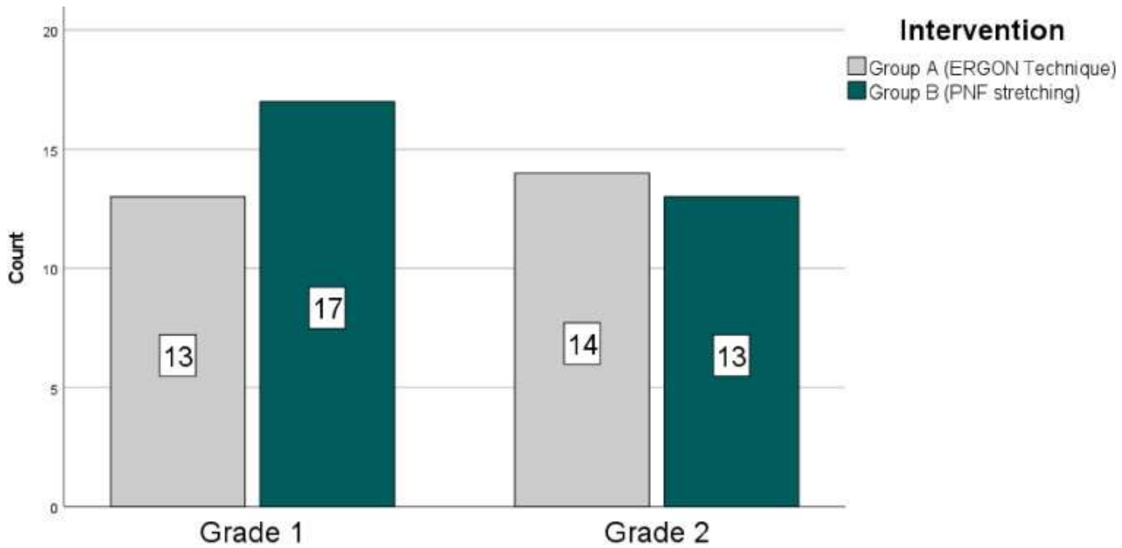

Figure 2. Frequency distribution knee OA grades.

A two-way mixed ANOVA utilised to look at how the intervention and assessment level interacted. According to the sphericity assumption, all dependent variables showed substantial impact sizes due to the treatments' interactions with the time factor. This encompasses Results on the AKET scale for hamstring flexibility ($F = 32.13(1,55)$, $p < 0.001$, $\eta p2 = 0.36$), and results on the VAS scale for pain ($F = 52.95(1,55)$, $p < 0.001$), $\eta p2 = 0.49$), stiffness on the WOMAC scale ($F = 96.15(1,55)$, $p < 0.001$), and physical function on the KET scale ($F = 18.25(1,55)$, $p < 0.001$, $\eta p2 = 0.24$), $\eta p2 = 0.63$}, as illustrated in Fig. 3.

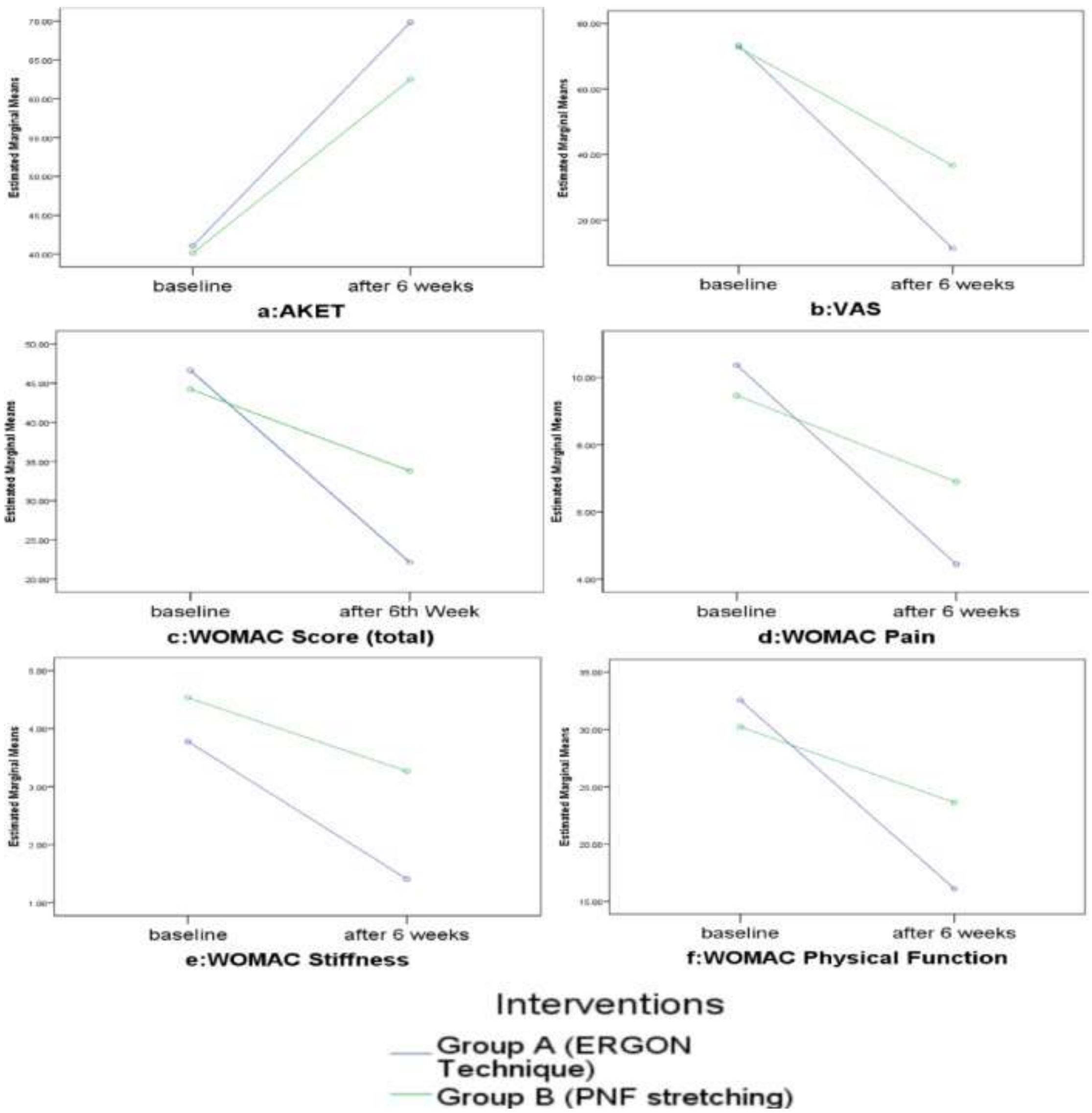

Figure 3. Interaction effect.

A significant interaction effect was observed for all dependent variables, necessitating the application of paired samples t-tests to determine the primary effect. Following the sixth week of the intervention, there was a substantial enhancement in the dependent variables, which encompass hamstring flexibility (AKET), pain (VAS), and health status (WOMAC), reflecting improvements in pain, stiffness, and physical capability ($p < 0.001$). (Table 1).

Table 1. Comparing the two sets of data at baseline and six weeks.

		Group A (IASMT technique) *n* = 27					Group B (PNF stretching) *n* = 30				
		Mean	SD	MD	*p*-value	Cohen's d	Mean	SD	MD	*p*-value	Cohen's d
AKE [a]	Baseline	41.01	3.26	−28.85	.000***	3.56	40.11	3.16	−22.38	.000***	4.86
	After 6th week	69.87	1.92			62.50	3.82				
VAS (Pain)	Baseline	73.33	7.96	62.00	.000***	12.33	72.70	9.17	36.06	.000***	14.34
	After 6th week	11.33	12.49			36.63	13.59				
Pain	Baseline	10.37	2.11	5.92	.000***	1.68	9.46	3.25	2.56	.000***	1.77
	After 6th week	4.44	1.45			6.90	2.75				
Stiffness	Baseline	3.77	1.36	2.37	.000***	1.11	4.53	1.56	1.26	.000***	0.82
	After 6th week	1.40	0.88			3.26	1.36				
Physical function	Baseline	32.55	5.29	16.44	.000***	5.30	30.23	9.12	6.60	.000***	2.84
	After 6th week	16.11	4.00			23.63	8.03				
Total Score	Baseline	46.62	6.76	24.48	.000***	6.71	44.23	12.04	10.43	.000***	3.74
	After 6th week	22.14	5.74			33.80	10.58				

The independent t-test comparison between the two groups indicated that participants who underwent the IASTM method had substantially greater improvement contrasted with group B, who received the PNF, there were significant gains ($p < 0.001$) in the AKT, VAS, and WOMAC measures of hamstring flexibility, pain, and health status, respectively approach (Table 2).

Table 2. At baseline and six weeks later, both groups underwent analysis.

		Group A (IASTM technique) *n* = 27		Group B (PNF stretching) *n* = 30				
		Mean	SD	Mean	SD	MD	*p*-value	Cohen's d
AKET ^o^	Baseline	41.01	3.26	40.11	3.16	−.90	0.29	–
	After 6th week	69.87	1.92	62.50	3.82	−7.37	0.00***	3.08
VAS (Pain)	Baseline	73.33	7.96	72.70	9.17	−.63	.78	–
	After 6th week	11.33	12.49	36.63	13.59	25.30	0.00***	13.08
Pain	Baseline	10.37	2.11	9.46	3.25	−.90	0.22	–
	After 6th week	4.44	1.45	6.90	2.75	2.45	0.00***	2.23
Stiffness	Baseline	3.77	1.36	4.53	1.56	.75	0.522	–
	After 6th week	1.40	0.88	3.26	1.36	1.85	0.00***	1.16
Physical function	Baseline	32.55	5.29	30.23	9.12	−2.32	0.24	–
	After 6th week	16.11	4.00	23.63	8.03	7.52	0.00***	6.44
Total Score	Baseline	46.62	6.76	44.23	12.04	−2.39	0.35	–
	After 6th week	22.14	5.74	33.80	10.58	11.65	0.00***	8.64

DISCUSSION

This research attempted to determine if stretching using PNF and IASTM may alleviate pain, enhance health, and increase hamstring flexibility in those suffering from knee osteoarthritis. During the course of treatment, Subjects in both groups shown significant amelioration in discomfort, hamstring range of motion, and overall wellness, according to the present study's within-group analysis. When comparing the two methods of stretching, it was shown that IASTM had a more significant impact on improving flexibility, discomfort, and health state of the hamstrings as measured by the WOMAC scores (physical, stiffness, and pain) functioning) than PNF stretching.

This project integrates two treatments to safely and effectively enhance alleviate symptoms, improve mobility, and build strength in people with PFPS with a regimen that includes both exercise and PT. Following the operation, it was observed that PFPS patients who had IASTM and BFR had less discomfort, more flexibility in their knee soft tissues, stronger lower limbs, and more mobility in their joints. A more flexible and pain-free knee is possible with pure IASTM therapy, which also increases the joint's strength without discomfort. In terms of total therapeutic efficacy, the combination therapy significantly surpasses alone IASTM treatment.

A research comparing People suffering from knee osteoarthritis who opted for PNF stretching rather than static stretching reported much better pain reduction and increased flexibility in their hamstrings. The results corroborate our findings that PNF stretching increases hamstring flexibility while decreasing pain ratings. The main neurophysiological mechanism that explains why PNF stretching works to lengthen hamstrings is that it triggers anticipatory relaxation in the targeted muscle and activates the Golgi tendon organ. With repeated sessions of the hold-relax method used in PNF stretching, the hamstring sarcomeres and musculotendinous unit showed significant improvement.

The current research shown Thus, in contrast to PNF stretching, IASTM considerably increased hamstring flexibility. The ability of IASTM to enhance hamstring flexibility by focussing on regions of tightness or adhesions, stimulating fibroblast activity, and assisting with tissue reattachment might explain this discrepancy. Using a stainless-steel instrument, IASTM is able to penetrate deeply and precisely, mobilise soft tissues more effectively, and promote wound healing by increasing blood flow and collagen production repair. The current study's findings correspond with prior research indicating that IASTM reduces functional impairment relative to traditional treatment. This research demonstrated that IASTM resulted in superior enhancement of general well-being, as measured by the WOMAC score, in contrast to PNF stretching. Through its adhesion detection, inflammation induction, improved blood supply to muscles, reduced tissue viscosity, and collagen tissue repair capabilities, IASTM is a powerful tool in the medical field. Given the hamstring's role in reducing knee osteoarthritis pain and stiffness, increasing flexibility in this area has the potential to improve quality of life significant role in the knee joint.

This research was limited to a single clinical environment. A further restriction that might impact the forecast include both unilateral and bilateral knee osteoarthritis, with variable degrees of the condition.

CONCLUSION

Benefits of IASTM and PNF stretching for knee osteoarthritis patients included increased improved flexibility, reduced discomfort, and overall well-being in general, according to this study. A group called the IASTM approach shown superior advantages compared to PNF stretching for flexibility, pain alleviation, and overall health improvement. These advantages may be ascribed to the enhanced flexibility of the hamstrings resulting from the IASTM procedure. Multicentered future research are advised based on BMI, gender disparities, and the retention effects of the intervention.

Reference

1. Liu, Yang & Wu, Lianqing. (2023). Effect of instrument-assisted soft tissue mobilization combined with blood flow restriction training on function, pain and strength of patients with patellofemoral joint pain. BMC Musculoskeletal Disorders. 24. 10.1186/s12891-023-06701-6.

2. Seffrin, Cristina & Reed, Melissa & Gardiner-Shires, Alison. (2019). Instrument-Assisted Soft Tissue Mobilization: A Systematic Review and Effect-Size Analysis. Journal of Athletic Training. 54. 10.4085/1062-6050-481-17.

3. Liu, Yang & Wang, Yidan. (2023). A comparative study of the efficacy of instrument-assisted soft tissue mobilization and massage techniques in patients with patellofemoral joint pain. Frontiers in Medicine. 10. 10.3389/fmed.2023.1305733.

4. Vardiman, John & Siedlik, Jacob & Herda, T & Hawkins, William & Cooper, Michael & Graham, Zachary & Deckert, Jake & Gallagher, Philip. (2014). Instrument-assisted Soft Tissue Mobilization: Effects on the Properties of Human Plantar Flexors. International journal of sports medicine. 36. 10.1055/s-0034-1384543.

5. Anjum, Narmeen & Kanwal, Raheela & Omer, Aadil & Anwar, Kinza & Khan, Muhammad Manan Haider & Aftab, Anam & Awan, Waqar. (2023). Comparison of instrument-assisted soft tissue mobilization and proprioceptive neuromuscular

stretching on hamstring flexibility in patients with knee osteoarthritis. PeerJ. 11. e16506. 10.7717/peerj.16506.

6. Zübeyir Sari, Onur Aydogdu. Clinical outcomes of kinesio taping applied in patients with knee osteoarthritis: A randomized controlled trial. Journal of Back and Musculoskeletal Rehabilitation. 2017; 1045-1051.

7. Arnab Chandra1, K. S. Sharad2, Anwer Shahnawaz3, Siddhartha Shankar Sikdar. a study on the efficacy of patellar taping for knee osteoarthritis as compared to conventional physical therapy. ijcrr. 2012;4(22): 91-98

8. Michelle J Lespasio, DNP, JD, ANP; Nicolas S Piuzzi, MD; M Elaine Husni, MD, MPH; George F Muschler, MD; AJ Guarino, PhD; Michael A Mont, MD. Knee Osteoarthritis: A Primer. The Permanente Journal.2017; 16-183.

9. Ashraf Ramadan Hafez1, Aqeel Mohammed Alenazi2, Shaji John, Kachanathu3, Abdulmohsen Meshari Alroumi4 and Elham Saed Mohamed5. Knee Osteoarthritis: A Review of Literature. Austin publishing group. 2014; 1(5). 1-8.

10. I Haq, E Murphy, J Dacre. Osteoarthritis. postgrad med J. 2003; 377-383.