Analysis of Iliotibial Band Among Unilateral Osteoarthritis Knee with Myofascial Release and PNF Stretching using Kemtai (AI)

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Abstract. A degenerative joint disease that often involves the knee, osteoarthritis (OA) leads to pain, stiffness, and reduced function. OA can tighten the iliotibial (IT) band a fascia that runs from the knee to the hip resulting in pain and limit mobility and range of motion (ROM). Directly related to this concept is the practice of PNF (proprioceptive neuromuscular facilitation) stretching in which muscle contractions and stretches are used to increase ROM (range of motion) and flexibility vs. self-myofascial release (MFR) through foam rolling which focuses on muscle and fascia tension. The purpose of the current randomized controlled trial was to investigate the influence of myofascial release (MFR) and proprioceptive neuromuscular facilitation (PNF) duplex in comparison with foam rolling on improving range of motion (ROM), flexibility and pain reduction at unilateral OA (Osteo Arthritis) knee in real-time performing with KEMTAI software. Thirty participants who had osteoarthritis in their knees were randomly selected for the study. Both female and male gender participants in the study were diagnosed with osteoarthritis knee aged between 50 - 70 years. Two groups of 15 individuals each. Pretest outcomes for the Ober test and ROM were registered for both (Experimental group (MFR with foam rolling), control group (PNF stretching with foam rolling)) groups. Intervention The exercise intervention lasted 8 weeks. Mean values of ober test, ROM in Experimental group 5.47 and 130.46 in Control group posttest. It found that the group with experimental is more effective than the control group in mobility and flexibility on the patients with OA knee. The authors of the research study thought that MFR + foam rolling was actually more successful than PNF stretching + foam rolling.

Keywords: Osteoarthritis Knee, Myofascial Release, Proprioceptive Neuromuscular Facilitation, Iliotibial Band, Foam rolling.

1 Introduction

Osteoarthritis (OA), often called age-related or wear-and-tear in terms of synovial joint deterioration, arthritis is the most prevalent type. It is characterized by meniscus deterioration, cartilage degeneration and eventual loss, subchondral bone changes, and synovial inflammation. The main weight-bearing joint that is most frequently affected is the knee joint, where the condition can be very incapacitating because to the problems

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in standing, kneeling, walking, ascending stairs, and getting out of a chair. Knee osteoarthritis can be classified as primary or secondary. An articular degeneration that happens without apparent cause is called primary osteoarthritis. Secondary osteoarthritis is mostly caused by either defective articular cartilage or incorrect force distribution inside the joint, such as in post-traumatic situations [1]. Both older women and males are more likely to have it. Changes in the collagen of cartilage occur as a result of the disruption of chemical processes in articular cartilage caused by osteoarthritis (OA). Individuals who experience pain are more likely to see reductions in activity as well as falls due to weakness of muscle, increased sway of body and impaired balance. Although many older people with arthritis opt for injury, exercise is one of the best non-pharmacologic treatments for osteoarthritis (OA), particularly for knee OA [2].

Weakness of the wrist extrinsical evidenced through passive movements can billionusd DNA Investorsveismic83 forms. KOA occurs in three compartments: patellofemoral, lateral and medial. It typically advances slowly over the course of 10 to 15 years and restricts day-to-day activity. It used to be considered an age-related articular cartilage disease due to wear and tear with no connection to inflammation. Degenerative changes, including tibial plateau collapse, joint constriction, and diminished medial compartment cartilage, lead to increased adduction moment and varus deformity in KOA.

The iliotibial band (IT band) is also known as the iliotibial tract or Maissiat's band. Along the outside of your leg, there's a long band of fascia, or connective tissue, that runs from hip to knee and shinbone. IT band allows hip rotation, abduction and extension. This stabilizes your knee side, allows movement and protects your outside thigh. The outside of the knee is being rubbed over and over against an irritated IT band that is tight and inflamed. Tightness of the iliotibial band can impact the patella motion and control and potentially the entirety of the knee complex. These changes may lead to irritation of the distal ITB through the knee joint, which modifies the insertion of the ITB into the lateral epicondyle. People suffering from medial compartment KOA presents with lateral knee pain [3].

KOA is a prevalent ailment that impacts 12.5% of those aged 45 and above. In North Africa, KOA is more prevalent than hip OA. Since the prevalence of knee OA is expected to rise as the global population ages, effective therapy alternatives are required to lessen symptoms and enhance functional ability. Physical therapy is one of the most important non-pharmacological treatments for osteoarthritis in the knee. Therapeutic treatments revolve around techniques that target reducing muscle tension, increasing overall physical function, and improving joint mobility. "Myofascial release" encompasses a range of techniques for loosening fascial restrictions that lead to neuromuscular disorders. A popular manual method named myofascial release works on a guided approach to relieve restrictions that are generating somatic dysfunctions. It has been discovered that myofascial release, when combined with other traditional therapies, offers instant pain relief and reduces tissue discomfort. The severity and intensity of pain are influenced by a person's psychosocial characteristics, external stimuli that create articular emotions, the parts of the knee that cause pain, and the neurological system's sensitivity to pain impulses originating from the joint. Flexibility, range of motion, and muscle control all improve as a result. Stretching to increase range of motion can also be used therapeutically to lessen cramps and enhance daily functioning.

MFR (myofascial release or massage) and PNF (proprioceptive neuromuscular facilitation) stretching, particularly in combination with foam rolling have become two popular methods. The primary aim of this study was to quantitatively evaluate the growing body of literature regarding the potential therapeutic benefits of ITB stretching and release techniques for the management of KOA [4]. Foam rolling, or self-myofascial release, applies pressure on muscle and fascia in a given area of the body by rolling a cylinder of foam over it. Allegedly, it is supposed to increase blood flow, decrease muscle soreness, and improve range of motion by breaking up adhesions and increasing flexibility of the tissues. Foam rolling is a self-manual treatment technique that has gained popularity over the last two decades and is often utilized to improve flexibility, enhance athletic performance, and used as a rehabilitation technique [5]. Foam Rolling for Knee Pain and Dysfunction — Iliotibial Band Foam RollingFoam rolling for knee pain and dysfunction frequently focuses on the iliotibial band, a thick band of connective tissue that spans the hip to the tibia. Foam rolling itself has been shown in studies to produce a reduction in symptoms, but further research is required to determine whether or not that efficacy is due to foam rolling on its own or in conjunction with other modalities. However, in PNF stretching, the isometric contraction is used in addition to the passive stretching, this makes it a more complicated stretching method. Pairing stretching with muscular contraction, PNF stretching uses both the muscle being stretched and its antagonist for increased strength and flexibility. Initiate myofascial stretching: Most commonly work the muscle to its end range or close to the end range, resist with strength for a very subtle amount and retest. It is assumed that PNF stretching is much more effective than static stretching only in increasing flexibility and decreasing muscle stiffness and joint mobility. PNF is an approach that prescribes therapy based on an outlook of movement within functional tasks. It has been applied successfully and safely for ICF and other musculoskeletal disorders [6].PNF stretching and foam rolling on the IT band combined with stretching can have a [7].

In this study, the Ober test assessed the passive flexibility and variability in length of the iliotibial band. For obers test, you can use a digital inclinometer to measure an angle. Ober test, length of IT band and ROM can be measure using KEMTAI software. Assessing the range of motion in everyday clinical practice is an essential task to accurately evaluate the benefits of the therapy. KEMTAI Software System — this is an unprecedented tool for use in clinical practice and functional assessments: the focus on human movement, the use of a camera to track and analyze movement. By recognizing specific anatomical features, the system can track and assess the movement range of joints, as well as analyze bodily postures, and deliver instant feedback on required movement patterns by parts to the user. This study aims to fill this gap by comparing the effectiveness of MFR with foam rolling and PNF stretching with foam rolling on the IT band in subjects with unilateral knee osteoarthritis. The evaluation is designed to establish if method is better at easing the pain, range of motion enhancement, and improved functional results [10]. By conducting a thorough comparison, this study aims to improve patient outcomes and professional practices by offering useful information on the best therapy approaches for treating knee OA. In summary, knowing the relative efficacy of various physical therapy approaches becomes more crucial as knee OA remains a problem to the healthcare system. By contrasting the effects of MFR and foam rolling with PNF stretching and foam rolling, this study seeks to enhance the quality of life for individuals with osteoarthritis in the knee. The information gathered from this study will be essential for directing treatment plans [11].

1.1 Methods

A total of 30 subjects with Osteoarthritis Knee were chosen from Saveetha Medical College and Hospital using a convenient sampling process based on inclusion and exclusion criteria. Patients were then given a thorough explanation of the study's methodology, and their written informed consent was acquired. The participants age from 50 to 70 years and both female and male gender had been diagnosed with osteoarthritis knee. Exclusion criteria included a history of Acute synovitis, any systemic & neurological illness, total knee replacement, severe peripheral neuropathy disorders and with history of in taken intra articular injections and any knee joint surgery. The 15 individuals in each group into two groups. Experimental Group (MFR with foam rolling) Control Group (PNF stretching with foam rolling) for both groups pretest results from obers test, NPRS and ROM were documented. Treatment intervention consisted of 8 weeks of exercises (2 sets per session, 15 reps per, thrice in a week). At the end of the study, collected data are tabulated and statistically analyzed.

1.2 Inclusion Criteria

Both men and women were included; the participants were in the 50–70 age range; According to the Kellgren-Lawrence Classification, they were in Grades 1 and 2; The Ober test revealed that they had IT band tightness; they had trigger points as defined by Travell and Simons; they had crepitus on active knee joint movement; and they experienced morning knee stiffness lasting longer than ten minutes.

1.3 Exclusion Criteria

Participants who have had lower limb surgery within the last six months, those who have any wounds or scars on the treatment site, those who have received intra-articular injections, Individuals with external tibial rotation with a knee varus deformity more than 10 degrees as determined by X-ray, pes-cavus, or any other predominant lower extremity deformity, Participants with advanced osteoporosis, patients complaining of excruciating back pain, neurological, vascular, or infectious diseases, and medically unstable conditions such uncontrolled blood pressure and coronary artery diseases, as well as those who are unable to walk 10 meters without help.

1.4 Outcome Measures

- **Primary outcome:** ROM using KEMTAI software
- **Secondary outcome**: Obers test

2 Procedure

Patients are divided into 2 groups of Experimental group and Control group.

Whereas Control group(n=15) will be receiving The PNF regimen was selected due to its proven ability to generate substantial increases in joint range of motion, demonstrating a notable increase in the desired muscle length. The iliotibial band was subjected to the PNF stretching protocol. For best effects, PNF stretching should be used in conjunction with other treatment approaches, particularly when addressing osteoarthritis, even though it is frequently employed in a range of rehabilitation cases.

First, place the patient on their back with their legs outstretched. Ask the patient to adduct, or bring, one leg across the back to the other side while maintaining a straight knee. The patient may alternatively choose to lie on their side and slightly abduct their leg. The therapist holds the leg in place at the knee or ankle for 15 to 30 seconds while gently applying pressure to deepen the stretch. The methodology for hold-relax proprioceptive neuromuscular facilitation stretching involved the passive movement of the dominant leg into a position that caused mild discomfort for the individuals, and then maintaining that posture for a duration of 30 seconds. After that, the subjects were instructed to contract the extended muscle isometrically for 10 seconds. After 30 seconds of muscle relaxation in the same position, the muscles were stretched to a new, mildly uncomfortable point. Then the leg was released. Stretch 3-5 times a day, making sure to hold each stretch for a sufficient amount of time. The patient can maintain flexibility and lessen stiffness by engaging in mild activity or simple range-of-motion exercises after stretching.

Whereas experimental group(n=15) will be receiving Depending on patient allocation, the patient began the treatment program the following day after completing the baseline evaluation. The participant is in a side-lying posture to address the superior limb; the limb was fully supported on the bed, with the knee and hips slightly bent to move forward and achieve optimal relaxation for efficient release. The participant is gently assisted in relaxing more fully by the adduction achieved from positioning and gravity, which puts the muscle in an extended position for optimal passive release. The Ischemic compression technique involves placing the trigger point halfway between the index and middle fingers to prevent it from sliding to one side during the release, and then applying appropriate pressure with the therapist's thumb pad to the participant's skin to make "contact" with the fascia. Throughout the entire process, the therapist's thumb stayed in touch with the skin covering the Myofascial trigger point to guarantee precise pressure repositioning for MFR. For every identified trigger point, participants were given a trigger point pressure release technique. This involved applying deep pressure to the trigger points with the thumb for 30 to 60 seconds at a time. Pressure was removed when the trigger point became less tense, when it stopped being sore, or when one minute had passed, whichever came first. The therapist applied pressure on each trigger point for a minimum of five minutes until the thumb of the patient felt the release.

Subjects in both groups were received Foam rolling as common along with that Experimental group were received MFR and Control group were received PNF Stretching.

2.1 Foam Rolling

The iliotibial band is the specific target of the foam rolling exercises that participants are instructed and guided on how to complete. Sessions typically involve rolling along the length of the IT band, applying moderate pressure to release tension and improve tissue mobility. The technique involves the participant standing on one side, supporting themselves with one or both hands, stacking both legs over the plinth, and positioning the foam roller just below the hip. As the weight is shifted from side to side, the roller will move down the thigh toward the knee and back the other way. It is requested that the participant stay inside the knee and hip joints. In addition, you might roll by extending the upper leg forward. Rolling is done for 60 seconds and then three times per day [5].

3 Statistical Analysis and Result

The data collected was tallied and examined. For every parameter, Calculations were used to determine the mean and standard deviation (SD). Significant differences between the pre- and post-test variables were examined using the paired t-test. To find any significant differences between the two groups, an unpaired t-test was employed. The P-value was considered statistically significant was less than 0.001. Fig 1 show the Posttest values of control and experimental group.

Table 1. comparing clinical outcomes post-test values between groups.

Outcome measures	Control group		Experimental group		P Value
	Mean	SD	Mean	SD	
ROM using KEMTAI	116.00	6.04	130.46	5.32	<0.0001
OBERS TEST	1.73	4.2	5.47	5.39	<0.0001

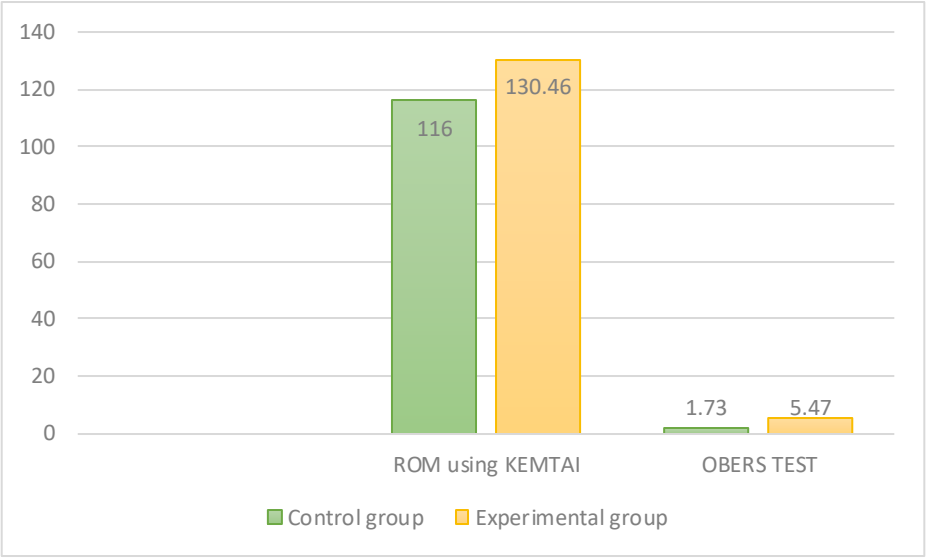

Fig. 1. Post test values of control and experimental group.

The statistical examination of the quantitative data showed that the values in both groups had changed in a way that was statistically significant.

Table 1 show the post-test mean values for the ROM and ober test in the Experimental group, which are 5.47 and 130.46, respectively, for the Control group. comparing the

groups' mean values before and after the test. Because the P-value is less than 0.0001, the results are regarded as highly statistically significant. The flexibility and range of the patients with KOA are somewhat improved in both groups.

Thus, shows that the MFR with foam rolling have good functional performance in reducing pain and improve the flexibility and mobility than the PNF stretching with foam rolling.

According to the table 1, resulted that the Experimental group is more effective than the Control group on the mobility and flexibility among the subjects with OA knee. Based on the statistical data analysis.

4 Discussion

The goal of this study was to evaluate the effect of MFR with foam rolling Versus PNF stretching with foam rolling in Iliotibial Band for osteoarthritis of the knee subjects to improve ROM and reduce pain in osteoarthritis knee subjects.

Rahman H et al; 2023 A study shows strong evidence of the efficacy of myofascial release technique either alone or in combination with stretching on knee osteoarthritis patients' pain and functional impairment. The combined effects of stretching and MFR point to a possible therapeutic benefit for patients with knee OA and ITB tightness. Stretching exercises can be a useful tactic for enhancing functional outcomes and lowering symptoms when included in the treatment plan. This comprehensive method treats knee OA's prevalent long-term flexibility and mobility problems in addition to the acute alleviation of tightness. Our results are consistent with earlier studies showing MFR's effectiveness in treating myofascial pain disorders and increasing range of motion. However, few studies have specifically investigated the potential for synergistic effect of MFR and stretching in knee OA [1]. This study enhances our knowledge in highlighting the importance of a multimodal treatment regimen whose tailor-made components should be individualised in patients with OA-induced ITB tightness.

Weng MC et al; 2009The aim of this study was to evaluate the effect of different stretching methods on knee osteoarthritis (OA) patient's response to isokinetic exercise. These results illuminate not only the efficacy of different modalities of stretching but also the possible additive effect of stretching on isokinetic exercise in this patient population. Because various exercise stretching methods affect the results of isokinetic activity reasonably, it is essential to tailor stretching therapy to the potential of individuals with knee OA. Static stretches are useful for maintaining flexibility, dynamic and PNF stretches may be more advantageous to strength and overall functional performance [2]. Isokinetic exercises are commonly used to improve muscle strength and joint stability in individuals with knee injuries; however, the effectiveness of these exercises is debatable.

Gomaa EF et al; 2016 The objective of this study was to evaluate the effect of myofascial release (MFR) of the iliotibial band (ITB) in patients with osteoarthritis (OA) of the knee on functional impairment. As per our studies, ITB MFR can significantly reduce functional impairment among this patient population, thereby improving daily functioning and quality of life. Our results are in accordance with previous studies reporting the positive effects of MFR on musculoskeletal disorders.

Previous studies have shown that MFR can help reduce pain and improve function in many disorders, such as lower back pain and shoulder dysfunction. However, the specific focus on ITB MFR as a potential treatment for knee OA offers valuable insights into its potential role in managing knee-related disabilities [3]. The addition of MFR into rehabilitation pathways for patients with

Opara M et al; PDF 2023 This narrative review examined the efficacy and underlying mechanisms of myofascial release and stretching therapies for the iliotibial band (ITB) complex in the management of iliotibial band syndrome (ITBS). The results show that both interventions are effective in reducing ITBS symptoms, but their mechanisms and effects may vary considerably. MFR, as well as stretching, are beneficial, however, the degree to which they are effective differs from person to person, and is contingent on the specifics of one's ITBS [4]. MFr is for deeper fascial restrictions and may provide more immediate symptom relief, whereas stretching is more for flexibility and may help to prevent stiffness in the ITB. Integrating these methods may provide a more comprehensive treatment approach to managing ITBS by addressing myofasical tension in addition to being flexible. The findings suggest that treatment approaches for ITBS that incorporate stretching and MFR together may be more effective than those that use either technique alone.

Vaidya SM et al; 2022 A RFCT to assess the effect of foam rolling of quadriceps, hamstrings and iliotibial (IT) band in patients with patellofemoral pain syndrome (PFPS) were Randomized controlled trials. Primary outcomes were knee physical function and passive range of motion (ROM). To the best of our knowledge, this is the first study that looks at the impact of foam rolling of these muscle groups in PFPS patients to enhance the range of motion and, overall, functional outcomes. The findings of the current study have significant therapeutic implications for PFPS. Foam rolling is a simple, low-cost intervention that lends itself well to incorporation into rehabilitation regimens [5]. Foam rolling may be advised as an adjunct treatment to other interventions for PFPS, such as

MAIA TF et al; 2022Objective: To know about the comparison of efficacy between PNF and conventional resistance exercise therapy for patients with knee OA. The design of this randomized clinical trial will aim to evaluate whether these patients may benefit from 2 therapeutic modalities, and to what degree can they improve their functional outcome, pain and quality of life. If results of the study confirmed PNF superiority over the current resistance exercise therapy, training techniques could have been a helpful component of knee OA rehabilitation programs. PNF integration could offer a more holistic treatment option for knee OA treatments that address proprioception and muscle strength [6].

Moyano FR et al; 2013 Abstract The purpose of this randomized controlled study was to determine the effectiveness of different physiotherapy types like stretching and exercise in pain and physical function among individuals with patellofemoral pain syndrome (PFPS). We assess the magnitude of the benefit of different therapeutic interventions for this"UESK" the most prevalent knee disorder [7]. We find that you improve more from both stretching and strengthening than just from one or the other. PFPS is thought to have both muscular and flexibility components so treatment should be systemic, emphasizing the need for muscular strengthening as well as flexibility as part of an effective rehabilitation program.

Farzana Sharmin et al; 2019 The purpose of this study was to determine the therapeutic efficacy of myofascial release (MFR) for the treatment of osteoarthritis (OA) in the knee. Data Analysis: In general, our findings demonstrate the efficacy of MFR in reducing the symptoms and improving the functional outcomes among knee OA patients. While MFR seems promising, it is worth assessing its efficacy compared with other standard-of-care treatments for knee OA, including manual therapies, medication, and exercise therapy [3, 4]. Based on our findings, MFR can be a beneficial adjunct to other therapy modalities, particularly when used together with exercises aimed at strengthening the knee muscles and improving overall knee function. The clinical utility of MFR, both in terms of therapeutic outcomes in knee OA, underscores its clinical relevance. MFR can be the basis from which multidisciplinary treatment plans can be developed to address miosfaschial restrictions in conjunction with a variety of other IO therapy modalities.

Stevan et al;2024 Aim of this study was to investigate practical applicability and feasibility of implementing the motion tracking hardware into routine clinical practice, as well as to evaluate accuracy and reliability of Kemtai software (motion tracking technology) versus standard goniometry. Motion tracking technologies such as Kemtai have the potential to improve joint range of motion measurement accuracy and efficiency, which could lead to better patient assessment and treatment. These technologies might make tele-rehabilitation and remote monitoring easier, enabling more adaptable and ongoing patient care. For the integration to be successful, clinicians would need to have the proper training on how to use motion tracking devices and analyze the data. Costs and technological obstacles need to be considered, particularly for smaller clinics or practices with tighter finances.

Hoda NAD, Khadra M, Naous A et al; 2023 The authors examined the efficacy of adjunctive DFMR to conventional exercise therapy on pain and function in patients with knee OA. These results indicate that using DFMR on top of an exercising routine can lead to further advantages if managing knee OA symptoms are considered, functional results and increasing the overall effectiveness of treatment. Use of DFMR in conjunction with exercise treatment led to greater improvements in pain and function compared to exercise therapy alone, the study concluded. This may lend credence to the idea that DFMR and exercise therapy, used together, can have synergistic effects to address the mechanical and myofascial components of osteoarthritis in the knee.

Multitype. There is a need to consider limitations of many types. The findings of the study may not be as broadly applicable, because of the small sample size. Furthermore, the study was short and did not evaluate any long-term effects. The limited sample size may mean these findings are not generalizable. Moreover, the study was brief and did not assess any long-term impacts. This is a small sample, and so these findings may not reflect the world at large. Although this study would promote the application of H-WL for knee OA treatment, more comprehensively understanding its role in knee OA treatment through further investigation of its efficacy in different populations and its potential effects on combination with other modalities like physical exercises and other physiotherapy modalities is needed to better understand it. The recovery period was significantly less than that of age-matched controls.

5 Conclusion

The results showed that foam rolling was more effective than PNF stretching for myofascial release of the iliotibial band. In unilateral osteoarthritis knee, myofascial release was more effective than PNF stretching at easing iliotibial band tightness and pain

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