

# Effect of Kinesio Taping Versus Mulligan's Mobilization with Movement on Pain and Function in Subjects with Osteoarthritis of Knee: A Comparative Study

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**Abstract:** ***Background:** Osteoarthritis is becoming increasingly recognized in both developed and developing countries as a major cause of pain and functional disability especially in elderly. As compared to other joints, OA of the knee causes greater disability and clinical symptom. **Objective:** To compare the effect of kinesiotaping and Mulligan's Mobilization with Movement on pain and function in subjects with osteoarthritis of knee. **Outcome measures:** VAS and WOMAC. **Methodology:** 36 subjects were divided into 3 groups for mobilization with movement, kinesiotaping and control group. **Result:** statistically significant difference can be seen in each group as well as between group. **Conclusion:** Mobilization with movement and kinesio taping both reduce pain and improve function but better improvement was seen in mobilization with movement group.*

**Keywords:** kinesio taping, mobilization with movement, osteoarthritis of knee

## 1. Introduction

Osteoarthritis (OA) is one of the most prevalent musculoskeletal complaints worldwide. <sup>(1)</sup> It has been defined by the American College of the Rheumatology (ACR) as a "heterogeneous group of conditions, which lead to joint symptoms and signs associated with defective integrity of the underlying bone and joint margins." Osteoarthritis is becoming increasingly recognized in both developed and developing countries as a major cause of pain and functional disability especially in elderly. As compared to other joints, OA of the knee causes greater disability and clinical symptom. <sup>(2, 3, 4)</sup>

Osteoarthritis (OA) is a common condition seen after 40 years of age and is widespread in adults older than 65 years. <sup>(5)</sup> Osteoarthritis is the second most common rheumatologic problem and it is the most frequent joint disease with a prevalence of 22% to 39% in India. <sup>(6)</sup> Worldwide estimates indicate that 9.6% of men & 18% of women aged  $\geq 60$  years have symptomatic OA. According to world health report 2003, increases in life expectancy and ageing populations are expected to make osteoarthritis (OA) the fourth leading cause of disability by the year 2020. <sup>(7)</sup> The Framingham knee osteoarthritis study suggest that knee osteoarthritis increase in prevalence throughout the elderly years, more so in women than man. <sup>(8)</sup> In India, osteoarthritis of knee was found in females is 31.6% and in males is 28.1%. <sup>(6)</sup>

Osteoarthritis is a chronic degenerative disorder of multifactorial etiology characterized by loss of articular cartilage and peri-articular bone remodelling. It is probably not a single disease but it represents the final end result of various disorders as joint failure. OA may cause joint pain, bony or soft tissue swelling, bony crepitus, tenderness, bony

hypertrophy, peri-articular muscle atrophy, deformity and marked loss of joint motion. Osteoarthritis commonly affects the hands, feet, spine, and large weight-bearing joints, such as the hips and knees. <sup>(9)</sup>

When OA affects weight-bearing joints, mainly the knee, it leads to a marked decline of muscle function and consequently to a reduction balance and especially of the ability to perform sit-to-stand tasks, to gait alterations, functional limitation, and loss of independence. Therefore, OA is considered to be an intrinsic risk factor for the occurrence of fall. Osteoarthritis of knee may result in changes that affect not only intracapsular tissues but also periarticular tissues, such as ligaments, capsule, tendons and muscle. <sup>(10)</sup> In present era Kinesio taping and Mobilization with Movement technique are used most frequently for management of musculoskeletal conditions. Kinesio taping (KT) is a therapeutic technique that corrects and treats many musculoskeletal disorders which is based on natural healing process. <sup>(11)</sup> Mobilization with Movement (MWM) is a manual therapy technique advocated by Brian Mulligan for treating joint pain, stiffness, and dysfunction. <sup>(12)</sup>

Studies have been shown that both Kinesio taping and Mobilization with Movement (MWM) techniques proved immediate and short term effective method of treatment on improving pain and functional disability in subjects with osteoarthritis of knee. <sup>(13, 14)</sup> So the purpose of study was to compare the effect of Kinesio taping and Mobilization with Movement (MWM) on improving pain and function in subjects with osteoarthritis of knee.

## 2. Review of Literature

Chandra Prakash pal et al. (2016) conducted a study on Epidemiology of knee osteoarthritis in India and related

factors. The total sample size was 5000 subjects. Data were collected using structured questionnaire and X-ray investigation. The present study shows a prevalence of 28.7% in the overall sample. The prevalence was higher in villages (31.1%) and big cities (33.1%) as compared to towns (17.1%) and small cities (17.2%). OA of the knees was found to be more prevalent in females (31.6%) than in males (28.1%). This finding is statistically significant ( $P = 0.007$ ). Prevalence was highest in participants who have a sedentary lifestyle followed by participants with a physically demanding lifestyle and active lifestyle. OA prevalence was found to be significantly more ( $P = 0.001$ ) in participants who used Western toilet (42.1%) as compared to those who used Indian toilet (29.7%) or both types (38.8%).<sup>(6)</sup>

**Bharti Tripathi et al (2017)** conducted a study on Effects of kinesiotaping on osteoarthritis of knee in geriatric population. In these study they have included 30 participants with clinically diagnosed OA and were divided into 2 groups (Experimental and Control group). Participants in Experimental group received kinesiotaping along with standard conventional physiotherapy. Participants in Control group received only standard conventional physiotherapy and both the groups were treated for 3 week. The results shows that the experimental group showed more improvement than control group so it can be started that conventional physiotherapy with kinesiotaping has beneficial effects in participants osteoarthritis of knee.<sup>(15)</sup>

**Sathiyavani Dhanakotti et al (2015)** conducted a study on Effects of Additional Kinesiotaping Over the Conventional Physiotherapy Exercise on Pain, Quadriceps Strength and Knee Functional Disability in Knee Osteoarthritis Participants- A Randomized Controlled Study. In these study they have included 30 knee osteoarthritis individuals and were randomly allocated into two groups (conventional PT & kinesiotaping plus conventional PT; N=15 in each group). Both groups received the same conventional PT program of muscle stretching and strengthening exercises for 3 weeks and the KT group additionally received kinesiotaping at thrice per week for 3 weeks. The study concluded that the addition of kinesiotaping to the CPT was capable of reducing pain, improving quadriceps strength and knee functional ability in knee OA participants.<sup>(16)</sup>

**Reepa Avichal Ughreja et al (2017)** conducted a study on MULLIGAN'S MOBILISATION WITH MOVEMENT (MWM) relieves pain and improves functional status in osteoarthritis knee. In these study they have included 30 patients diagnosed with medial compartment tibiofemoral osteoarthritis of the knee and were randomly divided into two groups (experimental and control groups) with 15 subjects in each group. The experimental group received medial glide MWM and medial rotation glide MWM in weight bearing and non-weight bearing positions after which the patients were asked to walk for a while. Conventional therapy in the form of shortwave diathermy (SWD), quadriceps strengthening and stretching of the calf and hamstrings was given to both the experimental and the control group. The duration of study was seven days. Outcome measures were WOMAC score, VAS score and distance walked in 6-minute walk test. The study concluded

that Mulligan's MWM is significantly effective in relieving pain and improving functional status in osteoarthritis of the knee.<sup>(17)</sup>

**Anjali Vyankatesh Kulkarni et al (2017)** conducted A Study to Determine the Effectiveness of Mobilization with Movement Techniques in Knee Osteoarthritis Pain. In these study 30 patients (males and females) who fulfilled inclusion criteria were selected with the informed consent from BSTR hospital, Pune, India. Subjects were randomly divided into two groups: Control Group (15 subjects) and Experimental Group (15 subjects). On the first day, each patient was subjected to 6-minute walk test and VAS (pain) and distance covered was noted. Control group received conventional treatment (TENS and exercise program) and Experimental group received conventional treatment along with Mulligan's mobilization with movement technique. The study concluded that Mulligan's Mobilization with Movement (MWM) technique is effective in reducing pain in patients with knee osteoarthritis. Statistically significant reduction in VAS (pain) and marked improvement in the distance covered by the subjects was observed in the experimental group post treatment.<sup>(18)</sup>

**Madhusudan Tiwari (2015)** conducted a study on "Effects of combined isotonic exercises protocol on unilateral symptomatic osteoarthritis knee". - An experimental design, different subject group was used in the study. Thirty short listed patients were randomly assigned to the two different groups. Group A (Experimental Group) - Combined (Quads. & Hamst.) isotonic muscle strength training group. Group B (Control Group) - Isolated quadriceps muscles isotonic strength training group. The result of this study shows that combined (Quadriceps and Hamstrings) isotonic Exercises are better than isolated Quadriceps isotonic Exercises in terms of pain reduction as measured by Visual Analogue Scale and improvement in function as measured by Step Test and Walking speed.<sup>(19)</sup>

### 3. Methodology

The study was approved by Institutional Ethical committee. 36 patients were taken for the study who were referred from the O.P.D based clinical setup and were screened to find out their suitability as per the inclusion and exclusion criteria were as follows:

#### Inclusion Criteria

- 1) Subjects referred by orthopedic surgeon with diagnosis of osteoarthritis of knee.
- 2) Age:-40-65 year
- 3) Both gender (male and female) were included.
- 4) Grade 1 and 2 radiologically diagnosed OA knee according to Kellgren and Lawrence grades of osteoarthritis.
- 5) Subjects with unilateral or bilateral involvement of knee.
- 6) Subjects willing to participate.
- 7) Patients who were able to comprehend commands.

#### Exclusion Criteria

- 1) Subject who undergone any lower limb surgery.

- 2) Subject with inflammatory joint disease of lower limb, neurological disorder (motor or sensory loss), cardiac or metabolic conditions.
- 3) Intra-articular corticosteroids or hyaluronic injection during past six months.
- 4) Subject giving history of hyper sensitive skin, allergy or any other skin conditions.

The whole procedure of the study were explained to all the subjects. A written informed consent of all subjects was taken prior to the study. Subjects evaluation form consisted of demographic data, chief complain, history, pain assessment, range of motion, manual muscle testing, VAS, modified WOMAC, was being evaluated. Then subjects were randomly divided into three groups, with 12 subjects in each group using lottery method. Subjects were treated for three session per week for two weeks. Outcome measures such as VAS for pain and modified WOMAC for function was taken on first day and after two weeks.

**For group A: Kinesio taping**

The Kinesio tape was applied with approximately 40% stretch of its maximal length on the 2 quadriceps group muscles based on the principle of activation technique . . . Kinesiotape was applied on the 2 quadriceps muscles (1) for rectus femoris [RF] ‘Y’strip was applied, 10cm bellow the anterior inferior iliac spine to the inferior border of the patella and (2) for vastusmedialis [VM], the KT was applied 10cm bellow the intertrochanteric line to the medial border of the patella. Patient was positioned in supine with knee bending. (13, 14)



Application of kinesio taping

**For group B: (12)Mulligan’s Mobilization with movement**

On the very first day of treatment, the patient was assessed completely about the perception of pain in weight-bearing as well as non-weight-bearing positions. If the patient had pain in both the positions, he/she was given MWM first in the non-weight bearing position. After that, in the weight bearing position.

**Medial glide MWM:** Patient lies in prone position. While applying a medial glide, the therapist stands on the contra lateral side of the patient. The belt is placed around the therapist’s waist and the patient’s lower leg. So the proximal edge is at the tibial joint margin. The patient’s thigh is stabilized above the knee with the one hand and support the lower leg with the other. Therapist glide the knee medially with the belt and ask the patient to flex his knee.



Non weight bearing medial glide with MWM

**Rotation MWM:** The patient lies supine. Then grasp the lower leg and the tibia is internally rotate the tibia on the femur. While maintaining the glide, the patient is asked to flex the knee and hold the position at the end range of the available pain free range for several seconds. An over pressure is applied through the therapist’s hands. When the patient is able to perform all the movement pain free in non-weight bearing position. Then he or she is progressed to weight bearing position by bending knee forwards and backwards on the stool to flex and extend the knee.



Non weight bearing internal rotation glide with MWM

When the patient is able to perform the movement painfree in non-weight bearing position, he or she is progressed to weight bearing position by bending the knee forward and backward in weight bearing position on the stool to flex and extend the knee.



Weight bearing MWM



10 repetitions were given three times per session to ensure prolonged correction of tracking and sufficient afferent input. 30 seconds of rest was given in between the sessions.

The self-management regime involved at least 20 movement repetitions, performed every three hours (or at least four to five times per day) was advised to do compulsorily. Subjects self-applied MWM were checked for their correctness at each review.

**Group C:**<sup>(46)</sup>**Control group:**

In all the groups conventional therapy were given according to below mentioned protocol for two weeks.

Exercise protocol:

- Static quadriceps exercise
- Terminal knee extension
- Straight leg raising
- Hip abductor strengthening
- Prone knee bending
- Hip extension exercise
- High sitting knee extension
- Hamstrings stretching



**Hip abductor strengthening**



**Prone knee bending**



**Static Quadriceps Exercise**



**Hip extension exercise**



**Terminal knee extension**



**Hamstring Stretching**



**Straight leg raising**



**High sitting knee extension**

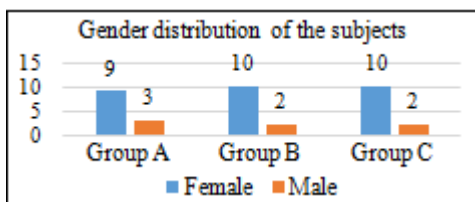
**4. Result and Analysis**

Data was analysed by using Microsoft excel 2013 and SPSS version 20. Change in the outcome measure was analysed within and between groups. Before applying statistical test, data was screened for normality. To check the normally distribution Shapiro-wilk test was used.

As the data was not normally distributed Wilcoxon signed rank test was used for within group analysis and Kruskal-wallis test was used for between group analysis.

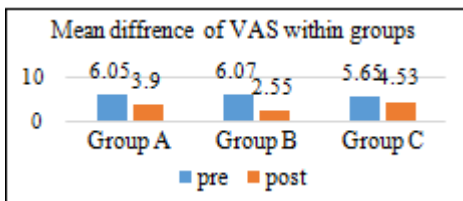
**Age distribution of the subjects**

Group	No.	Mean	±SD
Group A	12	58	5.68
Group B	12	50	6.33
Group C	12	55.75	4.88



**Mean difference of VAS within Group A, B and C**

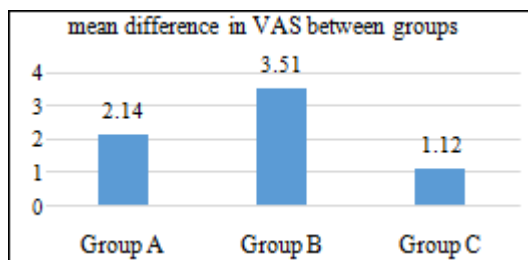
Groups	Pre treatment		Post treatment		Z value	p value
	Mean	SD	Mean	SD		
Group A	6.05	1.14	3.90	1.13	3.063	0.002
Group B	6.07	0.93	2.55	0.73	3.066	0.002
Group C	5.65	1.08	4.53	4.41	3.072	0.002



p value for group A, B, and C was <0.002. Which shows significant difference in VAS for three groups. All three groups improved after intervention.

**Mean difference in VAS between groups Group A, B and C**

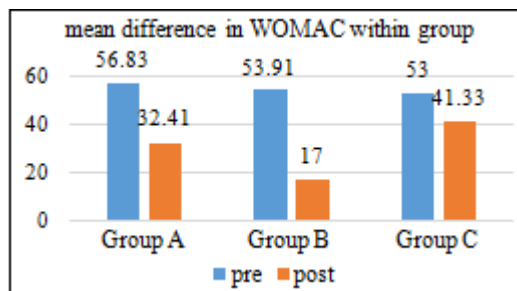
Difference in VAS score	Group A	Group B	Group C	Kruskalwallis value	p value
Mean	2.14	3.51	1.12	29.75	<0.001
±SD	0.31	0.57	0.28		



The p value was <0.001 showing significant difference in VAS score among three groups.

**Mean difference of WOMAC within Group A, B and C**

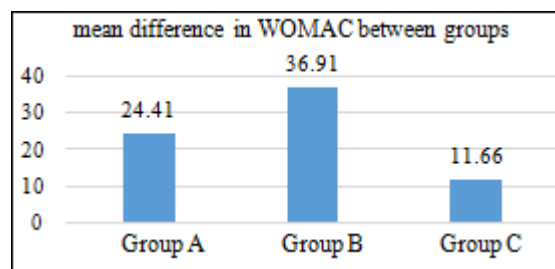
Groups	Pre treatment		Post treatment		Z value	p value
	mean	SD	Mean	SD		
Group A	56.83	5.79	32.41	5.66	3.087	0.002
Group B	53.91	11.52	17.00	7.13	3.065	0.002
Group C	53.00	6.67	41.33	4.41	3.072	0.002



p value for group A, B, and C was <0.002. Which shows significant difference in WOMAC for three groups. All three groups improved after intervention.

**Mean difference in WOMAC between groups Group A, B and C**

Difference in WOMAC score	Group A	Group B	Group C	Kruskalwallis value	p value
Mean	24.41	36.91	11.66	29.09	<0.001
±SD	2.84	6.93	2.49		



The p value was <0.001 showing significant difference in WOMAC score among three groups.

**Kruskal-wallis test multiple comparison test** was used for multiple comparison

Outcome Measures	Comparison	p value
VAS	Between Group A & B	<0.030
	Between Group B & C	<0.001
	Between Group A & C	<0.012

By comparing the mean difference among Group A, B and C, group B was having highest mean of VAS (3.51±0.57).

Outcome Measures	Comparison	p value
WOMAC	Between Group A & B	0.050
	Between Group B & C	<0.001
	Between Group A & C	<0.008

By comparing the mean difference among Group A, B and C, group B is having highest mean of WOMAC (36.91±6.93).

## 5. Discussion

The present study was conducted to investigate the effect of Kinesio Taping versus Mulligan's Mobilization with Movement on pain and function in subjects with osteoarthritis of knee.

In the present study attempts were done to improve the pain and function by applying KT and Mulligan's MWM.

Group A subjects were given Kinesio Taping along with conventional therapy, Group B subjects were given Mulligan's Mobilization with Movement along with conventional therapy while Group C were given only conventional therapy. Visual analogue scale (VAS) and Western Ontario and McMaster Universities Arthritis Index (WOMAC) were documented pre-treatment and after 2 weeks for all the groups.

Result of the present study showed positive findings with clinically and statistically significant improvement in VAS and WOMAC within Group A, B and C. So all three groups individually showed significant difference before and after treatment.

Result of the present study also showed statistically significant improvement in VAS and WOMAC between Group A, B and C. Group B showed better improvement on reducing pain and improving function than the group A and C. However, Group A shows significant difference in both reducing pain and improving function than Group C.

In Mobilization with Movement Group, the improvements could be because of **biomechanical** and **neurophysiological mechanisms** of MWM.

**Biomechanically** it was proposed that MWM alters the positional fault or internal derangement of the joint. 'Positional fault' that occurs secondary to an injury and lead to mistracking of the joint, resulting in symptoms such as pain, stiffness and weakness. The cause of positional faults are suggested to be due to changes in the shape of articular surfaces, thickness of cartilage, orientation of fibres of ligaments and capsules, or the direction and pull of muscles and tendon. Mulligan MWM corrects this by repositioning the joint causing it to track normally.<sup>(2)</sup> MWM might provide a stretching effect on the joint capsules and muscles, thus restoring normal arthrokinematics or may induce pain inhibition and improved motor control.<sup>(21,22)</sup>

**Neurophysiological mechanisms** include changes to the descending pain inhibitory system as well as central pain processing mechanisms. It is possible that MWM reduces pain by stimulation of joint mechanoreceptors and proprioceptors, in and around the joint, which subsequently inhibits nociceptive stimuli and help to release muscles and fascia around the joints. In addition to these neurophysiological and biomechanical effect, the repeated motion of MWM, might alter the concentrations of anti-inflammatory mediators in the joint, which might consequently inhibit nociceptors.<sup>(21,23)</sup>

Mobilization with Movement also provide nutrition to the affected joint cartilage. Mobilization with Movement in a weight bearing position requires muscle activity and might have resulted in improved motor performance, which would position the patient well to gain long-term benefits from a formal exercise program.<sup>(23,24)</sup>

This is in accordance with the study done by **Vrushali S. Jadhav et al (2015)** conducted a case study on knee osteoarthritis and found that the Mulligan Mobilization along with exercise protocol leads to reduction in pain, cause functional improvement, also improve ROM and muscle strength in knee osteoarthritis.<sup>(22)</sup>

**Dharmesh Solanki et al (2015)** conducted a Randomized Control Trial in knee osteoarthritis and found that intra group comparison result showed that pain relief, improved knee range of motion, functional performance and reduced functional disability was statistically significant in both the group. Whereas inter group comparison results showed that group B i.e. Internal Rotation Mulligan Glide MWM is better as compared to group A i.e. Medial Mulligan Glide MWM.<sup>(2)</sup>

The present study also showed a considerable reduction in pain and improvement in knee function in Group Akinesio taping group.

According the founder of Kinesio Taping KenzoKase, KT alleviates pain and facilitates lymphatic drainage by microscopically lifting the skin. The taped portion forms convulsions in the skin, thereby increasing interstitial space. So, result is that pressure and irritation are taken off the sensory and neural receptors, alleviating pain. Pressure is gradually taken off the lymphatic system, allowing it to drain more freely.<sup>(25)</sup> As a result, it reduces pain and swelling in injured areas. It also helps to improve blood flow circulation, increased blood flow to and from the muscle increases the presence of oxygen and nutrients to assist with repair of damaged tissues and accelerates the breakdown and removal of waste product when muscles are tired.<sup>(15)</sup>

The application of kinesio tape also is theorized to stimulate cutaneous mechanoreceptors. Cutaneous mechanoreceptors activate nerve impulses when mechanical loads create deformation. Mechanical loads include touch, pressure, vibration, stretch, and itch. The activation of cutaneous mechanoreceptors by an adequate stimulus causes local depolarizations that trigger nerve impulses along the afferent fiber traveling toward the central nervous system. The application of KT may apply pressure to the skin or stretch the skin, and this external load may stimulate cutaneous mechanoreceptors causing physiological changes in the taped area.<sup>(26)</sup>

Kinesio taping application and positioning of tape align the knee in more stable position and this reduce stress and strain on the soft tissue that surrounds the knee and improved osteoarthritis symptom. KT is also theorized to have several functions: restoring correct muscle function by supporting weakened muscles by facilitation of quadriceps muscle, reducing congestion by improving the flow of the blood and



lymphatic fluid, decreasing pain by stimulating the neurological system and correcting malaligned joints, by relieving muscle spasm.<sup>(26,27)</sup>

According to KenzoKase, the elastic properties of kinesiotape when applied using the Kinesio Taping Method enhances the function of muscle fibers. Recoil of the tape influences the muscle units called sarcomeres to elongate or shorten thus influencing muscle contractions.<sup>(25)</sup>

**Ebru Kaya Mutlu et al (2017)** reported that Kinesio taping resulted in superior short-term effects on walking task, pain, and knee-flexion ROM compared with placebo taping in patients with knee osteoarthritis.<sup>(28)</sup>

In the present study Group C receiving conventional exercise protocol which are used to improve strength and flexibility of knee joint muscle. This exercises are beneficial for improving knee pain and decreases the limitation of functional performance.<sup>(29)</sup>

Comparison of both the groups found that there is a statistically significant difference in both the groups. Mulligan's Mobilization with movement group show large effect size in improvement of osteoarthritis symptoms than kinesio taping group.

Both mulligan's MWM and KT works on the principle of pain gate theory given by Melzack and Wall. But greater improvement in Mobilization with Movement group seen could be because the most common alteration in the alignment of the osteoarthritic knee is a varus deformity. Varus deformity is often associated with internal femoral torsion because subjects with knee OA tend to rotate the tibia externally to point their feet straight ahead. So when correct Internal Rotation Mulligan Glide MWM is given positional fault is corrected and range of motion improves with a reduction in pain.<sup>(2)</sup> Where as in KT it facilitate the weakened Quadriceps muscle mainly Rectus femoris and Vastusmedialis, improve blood supply and support the knee joint while moving.

In addition to this MWM is given in functional weight bearing position in progression so it correct positional faults more and reduce pain and improve function effectively than the KT.

So, as per the analysis of the study it had been seen that Mulligan's Mobilization with Movement is more effective with conventional therapy.

## 6. Conclusion

The study shows that both Mulligan's Mobilization with Movement and Kinesio Taping techniques significantly shown improvement on pain and function in subjects with osteoarthritis of knee. There is statistically significant difference between both the groups. Mobilization with Movement shows better improvement than kinesio taping in reducing pain and improving function. Hence, it concluded that Mulligan's Mobilization with Movement technique found clinically more effective with greater percentage of improvement than Kinesio Taping technique.

## 7. Future Scope

- A long term follow-up study can be done.
- Same study could be done to check the improvement of strength of knee muscle

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