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Research Article

Kinesiotaping and Muscle Energy Technique Osteoarthritis

Comparative Study Between Kinesiotaping Versus Muscle Energy Technique in Patients with Knee Osteoarthritis

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Abstract: Osteoarthritis (OA) is a chronic progressive degenerative disorder of multifactorial etiology, causing greater disability and clinical symptoms among adults. Our study aim is to compare the effectiveness of kinesio taping with conventional therapy versus muscle energy technique with conventional therapy in subjects with knee osteoarthritis. Moreover, the assessed objectives are knee pain, range of motion, disability, quadriceps strength, and hamstring flexibility. It is a comparative study, where 30 subjects with knee osteoarthritis meeting the inclusion criteria were recruited and randomly divided into Group A (Kinesiotaping with conventional therapy) and Group B (Muscle energy technique with conventional therapy), each group containing 15 subjects. Both groups received the same conventional therapy, five sessions/week for three weeks. GROUP-A received Kinesiotaping 3 sessions/per week for three weeks, and GROUP-B received Muscle energy technique five sessions/per week for three weeks. Outcome parameters were a Visual Analogue Scale(VAS) for pain, a Goniometer for a range of motion, WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) for pain, Stiffness, and physical dysfunction, Quadriceps strength test for quadriceps strength and Active knee extension test for hamstrings flexibility. Paired t-test and independent t-test were used to analyze both groups' pre-test and post-results. The study concluded that Group A showed more significant improvement in knee pain ($t=3.862$, $p<0.05$), extension range of motion ($t=5.983$, $p<0.05$), and hamstrings flexibility ($t=5.983$, $p<0.05$) compared to Group B. However, there was no significant difference in improvement among the groups when compared between both groups. Hence, the intervention in Group A was more effective in decreasing pain and increasing knee extension range of motion and hamstrings flexibility in OA knee patients.

Keywords: Kinesiotaping, Muscle energy technique, Conventional treatment, Osteoarthritis, VAS, WOMAC

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1. INTRODUCTION

Osteoarthritis (OA) is a chronic degenerative disorder of multifactorial etiology characterized by the loss of articular cartilage, hypertrophy of bone at the margins, subchondral sclerosis, and a range of biochemical and morphological alterations of the synovial membrane and joint capsule.[1]A common symptom of knee osteoarthritis is quadriceps weakness.[2] The range of motion in the knee joint's flexion and extension significantly diminishes in persons with osteoarthritis.[3] In knee osteoarthritis, the hamstrings play a significant role in the development of atherogenic changes, and it results in the development of contracture while gradually leading to the loss of hamstring flexibility.[4,5,6]The most prevalent chronic musculoskeletal condition is osteoarthritis.[7]It is the most frequent joint disease with a prevalence of 22% to 39% in India. Nearly 45% of women over the age of 65 have symptoms. In comparison, 70% of people over 65 show radiological evidence.[8]Effect of pathological changes in osteoarthritis, erosion, or degeneration of the cartilage occur. So, there will be restricted movement and painful movement. If the progression of the disease results in a contracture of the muscles, weakness of the muscles, ligament tightness, osteophytes formation over the articular surfaces, and osteoporotic changes in the articular surfaces, make the joints immovable.[9] Muscle energy technique (MET) is a manual procedure. This approach primarily targets soft tissue and is also known as active muscular relaxation.[11]MET aims to normalize soft tissue structures, such as shortened or tight muscles, with no direct implication to the joint associated with these soft tissues. While Kinesio taping supports damaged structures without the restriction of mobility and, at the same time, may influence some of the mechanisms associated with muscle fatigue, such as blood flow and proprioception.[12;] it is a non-restrictive taping that allows for a full range of motion.[13] Kinesiotape increases muscle strength and flexibility, reducing pain and muscle fatigue while improving proprioception in patients with sports injuries or musculoskeletal disorders.[14,15,16] Kinesio taping gives support and stability to the joints and muscles without affecting circulation. It is applied over muscles to reduce pain and inflammation and relax overused tired muscles.[12,13] The physiological effects of Kinesio taping have been proposed, including 'lifting,' which is associated with the adhesive and elastic properties of Kinesio taping as the amount of inter-tissue space increases, improving blood and lymph circulation.[17] 'Gate- control of pain'; The pain intensity reduces due to the stimulation of mechanical receptors of the skin. Finally, 'neuro facilitation' stimulates skin mechanoreceptors, causing positive changes to the nervous system.[18,19,20] MET is claimed to be effective for a variety of purposes, including lengthening shortened or contracted muscles, as a lymphatic or venous pump to aid the drainage of fluid or blood, and increasing the range of motion (ROM) of a restricted joint.[21,22] MET may increase muscle length by a combination of creep and plastic change in the connective tissue, an increase in flexibility after muscle energy technique occurred due to biomechanical or neurophysiological changes, or an increase in tolerance to stretching.[23] The physiological mechanism behind the changes in muscle extensibility produced by MET- reflex muscle relaxation, viscoelastic or muscle property change, and changes to stretch tolerance. Muscle relaxation following contraction has been proposed to occur by Golgi tendon organs and their inhibitory influence on the a-motor neuron pool. According to sliding filament theory, during contraction, the series elastic components are under Tension and elongate, while the Tension in the parallel elastic components is reduced. During passive stretching, both parallel and elastic components are under Tension. However, the fewer parallel fibers will elongate more than the series component.[24] Heat is widely utilized before exercise because it has the benefit of increasing tissue metabolism. Heat is good for enhancing muscle and ligament flexibility, according to Jerrold et al. Cold treatment may help reduce sporting injuries but also have the reverse effect.[25] The use of superficial heat or cold is relatively prevalent. It is a "first-line" technique in treating knee pain.[26,27] Studies have shown that Kinesio taping and Muscle energy techniques effectively increase range of motion, reduce pain, and improve physical dysfunction, quadriceps muscle strength, and hamstrings flexibility. However, there is a lack of evidence where the comparative effect of Kinesio taping with conventional therapy versus Muscle energy technique with conventional therapy in knee osteoarthritis has been studied. Therefore, this study is designed to determine the comparative effect of Kinesio taping vs. Muscle energy technique in subjects with knee osteoarthritis.

2. METHODOLOGY

A comparative study was conducted for six months in physiotherapy OPD at Assam Down Town University. A total of 30 subjects who met inclusion criteria were taken into the study and were divided through simple random technique into two groups, 15 members in group-A (Kinesiotaping with conventional therapy) and 15 members in group B (Muscle energy technique with conventional therapy). In both groups, interventions were given for group-A received Kinesiotaping with conventional therapy. Kinesiotaping was done thrice on alternate days, and conventional therapy was given five consecutive days per week for 3 weeks. Group B received Muscle energy technique with conventional therapy for 5 sessions per week, each 30 minutes' duration & for 3 weeks. The outcomes of the interventions were measured by using the VAS for assessing pain, Goniometer for assessing the range of motion, WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) for pain, Stiffness, and dysfunction, Quadriceps strength test for quadriceps strength, and Active knee extension test for hamstrings flexibility.

2.1. Study design

The study was a comparative study approved by the Institutional Research and ethical committee (Adtu/Ethics/stdnt-lett/2022/35). Therefore, all the experimental procedures were to the University's guidelines.

2.2. Participants and procedure

Several 30 subjects, both male and female, with a primary diagnosis of knee osteoarthritis by the physician fulfilling the inclusion criteria were allocated into Group-A, and Group B, where Group-A (n=15) received Kinesiotaping with conventional therapy and Group B (n=15) received Muscle energy technique with conventional therapy. After a proper explanation of the study protocol to the patients, written informed consent was obtained from them. For each subject, demographic data were collected. A Pre-test and Post-test data analysis were carried out for both Group A and Group

B by VAS for assessing pain, Goniometer for assessing the range of motion, WOMAC (Western Ontario and McMaster Universities Osteoarthritis Index) for pain, Stiffness, and dysfunction, Quadriceps strength test for quadriceps strength, and Active knee extension test for hamstrings flexibility. This study was conducted in the Physiotherapy OPD, Down Town Hospital, Guwahati, and Physiotherapy OPD, Assam Down Town University.

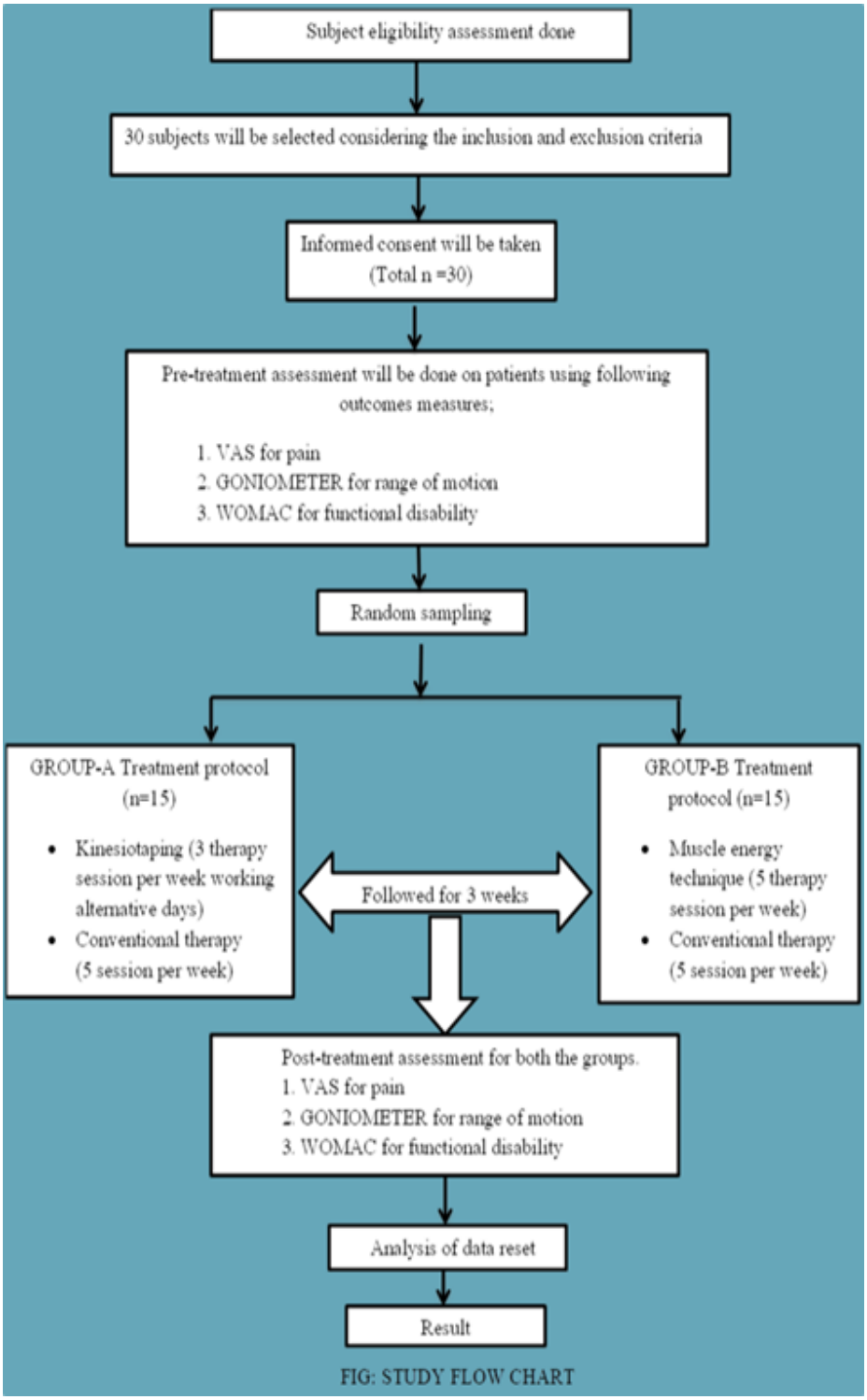

Fig : Flow Chart

2.3. *Inclusion Criteria*

Age 40-60, unilateral involvement of knee, diagnosed by a clinician as knee osteoarthritis, both genders (Male and Female), willing participants, radiographic findings of Grades 0-3 according to Kellgren Lawrence.

2.4. *Exclusion Criteria*

Painful knee stiffness after severe trauma, Any skin allergy, local skin lesion and infection, Tumors in the area of treatment, Inflammatory diseases such as rheumatoid arthritis, Recent undergone surgery / History of surgery on the knee, any hearing or visual defects.

2.5. *Data extraction*

Data extraction is collecting the required relevant information for the study to be carried out. The data was collected from Physiotherapy OPD, Down Town Hospital, Guwahati, and Physiotherapy OPD, Assam Down Town University. We collected a sample of 30 subjects, both male

and female with a primary diagnosis of knee osteoarthritis by the physician with fulfilling the inclusion criteria and were allocated into Group-A and Group B, where Group-A (n=15) received Kinesiotaping with conventional therapy and Group B (n=15) received Muscle energy technique with conventional therapy. For summarization, measures of central tendency were used for analysis. In addition, a pre-test and a post-test of subjects in both groups were assessed for pain by VAS, for a range of motion by Goniometer, for pain, Stiffness, and dysfunction by WOMAC, for quadriceps strength by quadriceps strength test and hamstrings flexibility by active knee extension test. Moreover, the results of the outcome measures were statistically analyzed by a paired sample t-test and independent sample t-test in IBM SPSS (statically package for social sciences) statistics 26 software.

2.6. Quality assessment

The included studies' quality was assessed using the physiotherapy evidence database scale. As a result, all the studies were of good quality.

2.7. Intervention

GROUP A received Kinesiotaping with conventional therapy. Kinesiotaping was done three times on alternate days, and conventional therapy was given for 5 consecutive days per week for 3 weeks

GROUP B received Muscle energy technique with conventional therapy for 5 sessions per week, each session was 30 minutes duration & for 3 weeks.

2.8. Protocol procedure

2.8.1 Group A

The Kinesio tape was applied with approximately 40% stretch of its maximal length on the two quadriceps group muscles based on the principle of activation technique. Here the direction of taping was applied originally to the insertion of the muscles. The taping protocol was designed based on the principle of activation technique. Kinesiotape has applied on the two quadriceps muscles 1) for rectus femoris [RF] 'Y'strip was applied, 10cm below the anterior inferior iliac spine to the inferior border of the patella and 2)for vastus medialis [VM], the KT was applied 10cm bellow the intertrochanteric line to the medial border of the patella. The patient was positioned in a supine with knee bending. [Figure 1&2] Also, according to Kase Walli's principles of KT, a gap of at least 30 min was given after the tape application to achieve a complete activation of the glue, which is believed to improve the performance of the Kinesio tape on the quadriceps muscle. After applying KT, all the OA knee study participants were undergone supervised conventional physiotherapy.

2.8.2 Group B

i) Agonist contract and relax, is one of the MET techniques used in this study. For that, the supine patient fully flexes the hip on the affected side. The practitioner extended the flexed knee to the point of resistance (identifying the barrier).ii) The calf of the treated leg was placed on the shoulder of the practitioner, who stood facing the head of the table on the side of the treated leg. The practitioner's hand holds the treated leg's thigh to maintain stability when the barrier is being assessed. The other leg was stabilized with the stabilizing belt. iii) The patient was then asked to attempt to straighten the lower leg (i.e., extend the knee) utilizing the agonists to the hamstrings (quadriceps), employing 20% of the Strength in the quadriceps. The practitioner resisted this for 7-10 seconds. iv) Appropriate breathing instructions had given. The leg was then extended at the knee to its new hamstrings limit; after a passive stretch, it should be held for 30 secs, followed by relaxation, which is then repeated. [Figure 3]

2.8.3 Conventional Treatment protocol

The conventional treatment protocol was given for both group A and group B, which consisted of the following;

a) **Hot moist pack**, the patient will be made to lay in a supine position with the affected knee in slight flexion a hot moist pack will be applied around the knee for 15 minutes.
b) **Isometric Exercises for quadriceps** consist of 10 repetitions [1 rep=5sec hold, 10 repX3set].
c) **Straight leg raising** (10 reps, 3 sets)
d) **Hip abductors strengthening** (10 reps, 3 sets)
e) **In the last-degree knee extension board exercise training** (10 reps, 3 sets), the progression was done when the patient was eased to do exercises either by increasing repetition or frequency.
f) **Self-Hamstring stretching** (static) (3sets, each stretch 30 sec hold, between each set 5sec rests).g).[Figure 4-8].

Fig 1: KT for RF & VM in knee flexion

Fig 2: KT for RF &VM in knee extension

Fig 3: MET APPLICATION

Fig 4: Moist Heat Pack for Hot Fomentation

Fig 5: Isometric Quadriceps Exercise

Fig 6: Straight Legs Raise Exercise

Fig 7: Hip Abductors Strengthening Exercise

Fig 8: Self-Stretching of Hamstrings

3. STATISTICAL ANALYSIS

Pre-test and Post-test were carried out for both groups and analyzed using paired sample t-test and independent sample t-test in an IBM SPSS statistics 26 software. The significance level with P value was set at 0.005 and 0.001; less than this is considered statistically significant.

4. RESULTS

Table1: Demographic Representation of data

	Group A	Group B
Minimum	42.00	40.00
Maximum	60.00	60.00
Age (Mean + SD)	50.4 + 6.58	52.8 + 6.46

In the study, 30 subjects were selected by random sampling method and then allocated to Group A, and Group B. Group A's mean age was 50.4 years, ranging from 42 to 60. Group B's mean age was 52.8 years ranging from 40 to 60 years.

Table 2: Distribution of the patients according to their age				
Age	Group A		Group B	
	Frequency	Percent	Frequency	Percent
40 – 45 Years	2	13.3	2	13.3
45 - 50 Years	7	46.7	3	20.0
50-55 Years	0	0.0	1	6.7
55-60 Years	4	26.7	7	46.7
60 -65 Years	2	13.3	2	13.3
Total	15	100.0	15	100.0

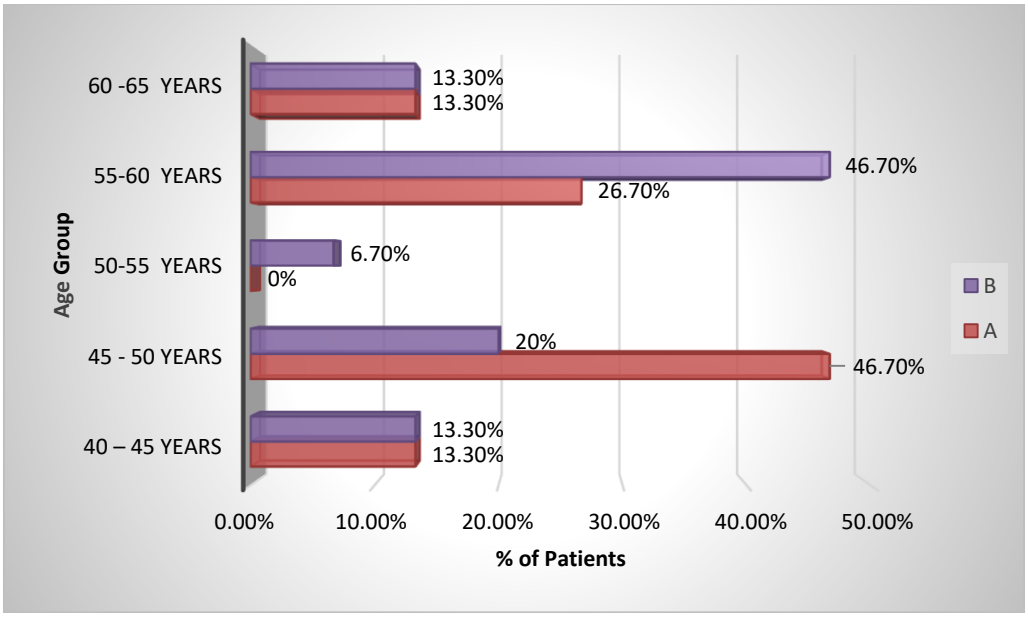

Fig 9: Age distribution of the patients in Group A and Group B

The above graph shows that in Group A and Group B, there were 13.30% of subjects were in the age group 40-45 years, 46.70% and 20% of subjects were in the age group 45-50 years, 0% and 6.70% of subjects were in the age group 50-55 years, 26.70 % and 46.70% subjects were in the age group 55-60 years, 13.30% subjects were in the age group 60-65 years.

Table 3: Distribution of the patients according to their gender:				
Gender	Group A		Group B	
	Frequency	Percent	Frequency	Percent
Female	9	60.0	9	60.0
Male	6	40.0	6	40.0
Total	15	100.0	15	100.0

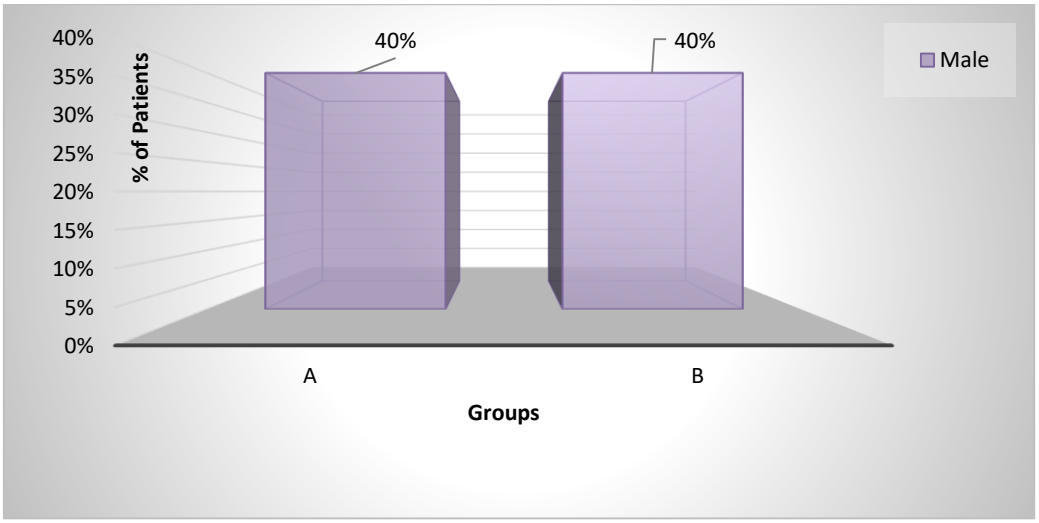

Fig 10: Gender distribution of the patients in Group A and Group B

The above graph shows that 60% of females and 40% of males were studied in Group A and B.

Table4: To find out whether Kinesiotaping along with conventional therapy can improve pain, range of motion, quadriceps strength and hamstrings flexibility in knee osteoarthritis

		Mean	N	Std. Dev	t	df	p
VAS	Before Treatment	6.9333	15	.70373	19.179		
	After Treatment	4.6667	15	.81650		14	0.00**
Goniometer Flexion	Before Treatment	100.600	15	4.74793	-6.789	14	0.00**
	After Treatment	104.866	15	4.13809			
Goniometer Extension	Before Treatment	13.6667	15	2.28869	---	---	---
	After Treatment	8.6667	15	2.28869			
WOMAC	Before Treatment	62.3333	15	7.62202	11.309	14	0.00**
	After Treatment	60.6000	15	7.58570			
Active knee extension test	Before Treatment	13.6667	15	2.28869	---	---	---
	After Treatment	8.6667	15	2.28869			
Quadriceps strength test	Before Treatment	1.1333	15	.22887	-11.225	14	0.00**
	After Treatment	1.7333	15	.25820			

NS: Not Significant; *: Significant at 5%; **: Significant at 1%
N value for Group-A is 15

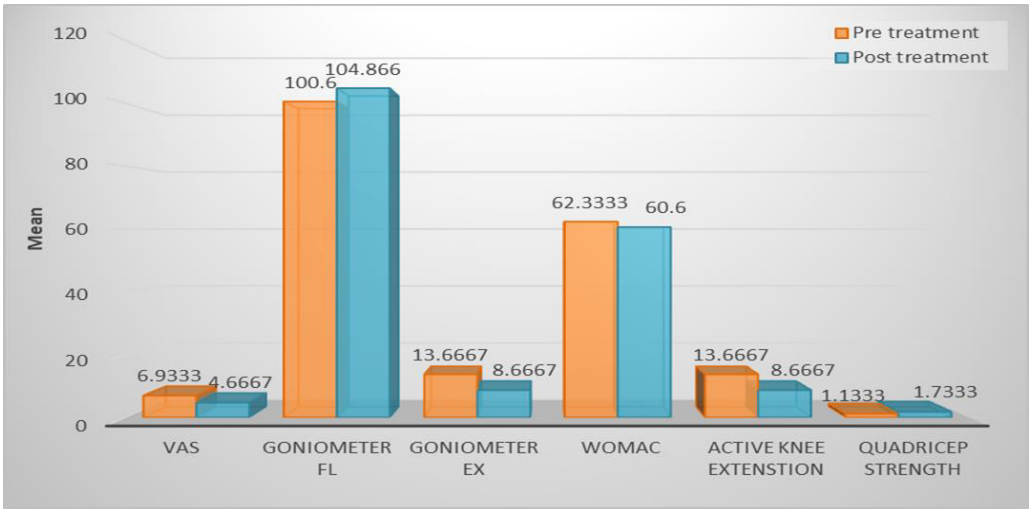

Fig 11: Comparison of mean of different parameters before and after applying the Kinesiotaping technique

Table 5: To find out whether muscle energy technique along with conventional therapy can improve pain, range of motion, quadriceps strength and hamstrings flexibility in knee osteoarthritis

		Mean	N	Std. Dev	t	df	p
VAS	Before Treatment	7.0667	15	.59362	26.458		
	After Treatment	3.7333	15	.45774		14	0.00**
Goniometer Flexion	Before Treatment	97.0667	15	3.30512	-10.986	14	0.00**
	After Treatment	107.066	15	2.08624			
Goniometer Extension	Before Treatment	14.3333	15	1.75933	23.482		
	After Treatment	3.6667	15	2.28869		14	0.00**
WOMAC	Before Treatment	67.5333	15	4.17247	7.075	14	0.00**
	After Treatment	62.2000	15	4.67822			
Active knee extension test	Before Treatment	14.3333	15	1.75933	23.482		
	After Treatment	3.6667	15	2.28869		14	0.00**
Quadricep strength test	Before Treatment	1.1000	15	.28031	-10.717	14	0.00**
	After Treatment	1.7333	15	.37161			

NS: Not Significant; *: Significant at 5%; **: Significant at 1%
N value for Group- B is 15

Table 5: To find out whether muscle energy technique along with conventional therapy can improve pain, range of motion, quadriceps strength and hamstrings flexibility in knee osteoarthritis

		Mean	N	Std. Dev	t	df	p
VAS	Before Treatment	7.0667	15	.59362	26.458		
	After Treatment	3.7333	15	.45774		14	0.00**

Goniometer Flexion	Before Treatment	97.0667	15	3.30512	-10.986	14	0.00**
	After Treatment	107.066	15	2.08624			
Goniometer Extension	Before Treatment	14.3333	15	1.75933	23.482		
	After Treatment	3.6667	15	2.28869		14	0.00**
WOMAC	Before Treatment	67.5333	15	4.17247	7.075	14	0.00**
	After Treatment	62.2000	15	4.67822			
Active knee extension test	Before Treatment	14.3333	15	1.75933	23.482		
	After Treatment	3.6667	15	2.28869		14	0.00**
Quadricep strength test	Before Treatment	1.1000	15	.28031	-10.717	14	0.00**
	After Treatment	1.7333	15	.37161			

NS: Not Significant; *: Significant at 5%; **: Significant at 1%
N value for Group- B is 15

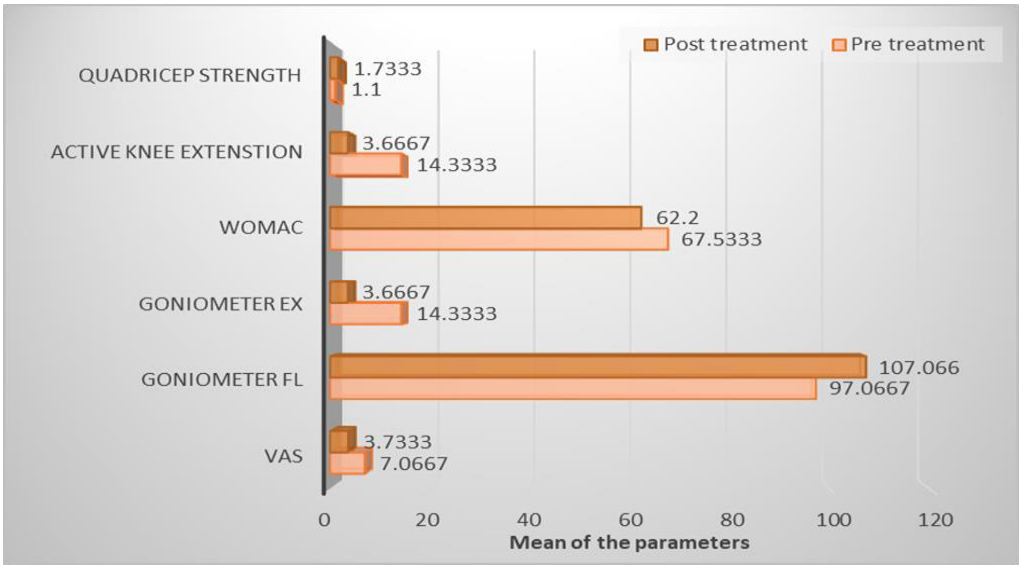

Fig 12: Comparison of mean of different parameters before and after applying muscle energy technique

Table 6: To compare improvement of knee osteoarthritis between the patients in two groups treated with Kinesiotaping along with conventional therapy and muscle energy technique along with conventional therapy (PRE TREATMENT)

Parameters	Technique	N	Mean	Std. Dev.	t	df	p
VAS	Kinesio Taping	15	6.9333	.70373	-.561	28	.579 NS
	Muscle energy technique	15	7.0667	.59362			
Goniometer Flexion	Kinesio Taping	15	100.60	4.74793	2.366	28	.025*
	Muscle energy technique	15	97.066	3.30512			
Goniometer Extension	Kinesio Taping	15	13.666	2.28869	-.894	28	.379 NS
	Muscle energy technique	15	14.333	1.75933			
WOMAC	Kinesio Taping	15	62.333	7.62202	-2.318	28	.028*
	Muscle energy technique	15	67.533	4.17247			
Active knee extension test	Kinesio Taping	15	13.666	2.28869	-.894	28	.379 NS
	Muscle energy technique	15	14.333	1.75933			
Quadriceps strength test	Kinesio Taping	15	1.1333	.22887	.357	28	.724 NS
	Muscle energy technique	15	1.1000	.28031			

NS: Not Significant; *: Significant at 5%; **: Significant at 1%
N value for both Group-A and Group- B is 15

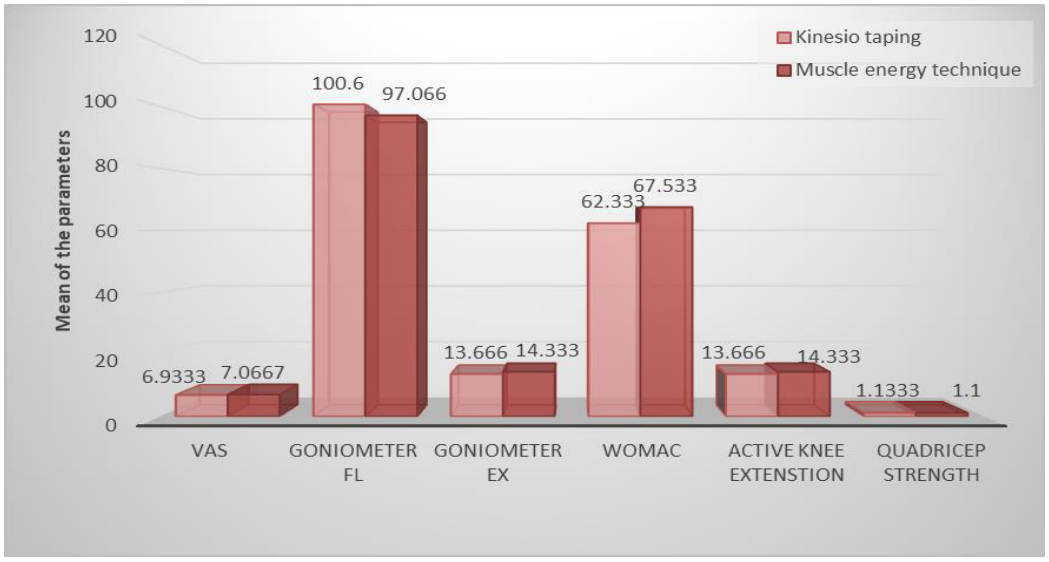

Fig 13: Comparison of mean of different parameters of the patients before applying Kinesiotaping and muscle energy technique

Table 7: To compare improvement of knee osteoarthritis between the patients in two groups treated with Kinesiotaping along with conventional therapy and muscle energy technique along with conventional therapy (POST TREATMENT)

Parameters	Technique	N	Mean	Std. Dev.	t	df	p
VAS	Kinesio Taping	15	4.6667	.81650	3.862	28	.001**
	Muscle energy technique	15	3.7333	.45774			
Goniometer Flexion	Kinesio Taping	15	104.86	4.13809	-1.839	28	.077
	Muscle energy technique	15	107.06	2.08624			*NS*
Goniometer Extension	Kinesio Taping	15	8.6667	2.28869	5.983	28	.000**
	Muscle energy technique	15	3.6667	2.28869			
WOMAC	Kinesio Taping	15	60.600	7.58570	-.695	28	.493
	Muscle energy technique	15	62.200	4.67822			*NS*
Active knee extension test	Kinesio Taping	15	8.6667	2.28869	5.983	28	.000**
	Muscle energy technique	15	3.6667	2.28869			
Quadriceps strength test	Kinesio Taping	15	1.7333	.25820	.000	28	1.000
	Muscle energy technique	15	1.7333	.37161			*NS*

NS: Not Significant; *: Significant at 5%; **: Significant at 1%
The n value for both Group-A and Group-B is 15.

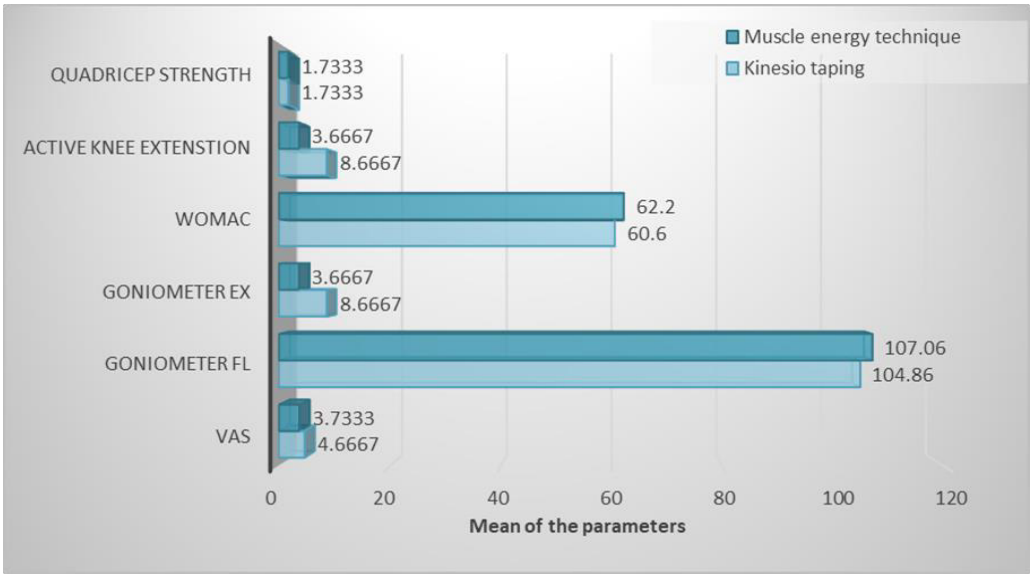

Fig 14: Comparison of mean of different parameters of the patients after applying Kinesiotaping and muscle energy technique

30 subjects received 5 therapy sessions per week for 3 weeks, where Group-A (n=15) received Kinesiotaping with conventional therapy and Group-B (n=15) received Muscle energy technique with conventional therapy. A paired t-test was performed to see the significant difference in VAS, Goniometer (for flexion and extension ROM), WOMAC, active knee extension test, and quadriceps strength test before and after treatment. Independent t-test was used performed to compare the effectiveness between Group-A and Group B. Table 4 shows that: (Test for VAS); It was found that t = 19.179, which is highly significant at 1% probability level (p=0.00), i.e., VAS has decreased significantly after implementation of Kinesiotaping along with conventional therapy to the patients. Hence we can say that Hence Kinesiotaping, along with conventional therapy, is highly effective in improving knee osteoarthritis in patients. (Test for Goniometer Flexion); It was found that t = -6.789, which is highly significant at a 1% probability level. We can say that Goniometer Flexion decreased remarkably after treating the patients with Kinesiotaping and conventional therapy. Hence Kinesiotaping, along with conventional therapy, is highly effective in knee osteoarthritis. Test for Goniometer extension; Paired t-test for Goniometer Extension cannot be computed as the standard error of the difference of pre and post-means of Goniometer Extension is zero. (Test for WOMAC); It was found that t = 11.309, which is highly significant at a 1% probability level (p=0.00), i.e., WOMAC has decreased significantly after the implementation of kinesio taping along with conventional therapy to the patients. Hence we can say that kinesio taping and conventional therapy are highly effective in improving knee osteoarthritis. (Test for active knee extension test) Paired t-test for active knee extension test cannot be computed as the standard error of the difference of pre and post-means of active knee extension test is zero. (Test for Quadriceps strength test); It was found that t = -11.225, which is highly significant at a 1% probability level. We can say that quadriceps strength decreased remarkably after treating the patients with kinesio taping and conventional therapy. Hence, kinesio taping and conventional therapy are highly effective in knee osteoarthritis. Table 5 shows that; (Test for VAS) was found to be; t = 26.458, which is highly significant at a 1% probability level (p=0.00), i.e., VAS has decreased significantly after implementation of muscle energy technique along with conventional therapy to the patients. Hence we can say that muscle energy technique and conventional therapy are highly effective in improving knee osteoarthritis. (Test for Goniometer Flexion); It was found that t = -10.986, which is highly significant at a 1% probability level. We can say that Goniometer Flexion decreased remarkably after treating the patients with the muscle energy technique and conventional therapy. Hence muscle energy technique and conventional therapy are highly effective in knee osteoarthritis. (Test for Goniometer Extension); It was found that t = 23.482, which is highly significant at a 1% probability level. We can say that Goniometer Extension increased remarkably after treating the patients with the muscle energy technique and conventional therapy. Hence muscle energy technique and conventional therapy are highly effective in knee osteoarthritis. (Test for WOMAC); It was found that t = 7.075, which is highly significant at a 1% probability level (p=0.00), i.e., WOMAC has decreased significantly after the implementation of muscle energy technique along with conventional therapy to the patients. Hence we can say that muscle energy technique and conventional therapy are highly effective in improving knee osteoarthritis. (Test for active knee extension test); It was found that t = 23.482, which is highly significant at a 1% probability level. We can say that active knee extension increased remarkably after treating the patients with muscle energy techniques and conventional therapy. Hence muscle energy technique and conventional therapy are highly effective in knee osteoarthritis. (Test for Quadriceps strength test); It was found that t = -10.717, which is highly significant at a 1% probability level. We can say that quadriceps strength decreased remarkably after treating the patients with muscle energy techniques and conventional therapy. Hence muscle energy technique and conventional therapy are highly effective in knee osteoarthritis. Table 6 shows that; (Comparison of VAS): It was found that t = 0.561, which is not significant. Hence we may conclude that the VAS of the patients of both groups was equal before treatment. (Comparison of Goniometer Flexion): It was found that t = 2.366, which is significant at a 5% level (p=0.025). Hence we may conclude that the Goniometer Flexion of the patients treated with Kinesiotaping along with conventional therapy was more than that of those treated with the muscle energy technique and conventional therapy before treatment. (Comparison of Goniometer Extension): It was found that t = -0.894, which is insignificant. Hence we may conclude that the Goniometer Extension of the patients of both groups was not statistically different before treatment. (Comparison of WOMAC): It was found that t = -2.318, which is significant at the 5% level (p=0.028). Hence we may conclude that the WOMAC of the patients treated with kinesio taping along with conventional therapy was less than that of those treated with muscle energy technique and conventional therapy before treatment. (Comparison of active knee extension test): It was found that t = -0.894, which is insignificant. Hence we may conclude that the active knee extension of the patients of both groups was not statistically different before treatment. (Comparison of quadriceps strength test): It was found that t = 0.357 which is not significant. Hence we may conclude that the quadriceps strength of the patients of both groups was not statistically different before treatment. Table 7 shows that; (Comparison of VAS): It was found that t = 3.862, which is significant at a 1% level (p=0.001), i.e., VAS of patients treated with Kinesiotaping along with conventional therapy was more than that of the patients treated with muscle energy technique along with conventional therapy for knee osteoarthritis. (Comparison of Goniometer Flexion): It was found that t = -1.839, which is not significant. Hence we may conclude that the Goniometer Flexion of the patients of both groups was not statistically different after treatment.(Comparison of Goniometer Extension): It was found that t = 5.983, which is significant at a 1% level (p=0.000), i.e., Goniometer Extension of patients treated with Kinesiotaping along with conventional therapy was more than that of the patients treated with muscle energy technique along with conventional therapy for knee osteoarthritis.(Comparison of WOMAC): It was found that t = -0.695 which is not significant. Hence we may conclude that the WOMAC of the patients of both groups was not statistically different after treatment. (Comparison of active knee extension test): It was found that t = 5.983, which is significant at a 1% level (p=0.000), i.e., active knee extension of patients treated with Kinesiotaping along with conventional therapy was more than that of the patients treated with muscle energy technique along with conventional therapy for knee osteoarthritis. (Comparison of quadriceps strength test): It was found that t = 0.000, which is not significant. Hence we may conclude that

the quadriceps strength of the patients of both groups was not statistically different after treatment.

5. DISCUSSION

The primary purpose of this study was to determine the comparative effects of the Muscle energy technique with conventional therapy versus Kinesiotaping with conventional therapy for decreasing knee pain, functional disability, improving range of motion, quadriceps strength, and hamstrings flexibility in subjects with knee osteoarthritis. Outcomes include using VAS for knee pain, a Goniometer for a range of motion, WOMAC for pain, Stiffness, and physical dysfunction, a Quadriceps strength test for quadriceps strength, and an Active knee extension test for hamstrings flexibility. The results indicate that group-A (Kinesio taping with conventional therapy) showed significant improvement in pain, extension range of motion, and hamstrings flexibility compared to group B (Muscle energy technique with conventional therapy) A study done by Olaogun Mob et al. to; determine the reliability and concurrent validity of the visual analog scale and verbal rating scale concluded that two methods of pain rating scales for knee osteoarthritis are reliable and valid for clinical use.[28] Batistalh, Camargo PR, et al. conducted a study. The study aimed to analyze the correlation between the knee joint ROM measurements made using a universal goniometer and an isokinetic dynamometer; both the universal Goniometer and the isokinetic dynamometer can be used to evaluate knee ROM since they both present reliable measurements.[29] Salaffi, G. Leardini, et al. (2003) conducted the study. The study aimed to determine the Reliability and validity of the Western Ontario and McMaster Universities (WOMAC) Osteoarthritis Index in Italian patients with knee osteoarthritis. WOMAC is a reliable and valid instrument for evaluating the severity of OA of the knee's widely used version.[30] Finding suggests that the active knee extension test showed excellent interrater and interrater reliability for assessing hamstring flexibility in healthy adults study done by Mohamad Shariff A Hamid et al.[31] and also a study done by D. Scott Davis on concurrent validity of four clinical tests found that Active knee extension test is considered to be the standard gold test for measurement of hamstring flexibility with intra-tester reliability 0.94.[32] Dong-il Seo, et al., (2012) conducted a study on Reliability of the One-Repetition Maximum Test based on Muscle Group and Gender. It can be concluded that a standardized 1RM testing protocol is a reliable measurement to assess muscle strength changes regardless of muscle group location or gender.[33] Estimation of a 1-RM as a method of assessment of muscular strength performance is valid.[34] In the present study, both groups showed equally effective in quadriceps strength may be due to a central nervous system neural plasticity, which enhances the quality of patients with knee osteoarthritis. The Strength of the quadriceps is important in knee osteoarthritis as it can predict the level of functional disability (McAlindon, Cooper, Kirwan, and Dieppe, 1993)[35]This study support the findings of Sathiyavani Dhanakotti et al.; (2016) concluded that Application of kinesio taping with conventional therapy could be considered beneficial for reducing pain, improving quadriceps strength and functional knee ability in knee OA.[36] Thelen dauber and Stoneman found that the Tension exhibited by Kinesiotape onto the skin provides a cutaneous afferent stimulation and is believed to stimulate the mechanoreceptors.[15]This, in turn, is believed to modulate pain as proposed by the gate control theory where nociception carried by the small diameter nerve fibers is alleviated by the afferent feedback carried by the large diameter nerve fibers (Gonza´lez- Iglesias et al., 2009), thereby improving the performance in quadriceps strength and knee function.[37] This study also supports the findings of Prachi Bakul Choksi et al., who state that the a significantly increased in quadriceps strength and flexibility of hamstrings muscle in osteoarthritis knee patients.[3] Agonist contract and relax, which is one of the MET techniques used in this present study to improve quadriceps strength, and hamstrings flexibility.[24] Chaggar Rupinder Singh et al. claimed that the Application of the post-isometric relaxation muscle energy technique strengthens the quadriceps muscle in college students.38. The present study also showed that quadriceps strength increase after isometric contraction. So here, in the agonist contract and relax technique, isometric contraction of the quadriceps muscle leads to its strengthening. Increased hamstring flexibility will improve the patient's quality of life with knee osteoarthritis. Kuchera stated the effectiveness of MET in the inhibitory Golgi tendon reflex. This reflex is believed to be activated during the isometric contraction of muscles, which produces a stretch on the Golgi tendons organs and a reflex relaxation of the muscle.[39] The results of the present study are in the same line with the previous study that demonstrated that analysis of changes in joint ROM showed significant effects in the Kinesio taping group. It is attributed to the fact that in elderly patients with degenerative knee arthritis, who were showing lower extremity muscle weakening and abnormal muscle tonus around the knee joint, the skin stimuli of the Kinesio taping acted on the muscle spindles or tendon organs to support the muscles around the joint. It also relieves the muscle tonus through the mutual suppression effects of the muscles, thereby further smoothing joint flexion and extension and increasing extensibility and flexibility, leading to increased joint ROM.[41]Muscle energy technique, muscle elongation that may produce an increase in muscle length by a combination of creep and plastic change in the connective tissue.[3] The agonist contract and relax (MET) has an effect in increasing joint ROM. This finding is supported by the study conducted by Leon Chaitow (2001).[24] The reason for the function may be attributed to the reduced pain and improved joint ROM leading to an efficient performance in daily activities. There was a subsequent reduction in WOMAC scores due to reduced pain. Both groups illustrated reduced WOMAC scores, reduced pain, and improved ROM. The result shows that after applying the Kinesio taping, improvements in pain may be attributed to the stimulation of neuromuscular pathways via increased afferent feedback (Kneeshaw, 2001).[41] However, previous authors have indicated that therapeutic taping had a greater effect on pain reduction and functional improvement than placebo or control conditions (Ernst et al., 1999; Cowan et al., 2002).[42,43] Kinesio taping researchers like Öğüt et al. (2018) state that KT in women with knee OA seems to be effective in reducing pain and increasing physical capacity.[44]Rahlf et al. reported that KT had beneficial effects on pain relief, reducing joint Stiffness and increasing knee function within a short time (three consecutive days).[45] Muscle Energy Technique (MET) is a form of manual therapy that uses a muscle's energy through gentle isometric contractions to relax the muscles via autogenic or reciprocal inhibition. It is a naturally occurring preventive mechanism to prevent rupture or further injury to the muscle. Thus, it has a lengthening effect due to sudden muscle relaxation under stretch.[46,47] MET acts on joint proprioceptors and mechanoreceptors

that will affect descending pathways, changing the motor programming of the target joint. It has also been advocated that the reduction of pain and increased mobility are due to changes in the viscoelastic properties of the soft tissue followed by the application of the technique.[24] Muscle energy technique researchers like Minal Bharat Masekar et al. (2021) stated that PNF stretching and MET both are effective in decreasing pain levels, enhancing hamstring flexibility, and improving functional mobility in patients with OA knee.[48]Handel et al. reported significant increases in passive torque (increase in force used to stretch the hamstring) after a contract-relax exercise program.[49] In this present study, the flexibility of the hamstring increase after applying Kinesio taping. The mechanism behind the gained flexibility in muscle the skin stimuli acted on the muscle spindles or tendon organs to support the muscles around the joint. It also relieved the muscle tonus through the mutual suppression effects of the muscles, thereby further smoothing joint flexion and extension and increasing extensibility and flexibility, leading to increased joint ROM.[40]Whereas the mechanism behind the flexibility in muscle after MET may be due to biomechanical, neuro-physiological changes and increase in tolerance to stretch.[50,51] Both group-A (Kinesio taping with conventional therapy) and group B (Muscle energy technique with conventional therapy) obtained successful outcomes. However, compared to Group B, Group-A is more effective over three weeks.

6. LIMITATIONS OF THE STUDY

The duration of the treatment short consisted of 3 weeks; the result only showed short-term effects of the interventions, there was no long-term follow-up of patients, the sample size was small (Group A, n = 15; Group B, n = 15), Strength of the complex knee musculature were not taken into account, not assessed particularly which head of hamstrings muscle was tight (short and long head), and only unilateral osteoarthritis patients were taken.

7. FUTURE RECOMMENDATION

It is recommended for long-term treatment and follows up; the study can be done with a large sample size, and the same study can be done on muscle energy technique aiming to relieve tightness of particular head of hamstrings muscle in knee Osteoarthritis participants, only unilateral osteoarthritis patients were taken in the study, so to study on bilateral involvement of osteoarthritis should be carried out.

8. CONCLUSION

Group-A (Kinesio taping with conventional therapy) and Group B (Muscle energy technique with conventional therapy) significantly improved post-treatment. Hence, this study can be concluded that the intervention given in group-A (Kinesio taping with conventional therapy) showed significant improvement in VAS in terms of pain, Goniometer in terms of extension range of motion, and Active knee extension test in terms of hamstrings flexibility compared to Group-B (Muscle energy technique with conventional therapy). In contrast, the Quadriceps strength test was equally effective in groups A and B. Therefore, Kinesio taping Group-A is more effective than Muscle energy technique Group B.

9. AUTHORS CONTRIBUTIONS STATEMENT

Tadar Anam, MPT Scholar, Dr. Abhijit Kalita PT, and Dr. Ankita Kalita PT conceptualized the study and data. Dr. Abhijit Kalita PT and Tadar Anam carried out the data collection and literature review research and drafted the manuscript. and Dr. Abhijit Dutta analyzed the data and forwarded necessary inputs and modifications toward designing the manuscript. Finally, all the authors read and approved the final version of the manuscript.

10. CONFLICT OF INTEREST

Conflict of interest declared none.

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