

Impact of Manual Traction on Knee Pain in Patients with Osteoarthritis

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Abstract: ***Background:** Osteoarthritis (OA) of the knee is a common degenerative joint disorder associated with pain, stiffness, and reduced functional mobility. Manual traction is a conservative physiotherapy technique used to reduce pain and improve joint mobility in patients with knee OA. **Methodology:** This experimental study was conducted in Nashik city on 61 participants diagnosed with Grade I, II, and III osteoarthritis of the knee. Subjects aged 40–60 years of both genders were selected using purposive sampling. Pain intensity was assessed using the Visual Analogue Scale (VAS) before and after 7 sessions of manual traction. During treatment, participants were positioned in supine lying, the femur was stabilized with a belt, and traction was applied along the long axis of the tibia for 30 seconds, repeated 3–4 times per session. Data were analyzed using SPSS version 26 with paired sample t-test. **Results:** The mean pre-intervention VAS score was 5.78 ± 1.46 , which reduced to 3.84 ± 1.46 post-intervention. The reduction in pain was statistically significant ($t(60)=15.8$, $p<0.001$) with a large effect size (Cohen's $d=2.02$). **Conclusion:** Manual traction was found to be effective in significantly reducing knee pain in patients with osteoarthritis and may be considered a useful conservative physiotherapy intervention.*

Keywords: Osteoarthritis knee, Manual traction, Knee pain, Visual Analogue Scale, Physiotherapy, Pain management

1. Introduction

The knee complex is the most common damaged joint during athletic activities and daily wear and tear process the intricacy of the joint is revealed by the multiple ligamentous attachments and muscle traverse it. The intricate interaction between the knee complex's simultaneous mobility and stabilisation roles is made possible by its anatomical complexity. During static erect posture, the knee joint supports the body's weight in concert with the hip, ankle, and foot joints. Moving and supporting the body during a range of routine and challenging activities is the dynamic responsibility of the knee complex. The intricate structure and variety of functions of the knee reflect its primary roles in mobility and stability. The tibiofemoral joint and the patellofemoral joint are two separate articulations that are housed inside a single joint capsule and make up the knee complex.¹

The articular surface of knee joint is condyles of femur, patella and condyles of tibia.² There are various degenerative disease of knee joint. Degenerative joint disease (DJD) is a common term used to describe OA. This is misleading since OA is not only a wear-and-tear process; rather, it is an aberrant remodelling of joint tissues brought on by a variety of inflammatory mediators in the affected joint. Age, gender, previous joint injury, obesity, genetic susceptibility, and mechanical variables, such as misalignment and aberrant joint form, are the most prevalent risk factors for osteoarthritis (OA).^{3,4}

The most often reported OA complaint is pain. People may have nagging, aching pain that is poorly localised, asymmetric, and episodic early in the course of the illness. Reports of pain intensity and frequency rise as the illness worsens. Although the pain may be referred, more severe

complaints of discomfort are typically localised to the affected joint.⁵

It is a common musculoskeletal disorder that can affect any joint, including the spine and upper limbs, but it is most commonly seen in the big joints of the lower extremities, such as the hip and knee.^{6,7} Numerous risk factors, including age (ageing process), genetics, obesity, joint damage, anatomical abnormalities, metabolic disorders, and inflammatory joint illnesses, might contribute to osteoarthritis.⁸ Intermittent traction had the effect of increasing lymphatic and vascular flow.⁹

Osteoarthritis is degenerative joint disease which causes deterioration of the joint structures leading to narrowing of the joint space and joint dysfunction.¹⁰ One method for treating joint dysfunction, including pain, stiffness, and reversible joint hypo mobility, is manual traction.

Traction is a passive movement that can be carried out slowly. It reduces pain increase joint mobility through the flow of synovial fluid, which can deliver nutrients to the fibro cartilage in the joints and the avascular portion of the joint cartilage on the joint surface, this traction can promote biological activity, there is an effect of giving Manual Traction in Osteoarthritis Sufferer.¹¹ Knee traction is not commonly practised for knee joint osteoarthritis.¹² Traction treatment is believed to help people with degenerative arthritis.¹³ Conservative measures are the first line of treatment for knee OA.¹⁴ Manual therapy (MT), electrotherapy, and therapeutic exercise are among the therapeutic approaches used in the rehabilitation of OA patients. Among these methods, manual therapy is a practical physiotherapy treatment that can help patients feel less pain and function better.¹⁵⁻¹⁷

Anatomy and biomechanics

The knee is largest and complex joint of body, the tibiofemoral or knee joint is double condyloid joint with about three rotator degree of freedom. The tibiofemoral joint and the patellofemoral joint are two separate articulations that are housed inside a single joint capsule and make up the knee complex. Articulating surface of knee joint are condyle of femur, the patella and condyle of tibia, the articulation between the proximal tibia and the distal femur is known as the tibiofemoral joint. The articulation between the posterior patella and the distal femur is known as the patellofemoral joint. The Anterior Cruciate Ligament (ACL), Posterior Cruciate Ligament (PCL), Medial Collateral Ligament (MCL), and Lateral Collateral Ligament (LCL) are the four primary knee ligaments; other ligaments are ligamentum patellae, fibrous capsule, oblique popliteal ligament, arcuate popliteal ligament. These ligaments give stability, regulate mobility, and shield the knee joint by joining the thigh bone (femur) to the lower leg bones (tibia and fibula). There are two menisci to prevent extrusion during compression of knee joint they are medial and lateral menisci namely. Muscles the flexor group of knee contain semimembranosus, semitendinosus, biceps femoris (long and short head), Sartorius, gracilis, popliteus and gastrocnemius; the knee extensor group contain four muscle called as quadriceps femoris they are vastus lateralis, vastus medialis, vastus intermedius, rectus femoris. Knee joint kinematics in weight bearing position the femoral condyle roll posteriorly while simultaneously gliding anteriorly on fix tibia, in extension femoral condyles roll anteriorly and glide posteriorly on fix tibia. Rolling and gliding of tibial plateaus on fixed femur during knee extension in non-weight bearing, the tibial plateaus roll anteriorly and glide anteriorly, in flexion tibial plateaus roll posteriorly and glide posteriorly.^{1,2} The range of knee flexion is 0° to 135° to 150° and Extension 0°.^{1,18}

Pathophysiology

Early in the disease, fibrillation occur due to the weight-bearing articular cartilage's loss of water is observed, followed by total articular cartilage loss. The underlying bone is under tremendous pressure as a result, which leads to Both later eburnation and sclerosis. Because of tiny fractures, cysts may develop into subchondral area. New bone growth occurs, leading to the creation of osteophyte formation. The following events occurring during osteoarthritis knee.

- 1) Degradation of Cartilage: Tough, smooth substance that covers the ends of the bones in the knee joint are called articular cartilage. Because of the dysregulation of chondrocytes (cartilage cells) in OA, more matrix metalloproteinases (MMPs) and other degradative enzymes are produced. Important elements of the cartilage matrix, such as collagen type II and proteoglycans are broken down by these enzymes. Cartilage thinning, fibrillation, and erosion result from the loss of the equilibrium between synthesis and breakdown.
- 2) Remodeling of the subchondral bone: The subchondral bone, which is beneath the cartilage, is subjected to more stress as the cartilage degrades. Osteophyte production (bone spurs), sclerosis (hardening), and occasionally bone cysts or microfractures are brought on by this. These alterations worsen joint mechanics and exacerbate stiffness and discomfort.^{1,2,3}

Manual traction

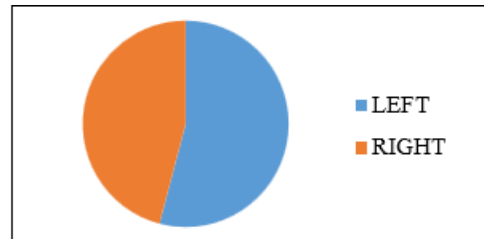
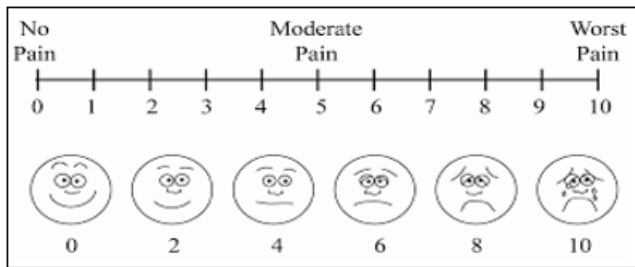
Traction is a type of manual therapy it is one method for treating joint dysfunction, including pain, stiffness, and reversible joint hypo mobility. Traction is a passive movement that can be carried out slowly. Through the flow of synovial fluid, which can deliver nutrients to the fibro cartilage in the joints and the avascular portion of the joint cartilage on the joint surface, this traction can promote biological activity.⁹

Effect of Manual Traction

Repeatedly using manual traction techniques will enhance microcirculation and fluid release as the traction moves, increasing the tissue's water and matrix content and making it more elastic. To improve and preserve the flexibility of the capsules, the traction motion components are also almost identical to the knee joint's physiological flexion movements. Any mechanical dysfunction in the muscles, ligaments, or both must be fixed mechanically. Consequently, manual therapy in the type of traction has a tendency to move the joints at the articular surface level; the combination of mechanical and athletic traction enhances function and lessens pain.⁹ Traction aids in pain relief, increases knee range of motion, and enhances the patient's quality of life, since joint cartilage is aneural; periarticular pain is recognized to be the cause of knee osteoarthritis pain. Outside the cartilage, as well as intra-articular tissues. By pulling the shortened tissues and distracting the knee joint, long axis traction momentarily reduces joint compression and permits smooth movement. By increasing vascular and lymphatic flow, intermittent traction lessens edema and stasis.¹⁴

2. Methodology

The purpose of this experimental study is to determine the impact of manual traction on knee pain in patients with osteoarthritis. The study will be conducted in Nashik city using a purposive sampling technique, and a total of 61 participants will be selected based on inclusion and exclusion criteria. The sample size has been calculated using OpenEpi software. Participants of both genders between the ages of 40 and 60 years, diagnosed with Grade I, II, or III osteoarthritis of the knee, will be included in the study. Individuals with any recent lower limb surgery, trauma or injury to the knee, malignancy, bone tuberculosis, or Grade IV osteoarthritis will be excluded from the study to avoid factors that may influence the effectiveness of the intervention or compromise participant safety. The materials required for the study include a Visual Analogue Scale (VAS), mobilization belt, and plinth. The intervention aims to evaluate the effect of manual traction on reducing knee pain associated with osteoarthritis. Pain intensity will be assessed using the Visual Analogue Scale (VAS), a valid and reliable tool for measuring perceived pain. The VAS consists of a 10 cm horizontal line where 0 indicates "no pain" and 10 indicates "worst pain imaginable." Patients will be instructed to mark their present level of pain on the scale. Pain scores are generally categorized as mild (1–3), moderate (4–6), severe (7–9), and worst possible pain (10). The study duration will be six months, and the findings will help determine whether manual traction has a significant impact on knee pain in patients with osteoarthritis.



Graph 1

3. Procedure

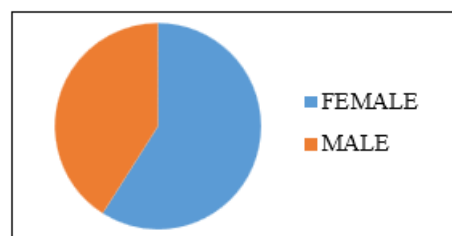
All participants signed an informed consent form after the basic information regarding the study was explained to them, and proper verbal instructions regarding the procedure and technique were provided. Pain intensity was assessed using the Visual Analogue Scale (VAS) before the application of manual traction treatment and after completion of the treatment protocol, i.e., after 7 sessions. The VAS is a valid and reliable tool used to measure perceived pain intensity and consists of a 10 cm horizontal line, where 0 indicates “no pain” and 10 indicates the “worst pain imaginable.” Participants were instructed to mark their present level of pain on the scale by drawing a vertical line intersecting the scale. They were also informed that scores between 1–3 indicate mild pain, 4–6 indicate moderate pain, 7–9 indicate severe aching pain, and 10 indicates severe pain. Pre-treatment VAS scores were recorded before the intervention. For the treatment procedure, the subject was positioned comfortably in a supine lying position on a couch. The femur was stabilized using a mobilization belt, while the therapist grasped the distal leg proximal to the malleoli with both hands. The therapist then applied manual traction by pulling along the long axis of the tibia with sufficient distraction force to separate the joint surfaces. The traction was maintained for 30 seconds and repeated 3 to 4 times during each session. The intervention was continued for one week. After completion of 7 sessions, pain intensity was reassessed using the Visual Analogue Scale with the same instructions regarding pain categories, and post-treatment VAS scores were recorded to evaluate the impact of manual traction on knee pain in patients with osteoarthritis.

The site of complaint percentage is left side affected is 54.10% and right side affected is 45.90% blue segments represents left side (54.10%), orange segments represents the right side (45.90%).

Gender distribution

Table 2

Gender	Count	Percentage of Total
Female	36	59.00%
Male	25	41.00%



Graph 2

Table 2 presents a total 61 subject were taken for study out of 61 subjects 36 were female and 25 were male, percentage of female patient was 59.10% and male 41.00%, Blue segment it presents females; Red segments: it presents male.

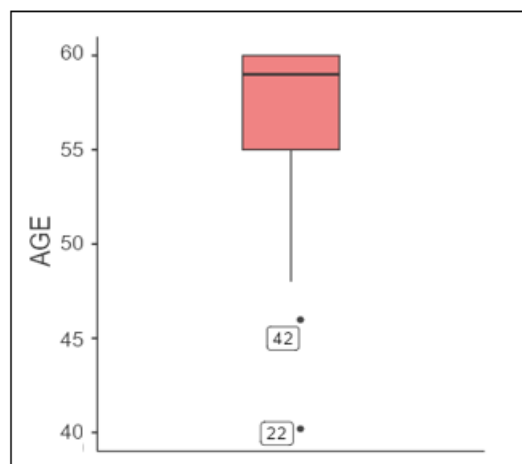
4. Data Analysis and Result

This chapter deals with the method used for statistical analysis, data analysis was done using SPSS version 26 software package mean and standard deviations were used as descriptive statistics, paired t test was performed to compare side affected, age, gender. Comparison of pre and post VAS score had been calculated by using shapiro Wilk test , comparison for pre and post VAS done using paired sample t - test The obtained data from the patient was organized in master chart various tables along with graphs derived for statistical analysis for easy interpretation of result.

Age distribution

Table 3

	N	Mean	Median	SD	Minimum	Maximum
Age	61	56.8	59	4.4	40	60



Graph 3

Table 3 presents the participants (N = 61) had a mean age of 56.8 ± 4.4 years (range: 40–60), with a median of 59 years, indicating a predominantly middle-aged to older adult sample.

Result

Frequencies of Site of Complaint

Table 1

	Count	Percentage of Total
Left	33	54.10%
Right	28	45.90%

Graph 3 presents the participants (N = 61) had a mean age of 56.8 ± 4.4 years (range: 40–60), with a median of 59 years, indicating a predominantly middle-aged to older adult sample.

Visual analogue scale distribution

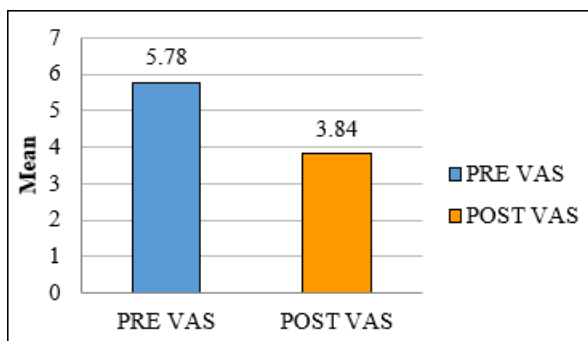
Paired sample t –test

	Mean	Median	SD	Minimum	Maximum	Shapiro-Wilk	
Pre VAS	5.78	5.8	1.46	2	8.5	0.97	0.138
Post VAS	3.84	3.6	1.46	0.5	7	0.979	0.375

Table .4

Table 5

	statistic	df	p	Mean	SE		Effect
Student's t	15.8	60	<.001	1.94	0.123	Cohen's d	2.02



Graph 4

This table no.4 and 5 presents the results of a paired t-test evaluating the effectiveness of an intervention in reducing pain, as measured by the Visual Analog Scale (VAS).

Pre-intervention VAS score: Mean = 5.78, Standard Deviation (SD) = 1.46 =Indicates moderate pain levels before the intervention.

Post-intervention VAS score: Mean = 3.84, SD = 1.46 = Shows a noticeable reduction in pain after the intervention t-value of 15.8 with 60 degrees of freedom suggests a highly significant difference.

p-value < 0.001 confirms the statistical significance.

Effect size (d = 2.02) is considered very large, indicating a strong impact of the intervention on pain reduction.

Sample Overview

VAS Pain: Pre –Post comparison

Table 6

Measures	Mean± SD
Pre –intervention	5.78±1.46
Post –intervention	3.84±1.46

Table 7

Test	t(df)	Mean.diff.	95%CI	p-value	Effect size
Paired t-test	15.8(60)	1.94	1.69-2.19	<0.001	2.02

Table 7 and 8 give descriptive statistics summarized the sample (N=61): mean age 56.8 ± 4.4 years (range 40–60), 59.0% female and 41.0% male, with the site of complaint left knee in 54.1% and right knee in 45.9%. Normality of VAS scores was verified with Shapiro–Wilk tests (PRE: W=0.970, p=0.138; POST: W=0.979, p=0.375), so a two-tailed paired-samples t-test ($\alpha=0.05$) compared pre- and post-intervention pain. Pain decreased from a mean of 5.78 pre-intervention to 3.84 post-intervention, a mean reduction of 1.94 VAS points (~33.6%). The change was statistically significant, $t(60)=15.8$, $p<.001$, with a very large effect size (Cohen's $d=2.02$). The mean difference had an estimated 95% CI of 1.69 to 2.19, indicating precise and substantial reduction in knee pain following manual traction, consistent with the study's aim and supporting rejection of the null hypothesis.

5. Discussion

The purpose of the current study was to assess how manual traction affected knee pain in individuals with osteoarthritis. According to the Visual Analogue Scale (VAS), the results indicate decrease in pain intensity after applying manual traction for a week. This gives idea that manual traction is useful treatment for osteoarthritis knee discomfort. Osteoarthritis is a chronic joint condition characterised by abnormalities in the cartilage of the joints and surrounding bones. Bones will rub against one another due to cartilage, which can be uncomfortable, stiff, and impair end-range movement, shows that osteoarthritis, a degenerative joint disease, is associated with the loss of joint cartilage.

The hallmarks of osteoarthritis, a chronic, slowly progressing disorder, and Weight-bearing joints like the spine, pelvis, knees, and ankles are commonly affected by osteoarthritis. Age (ageing process), heredity, obesity, joint injury, anatomical anomalies, metabolic diseases, and diseases of joint inflammation are just a few of the many risk factors.(Bove, Smith, Bise, 2018). Elevated BMI, prior knee injury, presence of Heberden's nodes or hand osteoarthritis, female gender, advanced age, vigorous physical activity, certain occupational tasks (such as kneeling or squatting), and decreased bone mineral density are identified as risk factors for the development of knee osteoarthritis in older persons. (Blagojevic M, Jinks C et al. 2010). Early in the illness, people may have episodic, asymmetric, poorly localised, nagging, aching pain. Intensity and frequency of pain are reported to increase with the severity of the sickness. More acute complaints of discomfort are usually restricted to the afflicted joint, however the pain may be transferred (Dong kyue Lee et al.2019). The effectiveness of manual knee traction on the several knee-specific factors was examined severalstudy. After six sessions of manual knee traction, it was shown that there was a substantial decrease in the degree of the pain, little variation in the improvement of knee flexion range, and an increase in overall functional outcome (Antony Leoaseer et al. 2014).

Manual traction techniques enhance microcirculation and significantly boost fluid release, hence augmenting the water and matrix content inside the tissue, resulting in improved elasticity. Manual traction techniques that are used often during traction movement can enhance microcirculation and fluid release, increasing the amount of water and matrix in the

tissue and making it more elastic. Furthermore, the components of the traction motion are nearly identical to the knee joint's natural flexion movements in order to maintain and improve the pain intensity. When compared to exercise therapy alone, manual therapy including traction may offer advantages in terms of pain relief and functional enhancement. To determine the long-term effectiveness and differentiate the unique effects of traction from other manual therapy modalities, these evaluations also underlined the necessity for additional high-quality randomised controlled trials (Alexios et al. 2021, Shah Nawaz et al. 2018) previous literature highlighted effect of traction in osteoarthritis knee management (Vaishali et al. 2014). For knee pain patients, manual therapy significantly improves physical function, reduces stiffness, and eases discomfort. The results showed that manual therapy was helpful in managing pain and might be used as an alternate and supplemental treatment for patients in rehabilitation programs. (Qinguang Xu et al. 2017) Manual therapy can help individuals with knee OA experience a temporary decrease in pain as well as an improvement in knee range of motion and functionality. By lowering pain and improving functionality, manual therapy methods can help patients with knee OA receive better care. By contrasting the effectiveness of manual therapy with that of other treatment approaches (Tsokanos A)

The Effect of Roll Slide Mobilization and Traction Manual on Knee Pain Scale Intensity Patients with Osteoarthritis. The average pain score for patients with knee osteoarthritis, as determined by mobilisation, is 2.82 with a standard deviation of 0.501. Following the application of manual traction and roll slide mobilisation to patients with knee osteoarthritis, the average knee pain score was 2.14, with a standard deviation of 0.774. The difference in knee pain intensity between patients with osteoarthritis before and after the Roll Slide Mobilisation and Manual Traction intervention is 0.682, with a standard deviation of 0.568 and a p-Value of 0.000. This indicates that the Effect of Roll Slide Mobilisation and Manual Traction in Osteoarthritis Sufferers is influenced. (Tati Murni Karokaro, et al. 2019)

In present study the Visual Analogue Scale (VAS) is used it is reliable tool for measuring changes in pain intensity before and after the intervention in the current study design. This study aim to whether a statistically and clinically significant reduction in pain may be attained by regularly performing manual traction and re evaluating pain levels pre and post traction after 7 setting, manual traction is non-invasive, and simple method for managing knee OA in physiotherapy, especially in environments with limited resource, In present study the total participants. (N): 61, Average Age: 56.8 ± 4.4 years, Gender Distribution: Female: 36 (59%), Male: 25 (41%), Site of Complaint: Left knee: 33 (54.1%), Right knee: 28 (45.9%) Pain (VAS) Comparison Pre-intervention VAS: 5.78 ± 1.46 , Post-intervention VAS: 3.84 ± 1.46 , Mean Difference: 1.94 (reduction in pain score), Paired t-test: $t(60) = 15.8$, 95% Confidence Interval: 1.69 – 2.19, p-value: < 0.001 (highly significant) Effect Size (Cohen's d): 2.02 (very large effect) The protocol of manual traction for 7 settings significantly reduced pain levels in patients (mean reduction of ~2 points on the VAS scale). The p-value < 0.001 indicates this result is not due to chance. Moreover, the very large effect size ($d = 2.02$) suggests the manual traction had a strong

clinical impact. However, the study emphasises the promise of manual traction as an economical, non-invasive treatment for osteoarthritis in the knee. Considering its simplicity and basic needs for equipment, it could be give into daily life profession of physiotherapy, particularly in environments with low resources. Overall, manual traction help patients with osteoarthritis experience less knee discomfort, according to the material currently in publication and the suggested approach. As a result, this intervention could be viewed as a supplement to traditional physiotherapy management techniques meant to enhance patients' comfort, mobility, and quality of life.

5.1 Summary

This study was undertaken to aim the impact of manual traction on knee pain in patient with Osteoarthritis of knee, The basic objective was to decrease the pain with manual traction, In the present study 61 patients diagnosed with Osteoarthritis of knee age group between 40 to 60 years and there were 36 female and 25 male.

In this study patient instructed pre VAS noted, patient in supine position manual traction given for 7 setting post VAS noted. According to outcome measure the Visual Analogue Scale (VAS), the results indicate a decrease in pain intensity after applying manual traction for a 7 setting.

Pain (VAS) Comparison Pre-intervention VAS: 5.78 ± 1.46 , Post-intervention VAS: 3.84 ± 1.46 , Mean Difference: 1.94 (reduction in pain score), Paired t-test is used, showed significant decrease in pre VAS and post VAS; $t(60) = 15.8$, 95% Confidence Interval: 1.69 – 2.19, p-value: < 0.001 , large effect size ($d = 2.02$) suggests the manual traction had a strong clinical impact.

5.2 Conclusion

The present study demonstrated a significant reduction in pain intensity following the intervention as indicated by decrease in visual analogue scale score (VAS) pre and post treatment the sample consisted of 61 participants, with higher proportion of female (59%) and male (41%) and mean age approximately 57 years, The mean pre intervention score (5.78 ± 1.46) decrease to post intervention score of (3.84 ± 1.46) with mean difference of 1.94, result from the paired t - test confirmed significance of this reduction ($t(60) = 15.8$, $p < 0.001$) and the large effect size (Cohen's d 2.02) further indicates the substantial clinical impact of intervention, the reduction in visual analogue scale gives the clinical importance of intervention in alleviating pain and improving patient comfort these finding support use of the studied approach as an effective strategy in decreasing knee pain in patients with osteoarthritis and provide foundation for future research.

5.3 Suggestions

Low sample size, only one outcome measure emphasise the necessity of bigger, more varied populations, longer intervention durations, and thorough outcome measures, including as imaging investigations and functional evaluations, in future research. The evidence foundation for manual traction's clinical use would be strengthened and its

role in treating osteoarthritis in the knee would be further clarified by including control groups and contrasting it with other conservative approaches.

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