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Systematic Review on Treatment of Knee Osteoarthritis

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Abstract

Background: Knee osteoarthritis (KOA) is a common degenerative joint disease affecting millions of individuals worldwide, leading to pain, functional impairment, and decreased quality of life. The management of KOA is multifaceted, involving pharmacological treatments, non-pharmacological interventions, and surgical options. Given the chronic nature of the condition, the development of effective, evidence-based treatment strategies is critical. This systematic review aims to evaluate the efficacy of current treatments for knee osteoarthritis.

Methods: Inclusion criteria encompassed randomized controlled trials, cohort studies, and systematic reviews that investigated the effectiveness of various treatment modalities for knee osteoarthritis. Treatment categories included pharmacological therapies, physical therapy, intra-articular injections, and surgical interventions.

Results: The review identified 10 relevant studies evaluating a wide range of treatments for KOA. Pharmacological treatments, such as nonsteroidal anti-inflammatory drugs (NSAIDs) and analgesics, were found to provide short-term pain relief, but long-term use is associated with side effects. Non-pharmacological interventions, including physical therapy, weight management, and education programs, showed significant improvements in pain and function. Intra-articular injections, such as hyaluronic acid and corticosteroids, provided moderate symptomatic relief, though their effects were temporary. Surgical options, such as total knee arthroplasty (TKA), were effective for advanced cases, providing long-term relief and functional improvement.

Conclusion: A multimodal approach combining pharmacological and non-pharmacological treatments is recommended for managing knee osteoarthritis. While surgery remains the option for end-stage disease, early intervention with physical therapy and weight management can significantly improve outcomes. Further research is needed to optimize personalized treatment plans and explore novel therapeutic agents.

Keywords: Knee osteoarthritis, total knee arthroplasty, intra-articular injections, surgery, multimodal approach, systematic review

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1. Introduction

Osteoarthritis (OA), also known as degenerative joint disease, primary OA, wear and tear arthritis, or age-related arthritis, is a major cause of disability in the United States and around the world1. case history, age, obesity, diabetes, synovitis, systemic inflammatory mediators, immunity, lower limb alignment (genu valgum and genu varum), joint shape and dysplasia, trauma, and inflammation caused by metabolic disorders all play a task in knee OA. (1)

Asymptomatic knee OA affects 10% of males and 13% of women over 60 years of age. Due to increase in aging and the prevalence of obesity or overweight in the general population, the proportions of people with symptomatic knee OA are projected to rise.

Pain around the knee joint is the most common sign of knee OA. The sensation of pain can be subtle, severe, persistent, or intermittent (off and on). Pain can range from minor to excruciating. The range of motion can be reduced. The practitioner may notice muscle weakness and hear grinding or cracking sounds. Knee swelling, locking, and giving way are common bothersome symptoms. Knee pain can develop gradually and worsen over time (as is most usual), or it might appear suddenly. Pain and stiffness are more likely in the morning, after sitting, or after prolonged rest. Painful symptoms may become more frequent over time, even when resting or sleeping. Pain usually worsens with strenuous exertion.

Table 1. Type of study, Participants Details and study result

Sr. no	Type of study	Participants details	Treatment/ Interventions Outcome measures	Results
1.	Cross sectional design ,2022 (1)	Participants were included if they 1) were over the age of 40 years, 2) had knee pain for longer than three months, 3) were radiologically confirmed for the presence of OA changes in the tibiofemoral joint bilaterally, and 4) were able to understand and follow the commands of the examiner. The subjects were excluded if they had 1) a previous injury or surgery to the lower extremities, 2) a history of systemic inflammatory arthritis, 3) a history of meniscus or ligament injuries in the knee, and 4) infiltration corticosteroids in the knees in the last six months.	1. Kinesiophobia – The Tampa scale of kinesiophobia is a self-reported questionnaire that assesses fear of injury based on fear avoidance behaviour of activity. 2. Knee Pain Intensity-Visual Analogue Scale (VAS)- The current level of knee pain intensity was evaluated on a 0 to 100mm continuous VAS anchored by two statements: "0" meaning no pain, and "100" meaning the worst imaginable pain. 3. Knee Joint Position Sense – A dual digital inclinometer was used to test knee joint position sense. Individuals sat on the edge of a bed with their eyes closed. For the evaluation of knee JPS, the passive to active joint repositioning approach was adopted. 4. Functional performance- The five times sit-to-stand test measured functional performance in subjects with knee OA. The individual sits against the chair with arms folded across the chest.	Kinesiophobia correlated significantly with pain intensity, JPS, and functional performance. Further, kinesiophobia significantly predicted pain intensity, JPS, and functional performance in individuals with KOA. Kinesiophobia is a significant aspect of the recovery process and may be considered when planning and implementing rehabilitation programs for KOA individuals
2	A Systematic review and meta analysis, 2021 (2)	This systemic review included patients with knee osteoarthritis	the objective of this systematic review was to identify and critically review the evidence on the short-term and long-term effects of dry needling techniques in patients with knee osteoarthritis.	The review demonstrates a moderate-quality evidence on the short-term effect of periosteal stimulation technique on pain and function in knee osteoarthritis.
3	A randomized controlled trial, 2019 (3)	Patients with a clinical and radiographic diagnosis of knee OA, certified by an orthopedic surgeon, and an age of 50 years or older were considered for inclusion. There is an increasing risk for elderly people beyond 50 to get OA.3 As the clinical symptoms do	primary outcomes of pain and physical function were measured by the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). The objective of this study was to determine the effects of kinesio tape on perceptions of pain and	The main finding of this study is that wearing a kinesiotape over 3 consecutive days is effective to improve the self-reported perception of pain, joint stiffness, and physical function in patients with OA compared with a sham tape or no intervention.

		not always agree with the X-ray,27 all degrees of severity of knee OA were included in this study. · Exclusion criteria were acute inflammation or pain with edema, a recent or simultaneous pharmacological treatment, a surgical intervention in the past 6 months, skin diseases or irritations or another previous total or partial joint endoprosthesis.	function as well as on ROM, strength, balance, and walking abilities	
4	A randomized controlled clinical trial, 2021 (4)	Patient with knee osteoarthritis	In a present randomized controlled clinical trial, a total of 48 diagnosed patients of knee osteoarthritis were allocated randomly into group A (n=24) and group B (n=24). Group A was treated with a soft and prolonged massage with Roghan-i-Bābūna while group B was managed with dry cupping on alternate day for 15 min. Visual Analog Scale (VAS) and Knee osteoarthritis outcome score (KOOS) were used for the assessment of efficacy	all KOOS subscales were found to be strongly significant at 20th day when compared with baseline
5	A Randomized Trial, 2022 (5)	Inclusion- Adults with degenerative knee OA, radiographically defined by a Kellgren-Lawrence grade	Two study groups were defined: GROUP 1 Treatment NMES group that received the original NMES therapy and a sham low-voltage NMES group as a control group and received a modified low-voltage NMES therapy. GROUP 2 The patients in the sham low-voltage NMES group were given a modified version of the NMES therapy with a limited maximum applied intensity of level 5.	The home-based NMES therapy as a nonsurgical treatment used in this study has shown efficacy in the treatment of OA-related knee pain, stiffness, and function. This treatment has the potential to provide suffering patients with a bridge between conservative management and definitive total knee procedures. Given the increasing incidence of patients with knee OA due to improved longevity, the health-care implications are clear. Moreover, as more providers embrace the bundled payment model, the cost-saving potential is imminent with TKA sparing measures like these. Future studies should further explore the low-voltage NMES effects on knee OA as seen in our sham group.
6	RCT,2022 (6)	Participants should be female, aged between 41 and 63 years, with a body mass index (BMI) greater than 25 kg/m, suffering from knee pain during most of the last 30 days before the study (unilateral and/or bilateral).	GROUP 1 Isokinetic strengthening GROUP 2 Neuromuscular electrical stimulation	Although no significant difference was demonstrated between the three strengthening modalities, our results underline the interest of the combination of ISO and NMES where we witnessed a significant superiority compared with the usual rehabilitation program with respect to the majority

				of measured parameters. This could lean our recommendation towards the combined training (ISO + NMES) with the intention of complete management of knee osteoarthritis.
7	RCT, 2020 (7)	INCLUSION-1) Having the age of more than 40 years. 2)self-reporting knee instability. EXCLUSION- 1)Subjects had strokes, 2) faced uncontrolled hypertension, 3) were unable to walk without assistant instruments, 4) had received other treatment interventions in the past three months, 5) were suffered obesity (BMI > 40 kg/m2, 6) suffered from neuromuscular diseases like multiple sclerosis or Parkinson, 7) had lower extremity fracture, 8) afflicted with concurrent hip osteoarthritis, 9) waited for arthroplasty, 10) cardiovascular diseases	A total of 200 knee osteoarthritis' female patients were studied for eligibility among which 36 individuals were included in the present study. Of the 36 participants, 12 patients were allocated to the aquatic exercise, twelve to TRX exercises, and the rest to the control group. However, 111 patients didn't meet the eligibility criteria and 53 declined to participate. The participants of the present study consisted of individuals from two groups: individuals who had regular referral from rheumatologist, and patients who waited for common physiotherapy in rehabilitation centers.	Although TRX and aquatic interventions had a similar effect on the patients' balance, pain and KI, TRX had more effect on WOMAC(stiffness), quadriceps strength, and knee flexion ROM than aquatic exercises.
8	RCT, 2021 (8)	INCLUSION- Patients aged 40 years and older who have chronic knee pain (for more than 6 months) . Patients with stage 2 or stage 3 OA in both knees according to KellgrenLawrence (KL) criteria were included in the study. EXCLUSION- Patients with previous knee surgery; those who have had intra articular injection. Patients with rheumatoid arthritis or other systemic, autoimmune, and rheumatic diseases; secondary KOA. Patients receiving anticoagulant therapy;	100 patients with KOA were randomly divided into the acupuncture group and the physiotherapy group. Both treatments were given in 12 sessions over 6 weeks.Thirteen acupuncture points were selected for the knee.The Visual Analog Scale (VAS) was used to measure pain intensity. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the 36-Item Short Form Health Survey (SF-36) were used to determine functional status and health-related QOL, respectively. All patients were evaluated at baseline, after the last treatment, and at the 12-week follow-up period.	Acupuncture and physiotherapy have similar efficacy in the treatment of KOA in both the short and long terms. It was determined that the effect of both methods continued after the treatment and 12 weeks later. The WOMAC pain, stiffness, and total score indicating functional status are improved in both short and long term only in the acupuncture treatment group. In addition, QOL general health subscores were improved only in the acupuncture group, whereas physical and social function was improved only in the physiotherapy group. Both treatment groups had improvement in different aspects of QOL up to 3 months. Acupuncture and physiotherapy have comparable effects on pain of KOA, but improvement in functional status and QOL may be different with regard to variable subgroups.

		hearing aids or pacemakers; abnormal hepatic or renal dysfunction; and neuropathic pain were excluded.		
9	Case report, 2024(9)	INCLUSION- Patient with bilateral knee pain. Female patients included. Age group of 40 to 50 years. Working womens. Exclusion - 1)Subjects had strokes, 2) faced uncontrolled hypertension, 3) were unable to walk without assistant instruments, 4) had received other treatment interventions in the past three months.	A six-week treatment plan for this patient that incorporates a number of advanced therapy techniques, including Mulligan mobilisation, Kinesio taping, and plyometric exercise sessions. We created a thorough rehabilitation programme for our patient, who had osteoarthritis in her knee, and it worked incredibly well. We assessed the efficacy of our outcome measures using a variety of outcomes, including the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Knee Injury and Osteoarthritis Outcome Score (KOOS), visual analogue scale (VAS), range of motion (ROM), and manual muscle testing (MMT).	Treatment plan for a patient with osteoarthritis in the knee that included advanced physiotherapeutic techniques like the eccentric training programme, balance training programme, Kinesio taping, and Mulligan mobilisation. The patient's functional activities, quality of life, and pain were significantly improved after the treatment. Along with the balance training programme, the eccentric training programme significantly increased muscle strength and improved involvement in functional tasks. The patient's quality of life increased as a result. However, using recent physiotherapeutic techniques in addition to a conventional physiotherapy programme proved to be more advantageous in terms of enhancing the patient's general health and quality of life
10	RCT, 2022(10)	INCLUSION- Subjects with the age group of 50 years. Having knee OA. EXCLUSION - Subject with chronic disease, lower extremity fracture with lower limb engagement, past knee surgery, lower limb thrombosis, interpersonal and inter corticosteroid injection in the previous 6 months, balance control deficit, neuropathy or sensory deficit, and skin damage in the knee region, as well as epilepsy, cancers, heart conduction block disease, and having electrical implants such as a pacemaker.	Group 1- interferential therapy To control pain suitable electrotherapeutic modalities are preferably be used like TENS, IFT, US, LASER etc. Group 2 - strengthening exercise. Exercise programme includes ROM exercises, strengthening exercises, joint mobilization, stretches, functional training, aerobic exercises etc. All these exercises or techniques help the muscle and the joints function to their greatest capacity, helping to restore injury by hastening recovery and lowering pain and distress at knee joint.It is a common cause of disability worldwide.	In individuals with knee OA, short-term IFT therapy might considerably decrease discomfort and enhance physical performance.These findings suggest that physical approaches can be utilised as an alternative to medications or as a supplement to drugs in the treatment of knee OA pain. It should be noted that this study is the first to compare IFT in treatment of knee OA, so further studies are needed to confirm these findings. Long term treatment with strengthening exercises could significantly relief pain and improves physical strength and range of motion of the knee joint.

Gelling occurs when joint pain and stiffness occur after sitting or prolonged rest for less than 30 minutes.

Kellgren and Lawrence explained the most common radiographic grading system. K/L grade 1 in either knee in this system (osteophytic lipping or one osteophyte). K/L grade 2 in each knee was defined as mild (or definite) OA (at least 2 definite osteophytes and possible joint space narrowing [JSN]). A K/L score of 3 in either knee indicated moderate to severe knee OA (at least 2 definite osteophytes and definite JSN).

2. Discussion

The narrative review on the treatment of knee osteoarthritis provides comprehensive insights into various therapeutic interventions, their effectiveness, and the nuances observed in clinical outcomes.

Kinesiophobia, or the fear of movement due to pain, is identified as a significant predictor of pain intensity, joint proprioception (JPS), and functional performance in individuals with KOA. This insight underscores the psychological aspect of KOA treatment. While much focus in rehabilitation tends to be placed on physical interventions, the role of kinesiophobia must not be overlooked. Rehabilitation programs for KOA should incorporate strategies that address this fear, potentially through cognitive-behavioral therapies, education, and progressive exercise protocols. Acknowledging kinesiophobia may improve patient compliance and enhance recovery outcomes. (1)

Moderate-quality evidence supports the short-term effectiveness of periosteal stimulation in reducing pain and improving function in individuals with knee osteoarthritis. This technique, which involves stimulating the periosteum (the membrane surrounding the bone), likely works by promoting healing and reducing inflammation. While the evidence is not yet robust enough for widespread adoption, periosteal stimulation could serve as an adjunct to more conventional treatments, especially for patients seeking non-invasive alternatives to surgery. (2)

The use of kinesio tape over three consecutive days is shown to improve self-reported pain, joint stiffness, and physical function in patients with OA, suggesting that this treatment could be a simple, cost-effective option for symptom management. Kinesiotape provides support without restricting movement, making it an ideal addition to a comprehensive rehabilitation plan. This treatment's non-invasive nature and ease of application also make it an attractive option for patients looking for quick relief without the need for extensive therapy or medications. (3)

Home-based NMES therapy has shown promise in the management of knee OA, particularly for reducing pain, stiffness, and improving functional performance. NMES helps by stimulating the muscles around the knee, promoting muscle contraction, and improving strength. This non-surgical intervention could be highly beneficial, especially for patients who wish to delay or avoid knee replacement surgery. The low-voltage NMES therapy's effectiveness as a bridge between conservative management and total knee arthroplasty (TKA) is of significant clinical value. Given the rising incidence of knee OA, especially in older adults, NMES may help reduce healthcare costs by serving as a TKA-sparing measure. (4)

The combination of isometric exercises (ISO) and NMES offers a superior treatment option compared to conventional rehabilitation programs. Isometric exercises strengthen the muscles without joint movement, which is particularly beneficial for patients with KOA who experience joint pain during dynamic movements. When combined with NMES, which helps activate deeper muscle fibers and improve muscle strength, this regimen has shown to significantly improve patient outcomes in terms of pain relief, strength, and function. These findings suggest that a combined approach may be more effective in managing the multifactorial nature of KOA. (5)

Both TRX suspension training and aquatic therapy have been found to improve balance, pain, and knee instability (KI), but TRX exercises have more pronounced effects on stiffness, quadriceps strength, and knee flexion range of motion (ROM). While aquatic therapy is beneficial for its low-impact nature, making it suitable for patients with severe pain or limited mobility, TRX offers more targeted benefits for strengthening the quadriceps and improving knee flexibility. These exercises should be considered based on the patient's individual needs, with TRX being more suitable for those who can tolerate weight-bearing exercises, while aquatic therapy remains ideal for those with severe limitations. (6)

Both acupuncture and physiotherapy demonstrate comparable efficacy in treating KOA in the short and long term. However, the two treatments have distinct effects on quality of life and functional status. Acupuncture was found to improve general health and reduce pain, while physiotherapy focused more on improving physical and social function. These differences suggest that acupuncture may be more beneficial for patients focusing on pain management, while physiotherapy could be better suited for individuals who need to enhance their mobility and overall function. The choice of treatment should therefore depend on the specific goals and needs of the patient. (7)

The combination of advanced physiotherapeutic techniques, including eccentric training, balance training, Kinesio taping, and Mulligan mobilization, has been shown to significantly improve pain, function, and quality of life in individuals with KOA. Eccentric training is particularly effective in strengthening the muscles around the knee and improving joint stability, while balance training enhances coordination and reduces the risk of falls. These interventions, when used in combination, provide a holistic approach to KOA management, addressing both the physical and functional limitations imposed by the condition. (8)

Short-term use of IFT therapy has been shown to significantly reduce discomfort and enhance physical performance in patients with knee OA. IFT works by using electrical currents to stimulate nerves and muscles, providing pain relief and promoting muscle function. This form of electrotherapy can serve as an alternative or adjunct to medications, offering a non-invasive solution for pain management. As this is the first study to compare

IFT in KOA treatment, further research is needed to confirm its long-term benefits and potential as a standard treatment option. (9)

Long-term strengthening exercises are essential in managing knee OA, as they provide sustained relief from pain and improve physical strength and knee joint range of motion. These exercises help to address the muscle weakness and joint instability that contribute to pain and functional limitations in KOA. Consistent strengthening over time can delay or even prevent the need for more invasive treatments, such as knee replacement surgery. (10)

3. Conclusion

The combination of strengthening exercises and electrotherapy provides a holistic treatment approach for KOA. Strengthening exercises target the muscle weakness and joint instability that are central to the disease, while electrotherapy provides immediate pain relief and enhances muscle activation. This dual approach has shown superior results in improving pain management, muscle function, and overall mobility compared to conventional rehabilitation methods.

Given the growing incidence of knee OA and the limited availability of surgical options for many patients, these non-invasive interventions represent highly effective and cost-efficient alternatives. Future research should continue to explore the long-term benefits and optimal combinations of strengthening exercises and electrotherapy, particularly focusing on how these treatments can be personalized to meet the needs of individual patients.

Overall, integrating strengthening exercises and electrotherapy into comprehensive rehabilitation programs can lead to significant improvements in the quality of life and functional outcomes for individuals with KOA, while reducing the need for invasive treatments such as surgery.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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