

# Effectiveness of Muscle Energy Techniques in Knee Osteoarthritis Rehabilitation: A Systematic Review

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## ABSTRACT

Knee osteoarthritis (OA) poses significant challenges to mobility, pain management, and overall quality of life, particularly in an ageing population. This study aimed to evaluate the effectiveness of MET in treating knee OA by examining the evidence on its effects on joint mobility, pain management, and functional improvement. The following PICO criteria were used to select the studies. Clinical trials that focus on patients over the age of 18, incorporate moderate exercise training, and report outcomes such as knee pain, joint function, or quality of life are included. These trials must be published between 2020 and 2024. Studies with non-specific results, narrative reviews, and meta-analyses are excluded from the analysis. A literature search was conducted using the five databases. The research keywords were determined based on the expertise of the participating authors. After a comprehensive search of multiple databases, 12,105 items were identified, and 12 articles were included in the final review. The results of this systematic review indicate that MET is efficacious in improving function, muscle strength, and flexibility in patients with knee osteoarthritis, thereby enhancing their overall quality of life. Optimizing outcomes for patients with knee osteoarthritis requires the integration of kinesio taping, Proprioceptive Neuromuscular Facilitation (PNF) methods, and structured rehabilitation programs. The use of specific rehabilitation techniques that address both the physical and psychological components of recovery will be crucial for the effective management of knee osteoarthritis as its prevalence increases, particularly among the elderly population.

**KEYWORDS:** Joint Mobility, Knee Osteoarthritis, Muscle Energy Technique, Pain Reduction, Rehabilitation

## INTRODUCTION

Knee osteoarthritis (OA) is a prevalent degenerative joint disease affecting approximately 25% of adults, with its incidence increasing significantly among older populations. It is a major contributor to pain and functional disability in individuals aged over 45 years, with estimates suggesting that between 19.2% to 27.8% of adults in this age group report knee pain attributed to OA, and around 37% of individuals aged 60 years and older experience knee complaints<sup>1,2</sup>. OA is defined by the progressive degeneration of articular cartilage, characterized by changes in the cartilage itself, the subchondral bone, and surrounding soft tissues. Symptoms typically include pain, stiffness, and impaired mobility, which significantly diminish the quality of life for those affected<sup>3,4</sup>.

Proper treatment for knee osteoarthritis (OA) is integral to enhancing patient well-being and functionality. Effective management strategies, such as tailored exercise therapy, are fundamental in

reducing pain and improving mobility. Research indicates that exercise can have pain-relieving effects comparable to those of analgesics, albeit with fewer side effects<sup>5</sup>. Furthermore, conservative treatments, including weight management and physical therapy, are strongly recommended within clinical guidelines to delay disease progression and mitigate associated complications<sup>6</sup>.

To prevent further deterioration, traditional treatments for knee OA focus on symptom management and functional improvement. Knee osteoarthritis (OA) management remains a clinical priority. Pharmacological treatments, such as NSAIDs and non-pharmacological treatments, such as physical therapy, weight control, and lifestyle changes, are both included in conservative treatment plans. Although these treatments may provide short-term relief, they often fail to address the complex nature of knee OA, in which joint biomechanics, muscle function, physical degeneration and pain perception are all linked<sup>7</sup>. The limits of traditional procedures have led to the emergence of manual treatment techniques, particularly the Muscle Energy Technique (MET), as supplementary strategies for maximizing joint health<sup>8</sup>.

The patient actively participates in a specialized manual therapy approach called the Muscle Energy Technique (MET)<sup>9</sup>. By applying regulated resistance to the patient's muscular contractions, MET helps enhance joint range of motion, develop muscle

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flexibility, and realign joint structures. In contrast to passive methods, MET actively engages the patient, encouraging improved neuromuscular control and muscle balance, which are crucial for achieving long-term functional gains and maintaining joint stability. According to these principles, MET may be beneficial for individuals with knee OA, providing a therapeutic strategy that improves knee joint stability and muscular support in addition to addressing pain<sup>10</sup>. The MET is a specialized manual therapy in which the patient actively participates through resisted muscular contractions aimed at enhancing overall joint function and promoting neuromuscular control<sup>11</sup>. Recent studies suggest that MET can lead to substantial improvements in pain levels, range of motion, and functional outcomes for individuals with Knee OA<sup>4,12</sup>. For instance, participants undergoing MET have demonstrated enhanced muscle flexibility, improvements in stability, notable reductions in localized swelling, and increased ranges of motion, underscoring its potential as an effective adjunct to conventional rehabilitation methods<sup>4</sup>. Systematic reviews also emphasize the need for standardized protocols for MET applications to establish its efficacy across diverse patient populations<sup>12,13</sup>. While some studies have shown favorable outcomes with MET, further research is essential to validate its long-term benefits and to develop comprehensive treatment guidelines. Given the complex multifactorial nature of knee OA, clinicians must consider incorporating MET into holistic treatment strategies, complementing traditional therapies with tailored physical training regimens focused on muscle strengthening and functional improvement<sup>3,4</sup>. This integrative approach aims to alleviate immediate symptoms while addressing the broader implications of knee OA on joint health and overall mobility. By analyzing its effects on important clinical outcomes, such as pain management, joint mobility, and functional ability, this systematic review aimed to compile the body of research on MET's role in knee OA rehabilitation. This review aimed to provide a better understanding of MET's therapeutic potential by combining data from recent trials. This will help doctors create evidence-based, customized treatment programs for patients with knee OA and guide future research. This systematic review presents a novel synthesis of the varied research on Muscle Energy Techniques (MET) in the context of knee osteoarthritis (OA) rehabilitation, which is a relatively underexplored modality compared to more traditional treatments. By rigorously analyzing the effects of MET on key clinical outcomes, specifically pain management, joint mobility, and functional ability, this review aims to elucidate the therapeutic potential of MET and establish a comprehensive understanding of its efficacy. The integration of recent clinical trials provides a robust evidence base to support the customization of treatment strategies for patients with

knee OA.

METHODOLOGY

Eligibility Criteria

The review considered clinical trials that addressed the use of the muscular energy technique (MET) to treat non-specific neck pain (NNP), published between 2020 and 2024, and available in English. The studies were selected using the following PICO criteria. (Table I)

Table I: PICOS Framework

Inclusion Criteria	Exclusion Criteria
Clinical trials	Meta-analysis, narrative review, and systematic review
English language	Other languages
Published between 2020 to 2024	Published before 2020
Patients with Knee Osteoarthritis, Pain, and Functional Activity	Populations with other diseases
Full text available	Full text not available
Aged >18 years old	A rehabilitation program that excludes MET
Male and female	Aged < 45 years and above
Program for rehabilitation that includes MET	All studies not including the mentioned outcomes
At least one of the following outcomes is present in every study: knee pain, joint function, and quality of life.	

Sources and Searches for Information

A literature search was conducted using the following five databases: Web of Science, PubMed, Google Scholar, ScienceDirect, and Scopus. The research keywords were determined based on the expertise of the participating authors. Keywords such as "Muscle energy technique AND/OR knee pain AND/OR knee osteoarthritis, MET AND/OR knee OA AND/OR knee osteoarthritis" were used.

Study Selection

All records discovered during the search were imported into Microsoft Excel. Two reviewers employed the same methodology to search the databases, ensuring sufficient cross-checking of the results. The authors evaluated the papers discovered through searches using preset inclusion and exclusion criteria.

Data Collection

The study design, intervention intensity, authors, study date, intervention type, essential components, diagnostic population, and original authors' evaluations of the effectiveness of various research outcomes were among the data collected from the included studies. When multiple studies were available, the reviewers highlighted instances where the most recent data outperformed earlier findings.

Quality Assessment

The danger of bias was assessed separately by the two writers. The Cochrane Collaboration's domain-

Table II: The Summary of Results

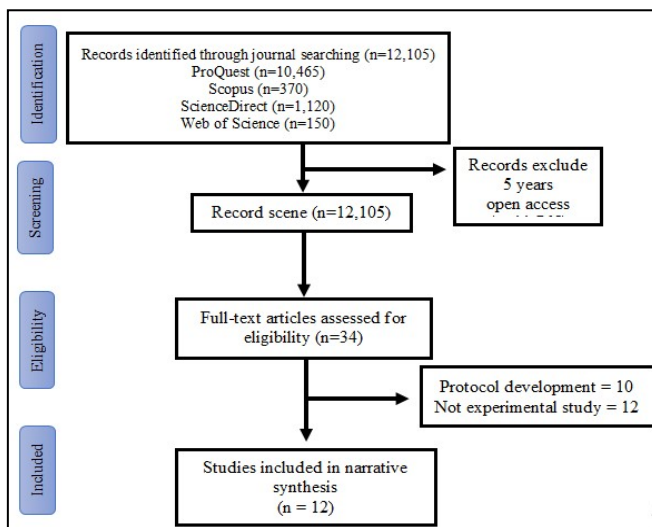
Ref	Type of Intervention	Sample	Intervention	Control	Conclusion
14	Methods of Proprioceptive Neuromuscular Facilitation (PNF)	50 patients with knee osteoarthritis	For eight weeks, 25 patients received PNF treatments twice a week, each lasting 30 to 45 minutes.	Twenty-five patients who merely received standard treatment without any extra help	When compared to the control group, patients with osteoarthritis in their knee showed a substantial improvement in muscle strength through the use of proprioceptive neuromuscular facilitation techniques. It is advised that medical practitioners include PNF approaches in treatment plans for this patient population if these results are supported by more research.
15	The study examined the efficacy of two therapy approaches in individuals with osteoarthritis of the knee: Muscle Energy Technique (MET) and Proprioceptive Neuromuscular Facilitation (PNF) stretching.	A random sample technique was used to choose the 36 participants in the study who had osteoarthritis of the knee.	PNF stretching is being administered to patients in addition to a baseline routine.	Individuals undergoing MET in addition to a baseline regimen	According to the study's main finding, patients in Group A (who received PNF stretching) showed noticeably higher improvements in their hamstring flexibility (Active Knee Extension Test scores: Group A: $10.63 \pm 4.89$ vs. Group B: $4.37 \pm 2.01$ ), functional mobility (WOMAC scores: Group A: $27.21 \pm 12.31$ vs. Group B: $14.11 \pm 7.88$ ), and pain levels (NPRS scores: Group A: $7.66 \pm 1.02$ vs. Group B: $3.44 \pm 0.92$ ). Therefore, it was found that PNF stretching was superior to MET in improving patients' functional mobility, flexibility, and pain levels in cases of knee osteoarthritis.
16	Kinesio taping in conjunction with traditional therapy (Group A) and the muscle energy technique in conjunction with traditional therapy (Group B) were the two therapeutic strategies for knee osteoarthritis that were examined in this study.	For the study, 30 participants with a diagnosis of knee osteoarthritis were recruited. They were randomly split into two groups, each with 15 subjects.	Participated in three sessions a week for three weeks, receiving Kinesio taping in addition to traditional therapy.	Receive five sessions a week for three weeks, combining the muscle energy technique with traditional therapy.	According to the study's findings, Group A (Kinesio taping combined with traditional therapy) outperformed Group B in terms of hamstring flexibility ( $t=5.983$ , $p<0.05$ ), extension range of motion ( $t=5.983$ , $p<0.05$ ), and knee pain ( $t=3.862$ , $p<0.05$ ). Nevertheless, there was no discernible difference between the two groups' total improvements. In individuals with knee osteoarthritis, the intervention in Group A was therefore found to be more effective at reducing pain and improving hamstring flexibility and knee extension range of motion.
17	Rehabilitation through regular exercise was the strategy used in this study.	There were 166 patients with knee osteoarthritis in the study's entire sample.	Patients receiving physical exercise therapy comprised the intervention group.	The control group was treated conventionally with COX-2 inhibitors and non-steroidal anti-inflammatory medications (NSAIDs), which included: - Naproxen ( $n = 28$ ) Diclofenac, with a total of 27 Celecoxib (sixteen)	The study's findings demonstrated that, over a 12-week follow-up period, physical exercise rehabilitation significantly outperformed NSAID and COX-2 inhibitor treatment in terms of symptom relief and quality of life for patients with knee osteoarthritis.
18	An aquatic training program was contrasted with an individualized comprehensive rehabilitation (ICR) program as the intervention type assessed in this study.	Forty women with a diagnosis of persistent knee osteoarthritis participated in the trial.	The individualized comprehensive rehabilitation (ICR) program was administered to the intervention group.	Participants enrolled in an aquatic training program comprised the control group.	Compared with the aquatic training program at the 3-month follow-up, the study's results showed that the 8-week, customized, comprehensive rehabilitation program significantly improved functioning, physical performance, and perceived health status. Significant differences favouring the ICR group were observed in physical performance (Timed Up and Go, $P = 0.031$ ; Stair Climbing Test, $P = 0.046$ ) and functionality (stiffness, $P = 0.049$ ; function, $P = 0.005$ ; and overall subscores, $P = 0.048$ ).
19	The study used non-invasive cardiac output monitoring and the 6-minute walk test (6MWT) to design a home rehabilitation exercise program for patients with osteoarthritis in their knees after total knee arthroplasty (TKA).	The study comprised 66 participants diagnosed with knee osteoarthritis and scheduled for total knee arthroplasty.	A multidisciplinary team comprising a cardiologist, an orthopaedic physician, and a clinical rehabilitation physician oversaw the extensive rehabilitation instruction provided to patients in the intervention group. Throughout their recovery, they sought advice and assistance via the WeChat app.	Patients in the control group were given rehabilitation training manuals upon discharge and were expected to finish their therapy on their own, unsupervised.	The results showed that post-TKA patients' lower limb function and exercise capacity were significantly improved by an interdisciplinary post-operative rehabilitation exercise program. Furthermore, it has a positive impact on non-invasive haemodynamic markers of heart function, indicating the intervention's efficacy compared with conventional rehabilitation techniques.
20	Patients with symptomatic knee osteoarthritis participated in a 6-week rehabilitation program	Thirty patients were assigned to each of the eccentric and concentric	Exercises that emphasize eccentric muscle activities—which highlight the extension of	The concentric group engaged in workouts that emphasized shortening of the muscle during	According to the study's findings, patients with symptomatic knee osteoarthritis benefit greatly from both eccentric and concentric physical activities in terms of enhanced function and decreased discomfort. The



Ref	Type of Intervention	Sample	Intervention	Control	Conclusion
	that included eccentric or concentric muscle strengthening exercises.	intervention groups, for a total of 60 patients in the trial.	the muscle under tension—are performed by the eccentric group.	contraction and focused on concentric muscle activity.	eccentric group, however, had certain advantages over the concentric group, including notable improvements in muscular performance (quadriceps power [P <sub>MAX</sub> ] and contraction strength [M <sub>MAX</sub> ]) and vastus medialis hypertrophy. There were no discernible differences between the two groups in terms of improvements in WOMAC scores or total pain reduction.
21	A comparison between conventional physical therapy (CPT) and proprioceptive neuromuscular facilitation (PNF).	This summary does not yet specify the total number of participants; they will be randomly assigned (1:1) to either the PNF group or the CPT group.	Twelve weeks of PNF training sessions will be provided to the PNF group.	For twelve weeks, the CPT group will get standard physiotherapy treatments.	The creation of a physiotherapy regimen based on the PNF model aims to provide a therapeutic strategy grounded in learning and motor control principles, thereby reducing pain and enhancing physical function and quality of life for people with knee osteoarthritis (KOA).
22	Combining laser therapy and stretching exercises, as well as comparing the results with a control group that received placebo therapy and stretching exercises, only laser therapy, simply stretching exercises, and a control group that did not receive any intervention, were the interventions used in this study.	430 knees with osteoarthritis were treated out of the 215 participants with the condition that were enrolled. There were forty-three patients in each intervention group.	1. Laser + Stretch (n = 43): Active laser therapy and stretching exercises were administered to patients. 2. Placebo + Stretch (n = 43): Patients underwent stretching exercises and placebo laser therapy. 3. Stretch (n = 43): Only stretches were given to patients. 4. Laser (n = 43): Active laser therapy was the only treatment given to patients. 5. Control (n = 43): No intervention was given to the patients.	In this study, the control group consisted of two groups: one that received placebo therapy (Placebo + Stretch) and the other that received no intervention (Control).	In patients with knee osteoarthritis, laser therapy in conjunction with stretching exercises significantly improved range of motion, stiffness, muscle shortening, and discomfort during everyday activities and during rest. This study demonstrates that this intervention effectively enhances function and reduces knee osteoarthritis symptoms.
23	Comparison of gap balancing (GB) and measured resection (MR) methods in patients with osteoarthritis in the knee following primary total knee arthroplasty (TKA).	96 patients with knee osteoarthritis were split into two groups: 48 to the GB group and 48 to the MR group.	The group that accepts gap-balancing approaches is called GB.	The measured resection approach was administered to the MR (measured resection) group.	In terms of lowering the osteoarthritis index, improving knee and squat function, extending knee range of motion, decreasing operative time, and lowering pain, the GB technique outperformed the MR technique by a substantial margin. Furthermore, compared to the MR group (18.75%), the GB approach had a decreased postoperative complication rate (4.17%), indicating that it merits widespread use and practical application.
24	Total hip/knee arthroplasty (THA/TKA) is an elective procedure for individuals with advanced osteoarthritis (OA).	70 participants (26 males and 44 females).	MuS+ patients (n=24) who are susceptible to muscular inflammation.	Patients lacking a sensitivity to muscle inflammation are known as MuS- (n=46).	In addition to higher proinflammatory and catabolic gene expression in the operative limb's skeletal muscle, patients with MuS+ status also have poorer skeletal muscle integrity, as seen by increased fibrosis. This implies that MuS+ status may have a substantial impact on postoperative outcomes, underscoring the importance of perioperative MuS assessment to customize postoperative therapy properly.
25	Three rehabilitation techniques after total knee arthroplasty (TKA) and total hip arthroplasty (THA) were examined in the trial: 1. Telerehabilitation at home 2. Rehabilitation at home 3. The control group did not undergo physical rehabilitation.	A total of 168 patients who have had THA or TKA will be included in the trial.	Group 1: Telerehabilitation at home. Group 2: Rehabilitation at home	Patients who would not get any therapeutic rehabilitation exercises after being discharged made up the control group.	The purpose of the study is to assess the efficacy of home-based rehabilitation and home-based tele-rehabilitation against no physical rehabilitation. The main outcome measure will be the knee injury and osteoarthritis outcome score (KOOS) for knee patients and the hip disability and osteoarthritis outcome score (HOOS) for hip patients. At the initial follow-up after the 6-week intervention, the primary focus will be on the function of daily living. The findings will provide essential insights into how post-discharge rehabilitation plans for patients following THA and TKA should be structured.

based evaluation methodology was used to evaluate the risk of bias in the controlled studies. Selection bias (hidden allocation and randomized sequence generation), performance bias (blinding of employee and participant), detection bias (blinding outcome assessment), attrition bias (incomplete outcome data, for instance, due to dropouts), reporting bias (selective reporting), and other sources of bias were the main domains evaluated in that order. The total risk score for systematic bias and the scores for each bias domain were classified as low, high, or unknown. Methodological quality was further assessed using the Physiotherapy Evidence Database (PEDro) scale.

**Figure I: PRISMA 2020 flow diagram for the process of study selection**



## RESULTS

As shown in **Table II**, the use of MET for knee OA focuses on outcomes such as decreased pain, increased joint mobility, and improved quality of life, all of which add to the body of research supporting MET as an effective knee OA rehabilitation technique.

## DISCUSSION

Proprioceptive neuromuscular facilitation (PNF) approaches have become a crucial therapeutic intervention for patients with knee osteoarthritis (OA). Joint pain, stiffness, and diminished muscle strength are the hallmark symptoms of this illness, and together, they cause functional limitations in affected patients. PNF approaches should be incorporated into routine therapy regimens because recent studies have shown that they can significantly enhance muscular strength, flexibility, and overall functional performance in patients with knee OA<sup>14</sup>. PNF techniques are applied through targeted strengthening and stretching activities that activate the proprioceptors of the muscles and joints. This stimulation improves neuromuscular control and coordination, which is especially helpful for patients with knee OA, as the degenerative nature of the

disease often results in proprioceptive impairments. For example, Sari's study shows that PNF stretching exercises provide a variety of benefits for individuals with knee OA, since they not only reduce pain but also enhance postural balance and dynamic stability<sup>26</sup>. The validity of the findings was reinforced by the study's methodology, which included a randomized selection of 36 participants. Because they reduce bias and enable a more precise evaluation of therapy efficacy, randomized controlled trials are regarded as the gold standard in clinical research<sup>15</sup>. Additionally, using validated assessment instruments such as the NPRS and WOMAC, ensures that the outcomes measured are accurate and relevant to the patient population being studied. These results are consistent with previous research highlighting the importance of customized treatment approaches for knee osteoarthritis. For example, a systematic review found that a variety of physiotherapy methods such as strengthening and stretching exercises are essential for OA patients to manage their symptoms and improve their function<sup>27</sup>.

An essential contribution to our understanding of non-pharmacological interventions for knee osteoarthritis (KOA) is a comparison of the effectiveness of Kinesio taping versus the Muscle Energy Technique (MET) in conjunction with conventional therapy. The results of the study showed that, compared with Group B, which received MET in addition to conventional therapy, Group A, which received Kinesio taping in addition to conventional therapy, demonstrated statistically significant improvements in knee pain, extension range of motion, and hamstring flexibility. In particular, the findings indicated that Group A saw a substantial decrease in pain ( $t=3.862$ ,  $p<0.05$ ) and improvements in hamstring flexibility ( $t=5.983$ ,  $p<0.05$ ) and extension range of motion ( $t=5.983$ ,  $p<0.05$ ), highlighting the possibility of Kinesio taping as a successful supplemental treatment for KOA<sup>16</sup>.

Numerous studies have examined the treatment of knee osteoarthritis (KOA), with particular emphasis on the effectiveness of rehabilitation through regular exercise compared with traditional pharmaceutical therapies. Compared with treatment with non-steroidal anti-inflammatory drugs (NSAIDs) and COX-2 inhibitors, a structured physical exercise rehabilitation program dramatically improved symptoms and quality of life over a 12-week follow-up period, according to a recent study involving 166 patients with KOA<sup>17</sup>. It is crucial to remember, though, that in some situations, oral NSAIDs may offer greater rapid advantages than exercise<sup>28</sup>. This result is consistent with the growing body of research supporting exercise as the primary treatment for KOA, emphasizing its ability to improve physical function and alleviate pain more effectively than pharmaceutical alternatives<sup>29</sup>.

The literature has extensively demonstrated the importance of customized rehabilitation regimens for knee osteoarthritis. For example, a randomized controlled trial by López et al.<sup>18</sup> examined the

efficacy of a customized, comprehensive rehabilitation program for women with knee osteoarthritis. Although a Cochrane review found no significant differences in pain, symptoms, functionality, or quality of life between self-management programs and other exercise-based physiotherapy interventions in patients with knee osteoarthritis, its findings imply that such programs can result in notable improvements in health-related quality of life and functional capabilities. Furthermore, it is impossible to overestimate the importance of exercise in the treatment. According to research, people with osteoarthritis in their knees often become sedentary due to the discomfort, which makes their condition worse<sup>19</sup>. his problem is directly addressed by the ICR program's emphasis on improving physical performance and functionality, which encourages active participation in rehabilitation exercises. The results of Kangeswari et al.<sup>30</sup>, found that strengthening exercises significantly reduce pain and enhance functional performance in individuals with knee osteoarthritis.

Evidence indicating that eccentric contractions can successfully lower joint loading and preserve articular cartilage supports the role of eccentric strengthening in the setting of knee OA<sup>20</sup>. This is particularly relevant, given that biomechanical factors significantly influence the onset and progression of knee OA. By reinforcing lower extremity muscle strength, especially the quadriceps, eccentric exercises can mitigate the mechanical stress on the knee joint, potentially delaying the progression of the disease<sup>31</sup>. In addition to the direct benefits of muscle strengthening, the broader context of rehabilitation includes flexibility and balance training. For example, yoga has been shown to improve flexibility and reduce pain in patients with knee OA, which complements the strength-training aspect of rehabilitation<sup>32</sup>. Trojani et al.'s (2022)<sup>33</sup> results are consistent with earlier studies that highlight the value of customized exercise regimens for patients with knee osteoarthritis. For example, a study demonstrated that a therapeutic exercise program combining elements of muscle strengthening and flexibility significantly improved physical function and reduced pain in patients with knee osteoarthritis. This supports the idea that patients may benefit considerably from a multimodal rehabilitation program that incorporates both eccentric and concentric strengthening exercises.

Recent orthopaedic research has focused considerable attention on the comparison of gap balancing (GB) and measured resection (MR) procedures in total knee arthroplasty (TKA) for patients with osteoarthritis in their knees. The clinical results of these two surgical approaches were the primary focus of this investigation, specifically regarding operative time, postoperative discomfort, range of motion, functional performance, and complication rates. According to the results, the GB

approach may yield better outcomes than the MR technique, supporting broader use in clinical practice<sup>24</sup>. The goal of the GB approach is to achieve optimal soft-tissue balance during total knee arthroplasty (TKA), which is crucial for achieving positive postoperative outcomes. GB aims to improve the overall stability and functionality of the knee joint following surgery by establishing symmetrical and equal gaps in both flexion and extension. Compared to the MR technique, which frequently requires more extensive soft-tissue release after bone cuts, this technique has been associated with shorter operating times because it enables more effective knee joint alignment and balancing. According to research, patients who undergo GB TKA spend less time in the operating room. This is because the treatment involves balancing the knee more efficiently<sup>34,35</sup>.

Given the rising incidence of total hip arthroplasty (THA) and total knee arthroplasty (TKA) in the elderly population, research on the efficacy of various rehabilitation techniques following these surgeries is crucial. The experiment compared three different rehabilitation modalities: home-based tele-rehabilitation, home-based rehabilitation, and a control group that did not receive any recommended therapeutic rehabilitation activities after discharge. With a specific focus on the hip disability and osteoarthritis outcome score (HOOS) for patients with hip disease and the knee injury and osteoarthritis outcome score (KOOS) for patients with knee disease, this study attempts to clarify the effect of these rehabilitation techniques on patient outcomes. At the initial follow-up after a six-week intervention period, the primary outcome measure will evaluate the function of daily life<sup>25</sup>.

Given the results of a pragmatic, randomized controlled study by Mark-Christensen et al.<sup>25</sup> that compared physical rehabilitation with no rehabilitation following THA and TKA, the trial design, which included a control group that received no physical rehabilitation, is particularly pertinent. According to their findings, systematic rehabilitation programs may improve postoperative results. The present study effectively evaluated the relative effectiveness of home-based therapy and home-based tele-rehabilitation compared with a baseline of no rehabilitation by incorporating a control group.

## CONCLUSION

Incorporating PNF approaches into rehabilitation regimens for knee osteoarthritis offers a viable way to improve patient outcomes. The importance of non-pharmacological therapies in the management of knee OA is supported by evidence for the effectiveness of PNF, as well as findings from studies on Kinesio taping, structured exercise programs, and customized rehabilitation strategies. Additionally, the investigation of various surgical methods and rehabilitation strategies following TKA and THA underscores the importance of continuous efforts to improve patient



recovery outcomes. Kinesio taping, Proprioceptive Neuromuscular Facilitation (PNF) techniques, and organized rehabilitation programs must be combined to achieve optimal results for patients with knee osteoarthritis. This demonstrates the effectiveness of these therapies in enhancing muscle strength, flexibility, and overall functional performance, all of which contribute to the improved quality of life for individuals affected by these conditions. As the prevalence of knee osteoarthritis continues to rise, particularly among older populations, it is crucial to employ specialized rehabilitation strategies that address the psychological and physical aspects of recovery. To provide patients with knee osteoarthritis the best possible care, doctors must stay up to date on the latest evidence-based techniques as the body of research continues to expand.

**Conflict of Interest:** The author states no conflict of interest.

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**Data Sharing Statement:** The corresponding author can provide the data proving the findings of this study on request. Privacy or ethical restrictions bound us from sharing the data publicly.

#### AUTHOR CONTRIBUTION

Sulfandi S: Gathering, evaluating and interpreting the data for the project, creating and editing the draft, and obtaining final approval

Azizan NA: Analyzing the data for the project, creating the work, and manuscript editing

Zahari Z: Analyzing the data for the project, creating the work, and manuscript editing

Cahya WD: Creating the work and manuscript editing

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