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Research Article

Effectiveness of Mechanical Traction in Managing Pain and Improving Joint Mobility in Knee Osteoarthritis: A Review

Javid Iqbal Wani[1]*, Dr. Sanjeev Attry[2], Dr. Ajeet Kumar Saharan[3], and Dr. Anshul G.[4], Dinesh Bansal[5]

[1]*PhD Scholar, Nims University Rajasthan, Jaipur-303121
[2]MCH Neurosurgery, Nims University Rajasthan, Jaipur-303121
[3]Principal-Nims College of Physiotherapy & Occupational Therapy, Nims University Rajasthan, Jaipur-303121
[4]Associate Professor, ITM University Gwalior
[5]MCH Orthopedics, Ishan Hospital, New Delhi – 110089, Delhi

***Corresponding Author:** Javid Iqbal Wani
PhD Scholar, Nims University Rajasthan, Jaipur-303121

Abstract
Background: Knee osteoarthritis (OA) is a prevalent degenerative joint disease causing chronic pain and mobility limitations. Mechanical traction has emerged in the past decade as a non-invasive intervention aimed at pain relief and improved joint mobility by unloading the knee joint. **Objectives:** This review examines the effectiveness of mechanical knee traction in reducing pain and enhancing joint mobility in patients with knee OA, summarizing clinical evidence from the last ten years. Both clinical outcomes and biomechanical rationales are discussed, including comparisons with standard therapies. **Methods:** A literature search (2015–2025) was conducted focusing on clinical studies, systematic reviews, and relevant biomechanical research on knee traction. Key outcomes of interest were pain reduction and improvements in joint range of motion (ROM) or physical function. **Results:** Recent randomized controlled trials (RCTs) and observational studies indicate that adding mechanical traction to standard physiotherapy or exercise regimens yields significantly greater pain reduction and functional improvement than conventional treatments alone (Choi & Lee, 2019; Abdel-Aal et al., 2022; Riyad et al., 2024). Traction at certain knee flexion angles (20°–90°) and intermittent traction protocols appear most beneficial (Abdel-Aal et al., 2022). Improvements in knee ROM are observed in some studies (Kamble & Malawade, 2023), though not uniformly in all trials. Mechanistically, traction likely relieves compressive joint forces, increases joint space, and reduces neuromuscular guarding, thereby alleviating pain. **Conclusions:** Mechanical traction is a promising adjunct therapy for knee OA that can reduce pain and modestly improve joint mobility, especially when combined with exercise. While short-term outcomes are positive, further research is needed to establish long-term efficacy, optimal protocols, and its place in clinical guidelines.

Keywords: knee osteoarthritis; mechanical traction; pain relief; joint mobility; physiotherapy; joint distraction; non-pharmacological therapy; rehabilitation

Author of correspondence: Email: gayakwad89@gmail.com

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Introduction

Knee osteoarthritis (OA) is one of the most common causes of chronic knee pain and disability among older adults worldwide. It is characterized by progressive degeneration of articular cartilage, osteophyte formation, joint space narrowing, and changes in subchondral bone, leading to pain, stiffness, and reduced joint mobility (Florjančič & Vauhnik, 2025). Globally, hundreds of millions of people are affected by knee OA, with prevalence increasing with age and risk factors such as obesity, joint injury, and repetitive stress. In India and other Asian countries, lifestyle factors like habitual squatting and sitting cross-legged contribute to a high burden of knee OA in both urban and rural populations (Kamble & Malawade, 2023). Patients typically present with knee pain, crepitus, limited range of motion (ROM), and functional limitations in activities such as walking and stair climbing.

Management of knee OA is multimodal and focuses on symptomatic relief and functional improvement, as there is no definitive cure to reverse cartilage degeneration. First-line treatments include patient education, weight management, and **physiotherapy** (physical therapy) interventions such as therapeutic exercises to strengthen the quadriceps and improve joint flexibility (Riyad et al., 2024). Low-impact aerobic exercise and muscle strengthening have well-documented benefits in reducing pain and improving function in knee OA without accelerating disease progression. Adjunct modalities like **transcutaneous electrical nerve stimulation** (TENS), ultrasound, low-level laser therapy, and manual therapy techniques are also used to help control pain and improve mobility (Florjančič & Vauhnik, 2025). Pharmacological management (e.g. NSAIDs and analgesics) provides pain relief but can have systemic side effects with long-term use. Intra-articular injections (corticosteroids, hyaluronic acid) offer temporary relief for some patients. Ultimately, advanced cases may require surgical intervention such as high tibial osteotomy or total knee arthroplasty if conservative measures fail. Within the spectrum of non-surgical options, **mechanical traction therapy** for the knee joint has gained attention as a potential means to reduce pain and improve joint function. Mechanical traction involves applying a distractive force to the knee, effectively “unloading” or slightly separating the joint surfaces of the tibiofemoral joint. By doing so, traction may temporarily increase the joint space and reduce compressive forces on damaged cartilage and bone, which can help alleviate pain. Traction therapy has long been used in spinal conditions to relieve nerve compression and joint pressure; analogous principles are now being explored for the osteoarthritic knee (Choi & Lee, 2019). Historically, a surgical form of prolonged knee traction known as **knee joint distraction (KJD)** uses external fixators to separate the joint surfaces for several weeks. KJD has shown promising results in severe knee OA, inducing cartilage repair and delaying the need for total knee replacement in younger patients, albeit with risks related to the invasive procedure (Jansen et al., 2021). This success of surgical distraction provides a rationale to investigate less invasive traction methods applied intermittently via mechanical devices or manual therapy.

The appeal of mechanical knee traction as a conservative treatment lies in its potential to provide pain relief without drugs or surgery. By gently pulling the joint apart, traction may reduce mechanoreceptor activation in subchondral bone and stretched soft tissues that produce pain, and it might facilitate increased circulation of synovial fluid. Improved synovial fluid movement could help lubricate the joint and remove inflammatory or noxious mediators from the articular environment (Kamble & Malawade, 2023). Additionally, traction can produce a stretch of periarticular structures (joint capsule, ligaments, muscle-tendon units), possibly reducing stiffness and increasing joint ROM (Vekariya et al., 2019). The mechanical stretching may also disrupt adhesions or entrapment of soft tissue, similar to how joint mobilization techniques work, thereby improving mobility. Some authors have suggested that knee traction leads to **muscle relaxation** around the joint and can diminish reflex muscle guarding that often accompanies chronic pain (Choi & Lee, 2019). This neuromuscular effect could further enhance comfort and allow greater movement. Despite these theoretical benefits, mechanical traction for knee OA has not traditionally been a mainstream modality, and its effectiveness has been uncertain. Over the last decade, however, an increasing number of clinical studies—especially from Asia and Europe—have evaluated knee traction in various forms. This review aims to synthesize the evidence from the past ten years regarding **the effectiveness of mechanical traction in managing pain and improving joint mobility in knee osteoarthritis**. We focus on findings from RCTs, clinical trials, and observational studies, and also discuss biomechanical insights into how traction may exert its effects. In addition, traction is considered in the context of standard knee OA management: we compare outcomes to other physiotherapy interventions and explore whether traction provides additive benefits. By doing so, we intend to clarify the role of mechanical traction as an adjunct treatment for clinicians and to highlight areas where further research is needed.

Mechanisms of Mechanical Traction in Knee Osteoarthritis

Mechanical traction is applied to the knee using either specialized traction devices or manually by a therapist, aiming to create a **distraction force** along the joint’s axis. Typically, the patient lies supine with the leg slightly flexed at the knee, and a cuff or brace around the distal thigh and ankle provides a pulling force. The force magnitude and knee angle can be adjusted; recent studies have explored forces proportional to body weight (such as 10–15% of body weight) and knee flexion angles of 20° or 90° versus full extension (Abdel-Aal et al., 2022). Traction can be applied continuously (sustained pull) or intermittently (cycles of pull and release). The physiological rationale behind traction in knee OA includes several factors:

- **Joint Decompression:** Traction separates the femur and tibia slightly, which reduces intracapsular pressure and unloading of the articular surfaces. This decompression may relieve the constant pressure on eroded cartilage and subchondral bone, thereby diminishing pain originating from these structures. By increasing the joint space even temporarily, traction might also reduce impingement of meniscal or synovial tissues. Imaging studies have demonstrated that sufficient traction force can widen the tibiofemoral joint space, although this change reverses after the force is removed (Vekariya et al., 2019). Nonetheless, even a transient increase in joint space during treatment might allow for better nutrient flow and waste removal in the joint.

- **Synovial Fluid Dynamics:** The oscillatory movement from intermittent traction could act like a pump, enhancing synovial fluid circulation. This helps distribute lubricating fluid across cartilage surfaces and may flush out inflammatory cytokines or pain mediators from the joint space (Kamble & Malawade, 2023). Improved synovial fluid exchange is postulated to create a more favorable biochemical environment in the knee, potentially reducing pain sensitivity. (Notably, in surgical KJD, long-term fluid pressure changes are thought to stimulate cartilage repair and thickening (Jansen et al., 2021), though short-term mechanical traction may not directly induce structural changes.)
- **Reduction of Nociceptive Inputs:** By stretching the joint capsule and periarticular tissues, traction may activate mechanoreceptors that inhibit transmission of pain signals (a gate control mechanism). Also, by relieving compressive stress, traction could reduce activation of nociceptors in the bone and soft tissue. Vekariya et al. (2019) noted that movement caused by traction *"assists circulation and decreases concentration of noxious irritants"* in the joint, thereby lowering pain. In effect, traction might break the cycle of pain leading to muscle spasm and more pain, by providing a novel sensory input and relief of compression.
- **Muscle Relaxation and Spasm Reduction:** Chronic knee OA pain often leads to reflex muscle spasm or guarding (especially in the hamstrings or gastrocnemius) which further limits motion. Traction exerts a gentle stretching force on these periarticular muscles and the joint capsule, which can trigger a relaxation response. Choi and Lee (2019) observed that knee traction therapy resulted in *enhanced dynamic muscle contraction and relaxation* around the joint, hypothesizing that it helps reset muscle tone. The intermittent stretching may also improve **proprioception**, helping muscles coordinate better rather than co-contract in a guarding pattern.
- **Improved Range of Motion:** By relieving pain and stretching tight structures, traction can acutely increase the range of motion available at the knee. Patients often report feeling less stiff after traction sessions. Mechanically, traction can help in loosening adhesions in the capsule or breaking up minor fibrotic changes that restrict motion. This is akin to the mechanism of joint mobilization techniques used by manual therapists, where gentle oscillatory distraction and gliding can restore accessory motions and thus improve overall ROM. Some case reports even suggest that a single session of high-force traction under anesthesia can dramatically increase knee flexion in cases with adhesions (Elson et al., 2023, as cited in the context of manipulation under anesthesia with traction).

It should be noted that most of these effects are short-term or immediate. Continuous or repeated traction sessions are usually needed to maintain benefits. Unlike surgical distraction that is maintained for weeks, mechanical traction in therapy is applied in sessions lasting minutes. Thus, its primary role is in symptomatic management (pain relief, temporary mobility gains) rather than altering disease progression. No current evidence shows that brief traction sessions can regenerate cartilage; however, by enabling patients to exercise more comfortably and improving function, traction could indirectly contribute to better joint health (e.g., by facilitating exercise adherence). The following sections will review clinical studies that have tested whether these theoretical benefits translate into measurable outcomes for knee OA patients.

Clinical Evidence: Effect of Traction on Pain Relief in Knee OA

Pain reduction is a critical outcome in knee OA management. Several recent clinical trials have evaluated whether adding mechanical traction can yield superior pain relief compared to standard treatments alone. Overall, the evidence suggests that mechanical traction can significantly alleviate knee pain in OA, especially when combined with exercise or other therapy, as summarized below.

Figure 1: Effect of Mechanical Traction on Pain in Knee OA (VAS Scores)

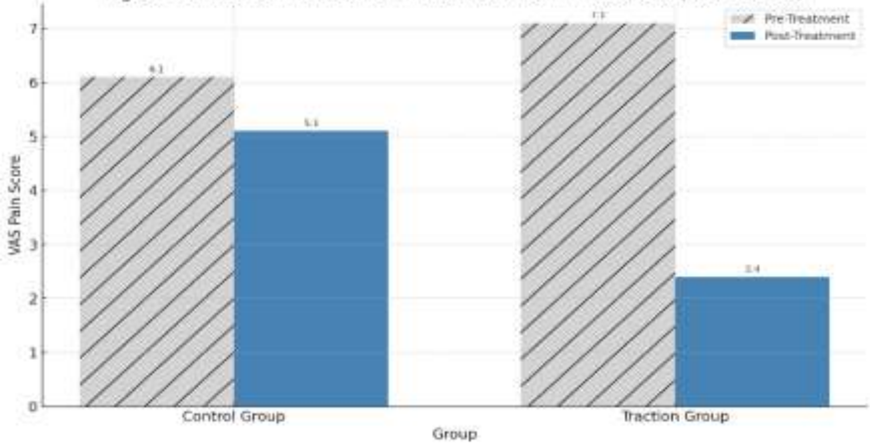

Figure 1. Pain reduction with mechanical traction vs standard therapy in knee OA, illustrated by changes in Visual Analog Scale (VAS) pain scores from a representative study (Choi & Lee, 2019). The traction-treated group showed a markedly larger drop in pain scores compared to the control group receiving only conventional therapy.

One of the earliest controlled studies in the last decade was by Choi and Lee (2019) in South Korea. They conducted an RCT involving 30 patients with degenerative knee arthritis, comparing an **experimental group** receiving knee traction plus conventional physiotherapy to a **control group** receiving conventional physiotherapy alone. Over 4 weeks of treatment, both groups showed some decrease in pain, but the traction group's improvement was far more pronounced. The traction group's VAS pain score dropped from an average of 7.1/10 at baseline to 2.4/10 post-treatment, a reduction of about 4.7 points (Choi & Lee, 2019). In contrast, the control group's pain only decreased from 6.1 to 5.1 (about 1 point). The between-group difference was statistically significant, indicating that traction provided additional pain relief beyond exercise and modalities alone. Notably, patients in the traction group also reported less pain-related interference in daily activities as reflected in their WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) scores. This study clearly demonstrated a short-term analgesic benefit of mechanical knee traction.

Around the same time, researchers in India were also exploring traction devices. Kamble and Malawade (2023) performed an RCT with 96 knee OA patients (Grade I–II Kellgren-Lawrence) divided into two groups: one received standard conservative therapy (exercise, hot packs, etc.), and the other received the same plus **dynamic traction** using a mechanical traction machine. After the intervention period, the dynamic traction group achieved significantly greater pain reduction on the VAS compared to the control group ($p < 0.001$) (Kamble & Malawade, 2023). The authors concluded that dynamic traction is *"beneficial and more effective… as compared to conventional methods"* for pain relief. This finding from an Indian context reinforced that even in typical outpatient physiotherapy settings, adding a traction modality can provide incremental pain relief for patients.

A high-quality, large RCT by Abdel-Aal et al. (2022) in Egypt provided more nuanced evidence on how traction angle and technique influence pain outcomes. In their study of 120 patients, all patients received a baseline of conventional physiotherapy (exercises and adjunct modalities), but they were randomized into four groups: **no traction** (control), traction applied with the knee in full extension, traction with knee at 20° flexion, and traction with knee at 90° flexion. The traction was given intermittently (three sessions per week for four weeks) using a traction device at a force of approximately 7% of body weight, per protocol. Pain was measured via VAS and WOMAC at baseline, after the 4-week treatment, and at a 4-week follow-up. The results showed that **all three traction groups** experienced significantly greater reductions in pain than the no-traction control group (Abdel-Aal et al., 2022). Moreover, among the traction groups, those with the knee flexed at 20° and at 90° had better pain outcomes than the group tractioned in full extension. For example, at the 8-week follow-up, the mean VAS pain score was ~16 mm in the 20° and 90° flexion groups, compared to ~24 mm in the extension traction group and ~31 mm in the control group (Abdel-Aal et al., 2022). This suggests that applying traction at a mid-range knee flexion may more effectively unload painful contact points within the joint (possibly by gapping both the medial and lateral compartments more evenly) than traction with the knee locked in extension. The study also compared continuous vs. intermittent traction in prior work (referencing earlier research), generally finding intermittent traction (e.g., 30 seconds on, 10 seconds off cycles) to be effective. Abdel-Aal et al.'s trial is important as it confirms that **mechanical traction provides a significant analgesic benefit** in knee OA and offers guidance on optimizing technique (traction angle) for pain relief.

Other trials have corroborated these findings. A randomized trial by Riyad et al. (2024) in Egypt specifically looked at **traction as an adjunct to exercise therapy**. Forty patients were split into two groups: one did a regimen of strengthening and stretching exercises for 4 weeks, and the other did the identical exercise program *preceded by a session of mechanical knee traction* before each exercise session. Pain severity was tracked using VAS and a knee pain/function questionnaire. Both groups improved with therapy, but the traction-plus-exercise group had a significantly greater reduction in pain scores than the exercise-only group (Riyad et al., 2024). The implication is that traction can potentiate the effects of therapeutic exercise, perhaps by reducing pain enough to allow patients to exercise more effectively or with less discomfort. Similarly, an observational study from Slovenia by Florjančič and Vauhnik (2025) reported substantial pain decreases when **continuous traction (150 N force)** was added to a multi-modal physiotherapy program. In that study without a control group, knee pain at rest and during movement (measured by VAS) dropped significantly over the course of eight traction sessions, confirming at least a temporal association between traction treatment and pain relief.

Across these studies, mechanical traction consistently led to greater pain reduction compared to control conditions. Patients often describe feeling relief immediately during and after traction sessions. The analgesic effect may be due to the combination of reduced joint pressure and neuromodulation of pain signals, as discussed earlier. It is noteworthy that none of the cited studies reported serious adverse effects from traction. Mild discomfort during high-force traction was occasionally noted, but generally patients tolerated the treatments well (Abdel-Aal et al., 2022; Florjančič & Vauhnik, 2025). This safety profile makes traction an attractive option for pain management, especially for patients who cannot use certain medications (e.g., due to NSAID contraindications) or who want to delay injections or surgery.

One limitation in the pain outcome literature is the duration of benefit. Most trials evaluated pain right at the end of a 4-week treatment period (or with a short follow-up like another 4 weeks). The longevity of traction's pain relief is not fully clear; some benefit might persist a few weeks after therapy, but maintenance treatments could be needed. For instance, Abdel-Aal et al. (2022) noted that at 4 weeks post-treatment, pain scores were still better in traction groups than baseline, but had inched up slightly from the immediate post-treatment values – indicating some regression without ongoing traction. Long-term studies are lacking, so whether regular "booster" traction sessions are required to sustain pain reduction over months is unknown. Nevertheless, the evidence to date strongly supports that **mechanical traction is effective in the short-term management of knee OA pain**, particularly as an adjunct to standard physiotherapy interventions.

Clinical Evidence: Effect of Traction on Joint Mobility and Function

Beyond pain relief, improving **joint mobility** (i.e. range of motion) and overall knee function is a major goal in OA treatment. Pain and stiffness in knee OA often lead to reduced ROM (especially loss of full extension or flexion) and difficulty with activities like walking, squatting, or climbing stairs. Mechanical traction's ability to stretch periarticular tissues and reduce pain suggests it could help restore some mobility and improve functional performance. The clinical evidence on mobility and functional outcomes with knee traction shows generally positive trends, though results are a bit more mixed compared to pain outcomes.

Many of the trials described above also measured indicators of physical function or mobility. Choi and Lee (2019), for example, assessed **WOMAC** function sub-scores and found that the traction group improved significantly more in physical function (which includes items on stair-climbing, walking, etc.) than the control group over 4 weeks. Additionally, they measured **knee flexion ROM** with a goniometer and reported greater gains in the traction group (though the numerical data for ROM were not highlighted as prominently as pain data in the paper). The traction group's average knee flexion increased, which the authors attributed to reduced pain and capsular stretching from traction, whereas the control group had minimal change in ROM. Improved WOMAC and ROM in the traction cohort indicates better joint mobility enabling daily activities. The difference in functional improvement was also reflected in a secondary outcome of the Choi study: patients' scores on the Beck Depression Inventory (BDI) improved more with traction, likely because reduced pain and better mobility led to improved mood and quality of life (Choi & Lee, 2019).

Similarly, Kamble and Malawade (2023) reported that their dynamic traction group had greater increases in knee flexion range and could perform functional movements more easily post-treatment than the conventional therapy group. Though exact figures were not provided in the abstract, they mention an extremely significant improvement in outcome measures for the traction group ($p < 0.0001$ for certain functional comparisons). Qualitatively, patients with traction felt less stiffness and could bend the knee further, which translated to better performance in functional tests (the study likely included something like a timed up-and-go or 6-minute walk, given common practice, but it specifically mentions "better results in their condition" for the traction group).

The large four-arm RCT by Abdel-Aal et al. (2022) measured **passive knee ROM** (presumably flexion range) as one of its outcomes, in addition to WOMAC. Interestingly, they found that *all groups* including control had some improvement in knee ROM after therapy, and **there were no statistically significant differences in ROM gain between the traction groups and the exercise-only group**. In other words, while traction dramatically improved pain and WOMAC scores, it did *not* lead to a significantly greater ROM increase than exercise alone in that particular study. One possible explanation is that the exercise program (which likely included stretching exercises) already improved ROM in the control group, and traction did not add much beyond those stretches in terms of pure goniometric flexibility (Abdel-Aal et al., 2022). It's also possible that the follow-up period (4 weeks post-treatment) was too short to detect differences in maintained ROM gains. Regardless, the lack of a clear ROM advantage in this study suggests that the **effect of traction on ROM might be modest** and perhaps more evident in active ROM (patient's functional use of motion) rather than passive ROM measurements. Indeed, pain reduction itself can allow patients to move more freely (improving active ROM), even if passive joint range (limited by structural changes) doesn't dramatically change.

Functional performance measures are another way to gauge mobility improvements. Riyad et al. (2024) included tests like **walking speed** (time to walk a set distance) and **stair ascent/descent time** in their study. After 4 weeks, both the exercise-only and traction+exercise groups improved their walking and stair times (indicating better mobility and endurance). However, **no significant difference** was found between the two groups in these particular functional tests (Riyad et al., 2024). This suggests that while traction provided superior pain relief and muscle strength gains (discussed below), both groups achieved comparable improvements in gross functional mobility, likely driven largely by the exercise component. Walking speed and stair negotiation might depend more on muscle strength and cardiovascular fitness which improved in both groups due to exercise, whereas traction's benefits were more apparent in subjective pain and disability scores rather than these performance tests.

On the other hand, traction may contribute to **muscle strength preservation or improvement**, which indirectly relates to function. Riyad et al. (2024) measured isometric quadriceps and hamstring strength and found significantly greater increases in the traction+exercise group than in exercise alone. One hypothesis is that by unloading the joint and reducing pain inhibition, traction allows patients to activate their muscles more fully during subsequent strengthening exercises, thereby achieving greater strength gains. Stronger quadriceps support the knee better and improve functional outcomes in the long run. Thus, traction might play a facilitative role in rehab by creating conditions (pain relief, reduced fear of movement) that let patients exercise more effectively.

Another interesting functional outcome comes from the Slovenian study by Florjančič and Vauhnik (2025). They included a **30-second sit-to-stand test** as a measure of functional mobility and leg strength. After the intervention of eight traction-enhanced physiotherapy sessions, patients showed improvement in the number of repetitions on the sit-to-stand test (Florjančič & Vauhnik, 2025). Though without a control group we cannot attribute this solely to traction, it aligns with the notion that traction helped reduce pain enough to enable better functional performance. In that study, the **KOOS (Knee injury and Osteoarthritis Outcome Score)** quality-of-life subscale did not change significantly, but KOOS pain and symptom subscales did improve (supporting earlier points on pain). Quality of life might require longer to improve or is influenced by broader factors beyond the knee symptoms alone.

In summary, the current evidence suggests that mechanical traction in knee OA can contribute to **improvements in joint mobility and function**, though these effects are somewhat variable across studies:

- Many patients experience increased knee ROM (especially flexion) immediately after traction sessions, and over a course of treatment some sustained ROM gains have been documented (Kamble & Malawade, 2023). However, structured exercise therapy itself improves ROM, making it sometimes hard to isolate traction's effect on ROM in controlled trials (Abdel-Aal et al., 2022).
- Traction consistently improves patient-reported functional scores (WOMAC function, KOOS daily living) more than controls in the short term (Choi & Lee, 2019; Abdel-Aal et al., 2022). This indicates patients feel more able to perform activities with less difficulty when traction is part of therapy.
- Objective functional improvements (like walking speed or chair rise tests) do improve from baseline with traction, but added benefits of traction over exercise alone may not always reach statistical significance in short durations (Riyad et al., 2024). Pain relief from traction might translate more to subjective function (what patients perceive they can do) than to maximal performance in a clinical test, at least in the short term.
- Importantly, no studies reported that traction worsened mobility; concerns that traction could potentially loosen joints excessively or cause instability have not been borne out. On the contrary, by enabling movement with less pain, traction can encourage patients to be more active in rehabilitation.

Taken together, **mechanical traction can be considered a helpful adjunct for improving functional outcomes** in knee OA, largely through the pathway of pain reduction and moderate increases in flexibility. Its direct effect on increasing ROM may be less dramatic than its effect on pain, but it appears to support overall rehabilitation goals by making movement easier for patients.

Table 1 **provides a summary of key recent studies (2015–2025) that have examined mechanical knee traction, highlighting their design, interventions, and main findings for pain and mobility outcomes.**

Study (Year)	Design	Sample (N)	Intervention	Outcomes	Key Findings
Choi & Lee (2019)	RCT (Korea)	30 (15 per group)	Traction + standard PT vs. standard PT alone	VAS, WOMAC, BDI (depression)	Traction group had significantly greater improvements in pain, function, and depression compared to control.
Abdel-Aal et al. (2022)	RCT (Egypt)	120 (4 groups)	Standard PT vs. PT + traction at 0°, 20°, or 90° knee flexion (intermittent traction)	VAS, WOMAC, passive ROM	All traction groups improved pain and function more than PT alone. Traction at 20° and 90° knee flexion showed the greatest pain relief; no significant between-group differences in ROM gain.
Kamble & Malawade (2023)	RCT (India)	96 (2 groups)	Conventional therapy (exercise, etc.) vs. Conventional + dynamic traction device	VAS, knee ROM, functional ability	Traction group (dynamic traction) showed significantly greater pain reduction and increased knee flexion ROM than the no-traction group, leading to better functional outcomes.
Riyad et al. (2024)	RCT (Egypt)	40 (2 groups)	Therapeutic exercises vs. Traction + same exercises	VAS, WOMAC, muscle strength, walking & stair test	Both groups improved, but traction+exercise led to significantly more pain relief, less self-reported disability, and greater quadriceps/hamstring strength gains. Walking and stair-climbing times improved similarly in both groups.
Florjančič & Vauhnik (2025)	Observational (Slovenia)	23 (single group)	Standard PT (education, exercise, TENS, etc.) **with added mechanical traction** (150 N force, 15 min, knee ~25° flexion, 8 sessions)	VAS, KOOS subscales, 30s sit-to-stand test	After treatment, pain at rest and during movement decreased significantly. KOOS pain scores improved, and patients' physical activity levels increased. The number of repetitions in the sit-to-stand test also improved. Quality of life scores showed no significant change in the short term.

Table 1: Summary of key clinical studies on mechanical knee traction in osteoarthritis (last 10 years). PT = physiotherapy; VAS = Visual Analog Scale for pain; WOMAC = Western Ontario and McMaster OA Index; ROM = range of motion.

Traction in the Context of Comprehensive Knee OA Management

The positive findings on mechanical traction raise the question of how this modality fits into the broader management of knee osteoarthritis. Clinicians and patients might ask: Should traction be used in addition to or instead of other treatments? How does it compare with other physiotherapy techniques and standard care? Here we discuss these considerations, including comparisons with exercise therapy, other manual therapies, and practical aspects of implementing traction.

Adjunct, Not Stand-Alone: A key point from the reviewed studies is that traction has been most often studied as an **adjunct to conventional therapy**, not as a replacement. In nearly all RCTs, the control groups received some form of exercise or physiotherapy, and traction was layered on top for the experimental group. This reflects real-world practice: traction alone, without addressing muscle strength or general fitness, would likely yield only transient benefits. The evidence indicates that combining traction with active exercise produces superior outcomes (Riyad et al., 2024). Exercise remains the cornerstone of knee OA management due to its effects on strength, joint support, and long-term function. Traction can be viewed as a modality to enhance the effectiveness of exercise by reducing pain and stiffness, thereby enabling better participation in exercise and daily activities.

Comparison with Manual Mobilization: Manual joint mobilization and manipulation are techniques sometimes used by physiotherapists or chiropractors to improve knee mobility and pain. These can include oscillatory movements (glides or distractions) applied by the therapist to the tibiofemoral joint. Traction, in a sense, is a specific type of joint mobilization (long-axis distraction). A systematic review by Weleslassie et al. (2021) on manual therapies in knee OA (specifically Mulligan's mobilization with movement technique) found that such manual interventions can significantly improve pain and function in the short term. This aligns with our findings for mechanical traction. The advantage of mechanical traction devices is that they can apply a more sustained force and possibly at higher magnitudes than a therapist can comfortably achieve manually for extended periods. On the other hand, manual therapy can be fine-tuned by the clinician and combined with specific movements (e.g., the Mulligan technique involves the patient actively moving while the therapist applies traction-glide). There are currently no head-to-head trials of mechanical traction devices versus skilled manual mobilization in knee OA; both appear to have merit. In practice, a therapist might use manual traction techniques during a session and/or use a mechanical traction machine depending on availability and the patient's needs. The common goal is to distract the joint to relieve pain and improve mobility. Courtney et al. (2016) demonstrated that even passive joint mobilization can activate pain modulatory pathways, supporting the notion that such interventions (manual or mechanical) can contribute to pain relief beyond just the biomechanical effects.

Traction vs. Other Modalities: Within physiotherapy, knee OA is often treated with modalities like TENS for pain, ultrasound or heat for tissue extensibility, and bracing or taping for joint support. How does traction compare or complement these? Traction offers a unique mechanical effect (joint gapping) that those other modalities do not provide. For pain relief, TENS and traction can both be effective via different mechanisms (electrical nerve stimulation vs. mechanical decompression); interestingly, Florjančič and Vauhnik (2025) used traction in addition to TENS and found additional benefit, implying the effects are additive. Knee unloader braces mechanically reduce load on one compartment of the knee and have shown moderate pain relief in unicompartmental OA; traction could be seen as an acute, therapy-session-based version of unloading the entire joint. Some patients who cannot tolerate weight-bearing exercise due to pain might benefit from traction first to reduce pain, then transition to exercise or weight-bearing activities. Unlike thermal or electrotherapy modalities, traction has a direct mechanical impact on the joint alignment and spacing, which might be crucial in certain individuals (for example, those with significant joint compression or impingement pain). That said, traction requires equipment and clinician time, so it might be reserved for patients who do not get enough relief from simpler measures.

Integration with Pharmacotherapy: Patients often use analgesics or anti-inflammatory medications alongside therapy. Traction has the advantage of being a drug-free treatment that poses no systemic side effects, which is especially valuable for older patients or those with comorbidities that make NSAIDs or opioids risky. Effective traction treatment may reduce the need for pain medications. Some studies did not explicitly report on medication usage, but one can infer that if pain levels drop, patients might rely less on analgesics. Traction could thus be part of a multimodal plan to minimize drug intake while managing pain.

Patient Selection: Not every knee OA patient may need or benefit greatly from traction. Ideal candidates might be those with signs of joint compression and pain that is relieved by slight joint distraction (one clinical clue: patients who feel better when the joint is unloaded, e.g., experiencing relief with leg pull or manual traction during examination). Patients with mild OA that is well-managed by exercise alone might not require traction. Conversely, patients with very advanced OA (bone-on-bone) might get temporary relief from traction but structural changes may limit functional gains. Also, traction might be particularly useful in patients with concomitant low back issues, because it can be done in non-weight-bearing (lying down), offering knee pain relief without stressing the spine further (unlike weight-bearing exercises). Importantly, contraindications for knee traction should be observed: these include severe joint instability, significant ligamentous laxity, acute inflammatory arthritis (e.g., flare of rheumatoid arthritis or active infection), or fractures. In osteoarthritis, those contraindications are rare, but if a patient has had recent knee surgery or is extremely hypermobile, traction would be used with caution.

Parameters and Practical Protocols: The evidence provides some guidance on effective traction protocols. Intermittent traction appears beneficial – for instance, Vekariya et al. (2019) concluded that intermittent mechanical traction with a 30-second hold and 10-second rest cycle for about 15 minutes was effective. This cycling may help pump the joint fluid and alternately stretch-relax the tissues. Continuous traction can also reduce pain (Florjančič & Vauhnik, 2025 used continuous 150 N for 15 min), but perhaps the intermittent method is more comfortable and equally effective for most. Regarding force, applying roughly 10–15% of body weight in traction force was common (Abdel-Aal et al., 2022), although some devices simply use a set force like 150 N (~15 kg). Higher forces might produce more gapping but also more patient discomfort; no study directly compared different forces systematically, aside from ongoing pilot work (there is a mention of trials trying to find the "most appropriate traction force" via imaging joint space). Knee flexion angle during traction matters: evidence points to performing traction with the knee slightly flexed (20°) or at mid-range (90°) rather than fully extended, for optimal pain relief (Abdel-Aal et al., 2022). Clinically, ~25° of flexion (as used by Florjančič & Vauhnik, 2025) is convenient using a roll under the knee, and seems to be a reasonable compromise to slacken the posterior tissues while still aligning the joint. Traction session frequency in studies was typically 2–3 times per week over a few weeks. No clear consensus exists on how many total sessions yield maximum benefit; improvements were seen after 8–12 sessions in various trials.

Patient Experience and Adherence: Anecdotally, patients often report feeling an immediate sense of lightness or relief in the knee after a traction session, which can be encouraging and build confidence in movement. This positive feedback may improve overall adherence to therapy programs. However, some patients might find the setup cumbersome or experience mild discomfort from the harness or force. Proper patient education and gradual increase of force can mitigate these issues. In the studies, drop-out rates were low, implying traction is generally well-tolerated.

Guidelines and Recommendation Status: As of now, major clinical guidelines for knee OA (e.g., from OARSI or the American College of Rheumatology) do not specifically list mechanical knee traction as a recommended treatment. This is likely due to the relative newness of robust evidence. Most guidelines strongly recommend exercise, weight loss, and topical or oral NSAIDs as first-line treatments, with conditional recommendations for modalities like acupuncture, tai chi, or manual therapy. Traction might eventually be considered in future guidelines if evidence continues to accumulate. For example, an evidence-based review (Vekariya et al., 2019) has already synthesized multiple trials and could serve as a basis for recommendations. In practice, especially in some regions (India, parts of Europe), physiotherapists have begun incorporating knee traction for patients who do not sufficiently respond to exercise alone. Given its safety and demonstrated efficacy in reducing pain, it could be argued that traction is a reasonable component of a comprehensive, non-pharmacological OA treatment plan, tailored to individual patient needs.

Conclusion

Mechanical traction has emerged as an effective supplementary therapy for managing pain and improving joint function in knee osteoarthritis. The collective findings from the past decade of research indicate that when mechanical knee traction is added to standard care—whether that be exercise therapy, electrotherapy, or manual therapy—it can significantly enhance pain relief. Patients undergoing traction report greater reductions in pain intensity and improvements in pain-related disability than those receiving conventional therapies alone. Traction achieves this by mechanically unloading the joint, which in turn likely reduces nociceptive drive and allows greater comfort with movement.

Improvements in joint mobility and physical function with traction are also evident, though they tend to be proportional to the pain relief achieved. In many cases, traction enables increased knee range of motion and better performance in functional tasks by alleviating pain and stiffness. When combined with targeted exercises, traction can facilitate larger gains in muscle strength and functional capacity, indirectly contributing to a more active lifestyle for knee OA patients. Essentially, traction helps "set the stage" for effective rehabilitation by mitigating pain and capsular tightness, thereby promoting fuller participation in exercise and daily activities.

From a clinical standpoint, mechanical traction should be viewed as an **adjunctive treatment**. It complements but does not replace core interventions like therapeutic exercise. For patients who continue to experience pain despite exercises and medications, or who have difficulty tolerating weight-bearing activities due to pain, traction offers a valuable tool to break the pain cycle and improve mobility. It is a safe modality with minimal side effects reported in trials; any minor discomfort from the pulling force is typically transient and can be controlled by adjusting traction parameters. The optimal traction protocol appears to involve intermittent traction at a moderate knee flexion angle, with forces individualized to the patient's tolerance (often around one-tenth of body weight), applied a few times per week.

In regions such as India and Egypt, where research has shown traction's benefits, this modality is gaining traction (no pun intended) among physiotherapists for routine clinical use. As evidence grows, it is likely that more clinics globally will incorporate knee traction, especially as part of multi-modal physiotherapy regimens.

However, there are still gaps in knowledge. Long-term effectiveness of mechanical traction remains to be determined—most studies so far have short follow-ups. It is unclear if regular maintenance traction (e.g., monthly sessions) would sustain the benefits or if patients regress once traction is stopped. Additionally, while short-term structural changes in cartilage are not expected from brief traction, the impact on disease progression (joint space narrowing over years) has not been studied. Future research should also compare traction to other interventions in head-to-head trials (for example, traction vs. knee bracing, or traction vs. acupuncture) to better position its role in treatment algorithms. Cost-effectiveness analyses would be useful to see if adding traction (with its equipment and therapist time requirements) provides sufficient benefit relative to its costs.

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