WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 8.074
Volume 7, Issue 9, 558-570. Research Article ISSN 2277– 7105

COMPARISON OF MULLIGAN'S MOBILISATION WITH MOVEMENT AND TENS ALONG WITH KINESIO TAPING FOR OSTEOARTHRITIS OF KNEE JOINT

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Article Received on
06 March 2018,

Revised on 25 March 2018,
Accepted on 17 April 2018

DOI: 10.20959/wjpr20189-11751

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ABSTRACT

Background: A common painful and chronic condition that affects a larger proportion of the older population is knee osteoarthritis (OA), may in part be due to excessive loading of the articular cartilage mainly in medial compartment. The present study was undertaken to determine and compare the effect of Mulligan's Mobilization with Movement (MWM) and Transcutaneous Electrical Nerve Stimulation (TENS) along with Kinesio Taping (KT) in knee OA. **Method:** 30 patients fulfilling the eligibility criteria were selected and an informed consent was taken. Subjects were randomly divided into two groups by using simple random sampling: Mulligan's MWM group (15 subjects) and TENS along with KT group (15 subjects). On the first day, each participant was assessed for Visual Analogue Scale (VAS); Foot Posture Index (FPI) and Timed Up and Go test (TUG). Group A received Mulligan's MWM and Group B received Burst TENS for 15 minutes along with KT for Quadriceps activation. The participants were assessed post intervention after 4 days using all three outcome measures. **Result:** Both groups obtained successful outcomes, as measured by significant change in VAS ($p<0.05$) and TUG ($p<0.05$). However, no significant change in FPI was seen in both groups. **Conclusion:** The study concluded that TENS along with KT

group showed statistically significant reduction in VAS and marked improvement in timed covered by TUG post treatment compared to Mulligan's MWM group.

KEYWORDS: Knee Osteoarthritis, Mulligan's Mobilisation with Movement, Transcutaneous Electrical Nerve Stimulation, Kinesio Taping, Visual Analogue Scale, Foot Posture Index, Timed Up and Go test.

INTRODUCTION

A common painful and chronic condition that affects a larger proportion of the older population is knee osteoarthritis (OA), may in part be due to excessive loading of the articular cartilage mainly in medial compartment. The forces transmitted across the knee joint are greater in medial compartment compared to the lateral compartment, during walking; and increased medial compartment loading has been observed in patients with knee OA.[1]

A frequent cause of knee pain which can be successfully managed by physiotherapy, by joint mobilization is knee OA. It has been shown to be useful modality to reduce knee pain.[2] A contemporary form of joint mobilization, consisting of a therapist-applied pain-free accessory gliding force combined with active movement is Mulligan's concept of mobilization with movement (MWM).[2]

A non-pharmacological, inexpensive and safe form of analgesia is Transcutaneous electrical nerve stimulation (TENS). Melzack and Wall described that the inhibitory effect of TENS is based on the 'Gate Control Theory' of pain perception. The theory suggests that stimulation of large (A-beta) afferent cutaneous fibers activate the inhibitory-interneurons in the dorsal horn of de medulla and this may weaken the transmission of nociceptive signals from small diameter A-delta and C-fibers. TENS may then be indicated as a facilitator for exercise as OA is a dynamic process that involves phases of inflammation with possible increase of pain during these phases. The use of TENS is recommended in various clinical guidelines as a conservative treatment to relieve knee pain in osteoarthritis of the knee.[3]

Kinesio taping (KT) has been used in clinics for pain control and motor function enhancement in patients with sport injuries or musculoskeletal disorders. KT helps in increasing muscle flexibility and muscle strength and improves proprioception in patients with various musculoskeletal disorders.[4] A combination of applying appropriate tension and placing the target muscle in a stretched position, is widely used as an interesting and

relatively novel method for various clinical treatments by KT. Many proposed benefits by KT are such as the provision of structural support, relief of swelling and inflammation, excitation and inhibition of muscle activity, and adjustment of blood and lymph flow.[5]

The development of a range of lower limb musculoskeletal conditions has long been considered to contribute by foot posture, as it may alter the mechanical alignment and dynamic function of the lower limb. People with medial compartment knee OA has shown to exhibit a more pronated foot. Genu varum malalignment of the knee is exhibited by people with medial compartment knee OA which has been shown to increase the risk of development and progression of knee OA. Compensatory foot pronation to enable the foot to be plantigrade when weightbearing has been lead genu varum malalignment of the knee.[1]

In participants with OA knee; Mulligan's MWM, TENS, KT was found to be effective in decreasing pain and improving functional mobility. But since no study shows the combined effect of TENS along with Kinesiology Taping on OA knee to decrease pain and improve functional mobility, there arises a need to assess the effectiveness of both the therapies given together. Also since there is no study done to compare the effect of Mulligan's MWM and TENS with KT on knee OA by using Visual Analogue Scale (VAS), Foot Posture Index (FPI) and Timed Up and Go Test (TUG), thus we undertook this study at our institution.

The main aim of the study was to compare the effect of Mulligan's MWM and TENS along with KT for knee OA. The objectives of the study were firstly to study the effect of Mulligan's MWM on knee OA; secondly to study the effect of TENS along with KT on knee OA; thirdly to compare the effect of MWM and TENS along with KT on knee OA by using VAS, FPI and TUG.

MATERIALS AND METHODS

An ethical approval from the Dr. D.Y. Patil College of Physiotherapy, Pune was taken. The participants were first assessed by the therapist and they were selected as per the inclusion criteria which were both genders; age ranging from 50 years to 75 years; Unilateral Osteoarthritis; participants who met the American College of Rheumatology (ACR) criteria for diagnosing knee OA by using history and physical examination, which contains presence of pain in knee joint plus any three of six factors like age more than 50 years old, presence of crepitus on active motion, less than 30 min of morning stiffness, bony tenderness, bony overgrowth and no palpable warmth of synovium[6]; score of greater than 5 cm in VAS.[4] The

written consent was taken from all the participants on the first day of intervention. The participants were randomly allocated using Simple random Sampling by coin toss method. The study design done is Comparative Study.

Participants were randomly divided into two groups namely: Group A- Mulligan's MWM group (15 patients), who were selected by coin toss and got 'Heads' and Group B TENS along with KT group (15 patients), who were selected by coin toss and got 'Tails'. On the first day (pre) each participant was subjected to VAS (pain), FPI, time taken by TUG was noted and then treatment was given; and on 4th day (post) participants were again only assessed.

The outcome measures were VAS, FPI and TUG. In VAS, the participants were asked to mark a point in between the 10 cm scale in which 0 being no pain and 10 being worst pain imaginable during any activity such as walking, climbing stairs.[4] In FPI, participant is made to stand relaxed for about 2 minutes. FPI includes talar head palpation, curves above and below the lateral malleoli, calcaneal angle, talonavicular bulge, medial longitudinal arch and forefoot to rearfoot alignment. Each item was scored on a 5-point scale between -2 and +2 and provides a total sum of all items between -12 (highly supinated) and +12 (highly pronated).[1] Scoring was carried out with reference to published guidelines: normal values are given as 0 to +5, the pronated foot +6 to +9 (highly pronated +10 to +12), and the supinated foot -1 to -4 (highly supinated -5 to -12).[10] In TUG, a stop watch was used to time the participant rising from a standard arm chair, walking to a cone on the floor 3 m away, turning around, returning to the chair and sitting down again. The participants were bare-footed and were asked to perform the task at his/her own pace. An explanation and demonstration was provided by the investigator but no practice trials were given.[7]

Group A received MWM which consisted of a sustained manual glide of the tibia (medial, lateral, anterior, posterior, or rotation) during active knee flexion and extension. Each participant was tested with sustained manual glides in each of the possible directions during active knee flexion and extension in supine lying. Frontal plane glides were tested first and then sagittal plane glides followed by rotation. The glide direction that reduced pain to the minimum level and improved range of knee motion most was chosen as the glide for the MWM treatment technique. Overpressure was included at end range if Range of Motion (ROM) was pain-free. If pain was not present in supine lying, then the glide direction for the MWM treatment technique was assessed in a weight-bearing position in a similar manner. If

in supine lying more than one glide direction had similar beneficial effects, then these assessments were repeated in weight-bearing to identify the most effective glide direction for the treatment technique.[8] The therapist initially applied the pain-free manual glide force on the tibia with the knee resting in a mid range position. The glide force was sustained while the patient performs 10 repetitions of self-paced active full range knee flexion and extension for 3 sets. 1 minute rest will be given between each set. Self treatment in weight bearing position were also taught to the patients.[8]

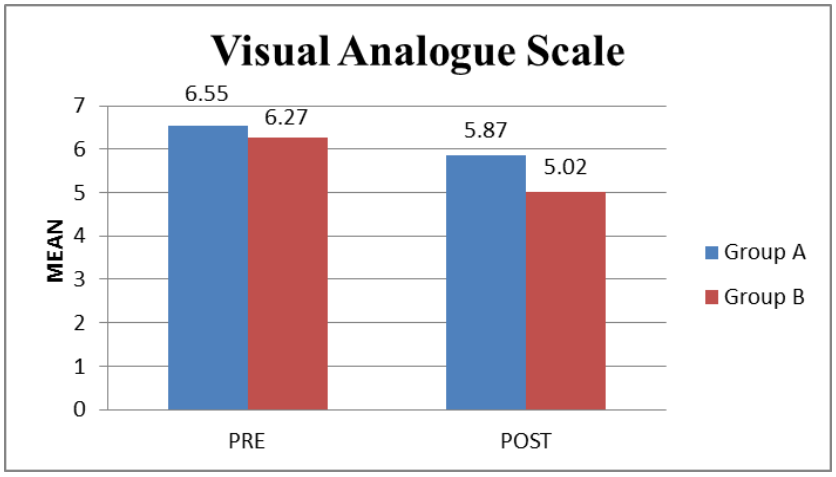
Group B participants received Burst TENS initially, the setting of the current was internal frequency: 100 Hz; burst frequency 3 Hz; intensity: until an unpleasant but non-painful sensation was acquired for 15-20 mins.[4] Then KT was applied, the participants were positioned lying on their side with the hip extended and the knee of the affected side at 60 degrees of flexion. The more affected limb of each participant with knee OA was taped with an I-shaped KT starting at the origin of the rectus femoris till the superior patellar border and Y-shaped KT continuing from superior patellar border till tibial tuberosity. The taping had no tension at its two bases, whereas the portion between the anchor and the superior patella were stretched 15%-25% and was kept for 4 days.[5]

RESULTS

Statistical analysis was done by Primer of Biostatics Version 7.0, 2011, then applying Paired‘t’ test for VAS and TUG when within the group was compared and Unpaired ‘t’ test while comparing the parameters of different groups. SPSS software Version 16.0 was also used for Mann-Whitney Rank Sum Test which was used for comparing the pre-post mean of both the groups in Foot Posture Index.

Table. 1: Visual Analogue Scale.

Visual Analogue Scale	Pre mean	Post mean	Pre SD	Post SD	P value
Group A	6.55	5.87	1.017	1.04	0.004
Group B	6.27	5.02	0.879	1.168	0.001

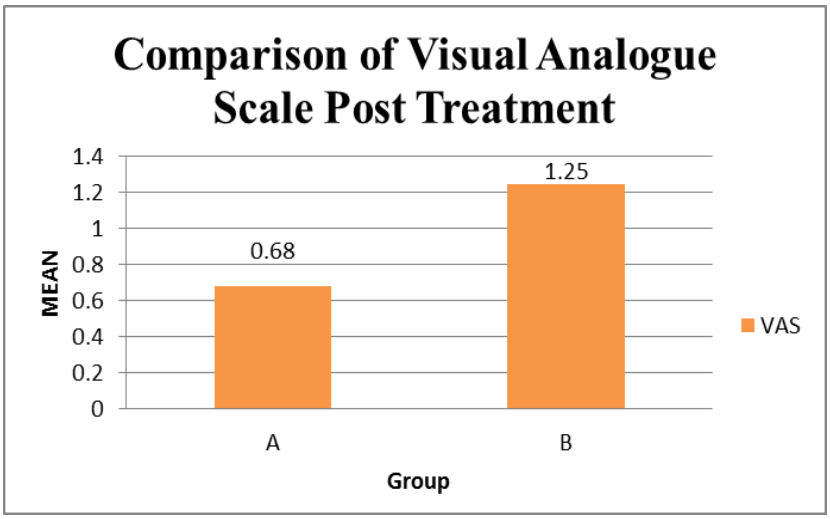


Graph. 1: Visual Analogue Scale.

Interpretation: In graph 1, the mean of pre treatment and post treatment pain assessment by VAS is shown of both the groups, p value was calculated as 0.004 ($p<0.05$) for Group A and 0.001 ($p<0.05$) for Group B, which are statistically significant. Thus post treatment shows that pain has decreased after the treatment on 4th day in both groups.

Table. 2: Comparison of Visual Analogue Scale Post Treatment.

Visual Analogue Scale	PRE-POST Mean	SD	Unpaired 't' Test
Group A	0.68	0.75	t= -1.75
Group B	1.253	1.02	p= 0.09

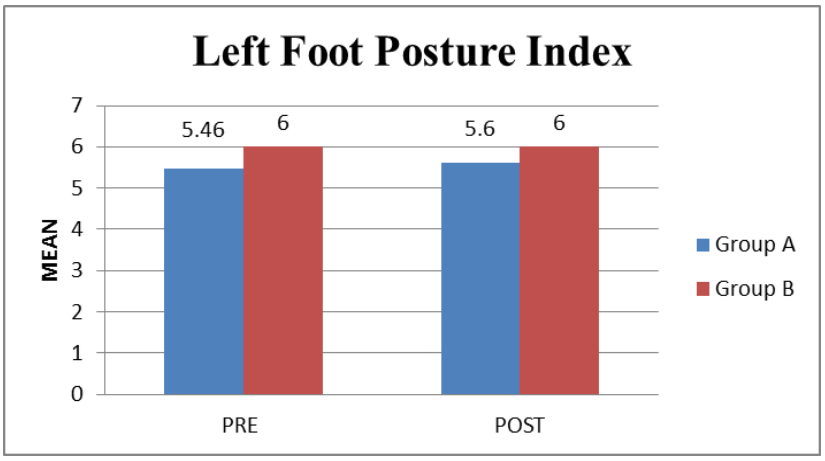


Graph. 2: Comparison of Visual Analogue Scale Post Treatment.

Interpretation: In graph 2, comparison of pain assessment pre-post treatment in both the groups was done of VAS and it shows that Group B showed better result as compared to Group A. The p value was calculated as 0.09 ($p>0.05$) which is statistically not significant.

Table. 3: Left Foot Posture Index.

Left Foot Posture Index	Pre mean	Post mean	Pre SD	Post SD	P value
Group A	5.46	5.6	3.75	3.81	0.164
Group B	6	6	3.546	3.546	0.001

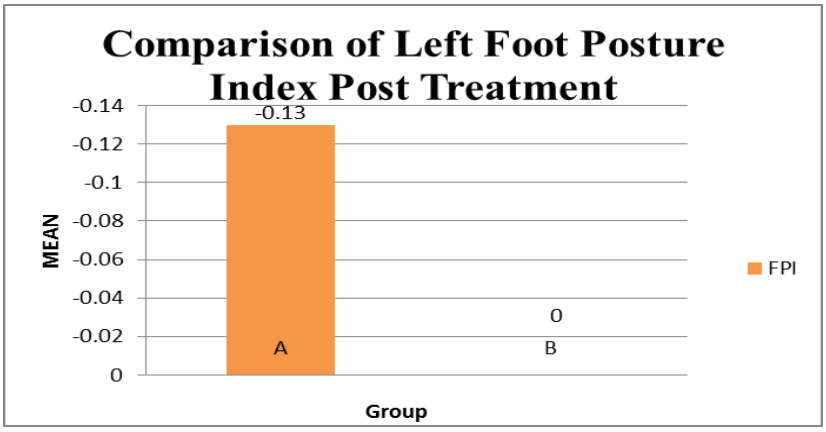


Graph. 3: Left Foot Posture Index.

Interpretation**:** In graph 3, the mean of pre treatment and post treatment by Left FPI was shown of both the groups, p value was calculated as 0.164 ($p>0.05$) in Group A which is statistically not significant and 0.001($p<0.05$) in Group B which is statistically significant. Thus post treatment shows not much significant change after the treatment on 4th day in both groups.

Table. 4: Comparison of Left Foot Posture Index Post Treatment.

Left Foot Posture Index	Mean	SD	Median	Mann-Whitney Rank Sum Test
Group A	-0.133	0.35	0	t= 0.609
Group B	0	0	0	p= 0.542

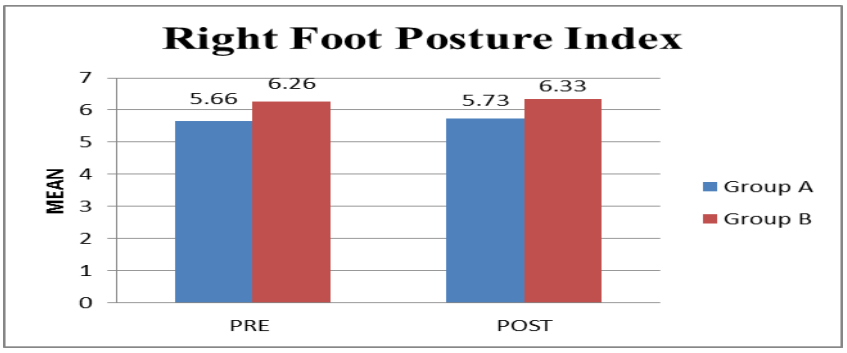


Graph. 4: Comparison of Left Foot Posture Index Post Treatment.

Interpretation: In graph 4, the comparison mean of Left FPI pre- post treatment in both the group is shown. The graph suggests that there was mean change of -0.13 in Group A and no change in Group B and the p value was calculated as 0.0542 (p>0.05) by Mann-Whitney Rank Sum Test, which is statistically not significant.

Table. 5: Right Foot Posture Index.

Right Foot Posture Index	Pre mean	Post mean	Pre SD	Post SD	P value
Group A	5.66	5.73	3.86	3.67	0.334
Group B	6.26	6.33	3.218	3.266	0.582

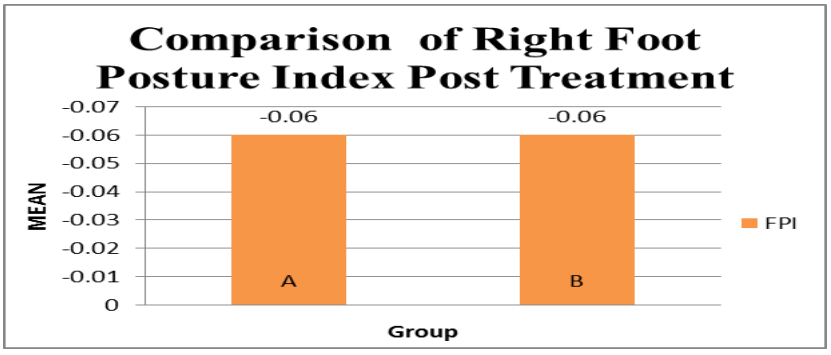


Graph. 5: Right Foot Posture Index.

Interpretation: In graph 5, the mean of pre treatment and post treatment by Right FPI was shown in both the groups, p value was calculated as 0.334 (p>0.05) in Group A and 0.582 (p>0.05) in group B, which are statistically not significant, after the treatment on 4th day in both groups.

Table. 6: Comparison of Right Foot Posture Index Post Treatment.

Right Foot Posture Index	Mean	SD	Median	Mann-Whitney Rank Sum Test
Group A	-0.066	0.258	0	t= 0
Group B	-0.066	0.457	0	p= 1



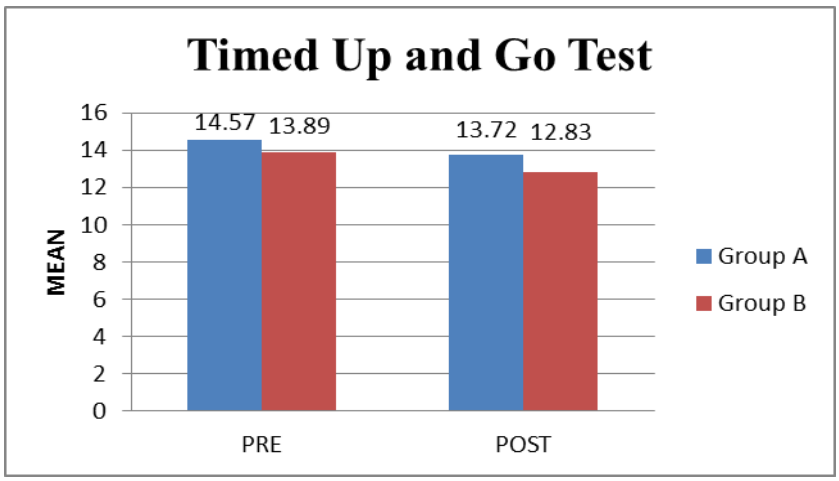
Graph. 6: Comparison of Right Foot Posture Index Post Treatment.

Interpretation

In graph 6, the comparison mean of Right FPI pre- post treatment in both the group is shown. The graph suggests that there was mean change of -0.06 in both the groups and the p value was calculated as 1 (p>0.05) by Mann-Whitney Rank Sum Test, which is statistically not significant.

Table. 7: Timed Up and Go Test.

Timed Up and Go Test	Pre mean	Post mean	Pre SD	Post SD	P value
Group A	14.57	13.72	2.75	3.25	0.026
Group B	13.89	12.83	1.989	2.204	0.001



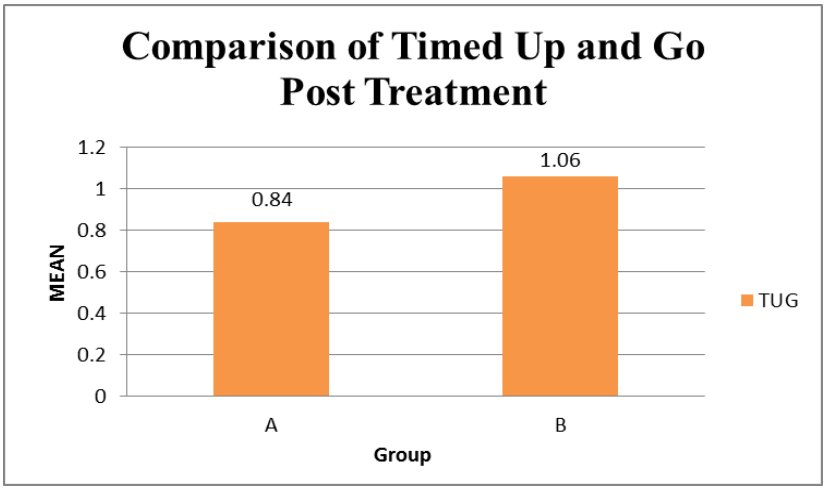
Graph. 7: Timed Up and Go Test.

Interpretation

In graph 7, the mean of pre treatment and post treatment functional mobility assessment by TUG was shown in both the groups, p value was calculated as 0.026 (P<0.05) in Group A and 0.001(p<0.05), which are statistically significant, after the treatment on 4th day in both groups.

Table. 8: Comparison of Timed Up and Go Post Treatment.

Timed Up and Go Test	PRE-POST Mean	SD	Unpaired 't' Test
Group A	0.846	1.318	t= -0.569
Group B	1.067	0.71	p= 0.574



Graph. 8: Comparison of Timed Up and Go Post Treatment.

Interpretation: In graph 8, comparison mean of TUG pre-post treatment in both the groups was done and it shows that Group B showed better result as compared to Group A and the p value is calculated as 0.0574 (P>0.05) which is statistically not significant. Thus the functional mobility has improved more in the Group B patients than the Group A patients.

DISCUSSION

This study shows that both the treatment that is Mulligan's MWM and TENS along with KT were effective in reducing pain and also improving the functional mobility of the patients with knee OA participants. But there was no difference seen in FPI post treatment in both the groups.

The mechanism by which the MWM exerts its effects in clinical practice is still a subject of research. It has been proposed that Mulligan's MWM produces its effects by correcting the positional faults of joints.[9] Manual therapy results in greater improvement in functional status and symptoms of the knee with passive physiological and accessory movements in OA knee. According to Positional fault theory (Mulligan, 1995)**,** joint alignment alteration occurs due to injury or chronic/poor arthokinematics, thus causes inconsistent bony congruencies that occur after strain or injury, resulting in movement restrictions & pain. MWM helps in relocating joint in correct alignment therefore immediate pain relief occurs. Thus explaining hypothetical mechanism for first successful Mulligan MWM.[9]

The study did not show significant difference in this group maybe because the participants may not have done correctly and regularly the self treatment taught as it was not been supervised between these 4 days.

Pain may be influenced by TENS by the electrical stimulation of low-threshold A-beta cutaneous fibers, the responsiveness of central pain-signalling neurons of OA knee participants who are centrally sensitized is augmented to the input of these electrical stimuli. TENS influences pain through different pathways and one of these pathways is the gate-control theory. Opioid pathways that involve peripheral, spinal and supraspinal mechanisms are also proposed as an explanation for the pain modulation of TENS. This pathway may be less vulnerable for an adverse effect of TENS in Osteoarthritis knee patients.[3]

KT decreases pain by inducing constant contraction and relaxation of muscle through physical stimulation of cutaneous afferents. Hence when the VAS scores was used to measure the pain intensity might have decreased. Pain modulation via the gate control theory is one plausible explanation for such a change, because it has been proposed that tape stimulates neuromuscular pathways via increased afferent feedback. Under the gate control theory an increase in afferent stimulus to large-diameter nerve fibers can serve to mitigate the input received from the small-diameter nerve fibers conducting nociception.

As the quadriceps muscle play an important role as a shock absorber, weakness of this muscle decreases the joint protection, resulting in greater stress and overload on the knee.

Thus the taping method used was activation of the quadriceps muscle which showed differences in severity of functional mobility or pain intensity before and after the treatment in the study.

As TENS helps in pain reduction and also KT helps in pain reduction and improves functional mobility, thus this treatment has been shown more effective than the other treatment because the KT was been kept for 4 days and thus it helped the patients for daily activity without any movement restrictions and proper support. Study shows that individuals with knee OA have pronated foot mainly which is calculated by FPI. Previous studies also show that mainly medial compartment of knee joint is affected with knee OA and thus there is more loading on the foot structures, thus leading to the pronation of the foot. The study also shows no much significant change in the FPI after both the treatments in knee OA individuals. This is because no sufficient follow up has been taken to see any changes in the foot structures. There is no long term follow up for the treatment group. The study was conducted in a small group of population so cannot be generalized to whole population. Hence a larger group is required.

The study can be conducted in a larger population to get more accurate results. Also follow up should be taken to know the long term effect of the treatment. Correct home protocol can be taught to help the patient to become functionally independent in a shorter duration of time.

CONCLUSION

The study concludes that there was more significant decrease in pain by VAS and improved functional mobility in participants who were treated by TENS along with KT compared to Mulligan's MWM participants. The study also shows that there was no significant change in Foot Posture Index of the patients in both the groups after the treatment.

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