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Effectiveness of Mobilisation with Movement Versus Conventional Physiotherapy on Pain and Functions Among Patients with Unilateral Medial Compartment Tibiofemoral Knee Osteoarthritis

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ABSTRACT

Objectives: The purpose of the study was to compare the effect of Mobilisation with Movement and conventional physiotherapy in patients with unilateral medial compartment tibiofemoral knee osteoarthritis.

Methods: A total of 30 subjects with osteoarthritis knee diagnosed clinically were included in the study and randomised equally into two groups, 15 in each. Group A had Mobilisation with Movement and Group B underwent conventional physiotherapy. The outcome measures used were Visual Analogue Scale (VAS) and Oxford knee score (OKS). The measurements were taken at baseline and after 2 weeks of intervention.

Results: The paired and unpaired t tests were used to compare within and between the groups respectively. Both the groups improved in pain and Oxford knee score, but Group A improved significantly more in Visual analogue scale (VAS) (P<0.0001) and Oxford knee score (OKS) (P <0.0405) than Group B.

Conclusion: The study concluded that Mobilisation with Movement (MWM) provides superior benefits over conventional physiotherapy in improving the pain and functions.

Keywords: Knee Osteoarthritis, Mobilisation with Movement, Shortwave diathermy, VAS, OKS

INTRODUCTION

Knee osteoarthritis (OA) is a chronic degenerative disease which is inflammatory in nature and characterized by changes in the articular cartilage, the presence of fibrillation areas, and cracking and thickening of the subchondral bone. Clinically, it is associated with pain, stiffness, deformity, and loss of functional capacity.[1,2] Knee OA is likely to become the eighth most important cause of disability in men and the fourth most important cause of disability in women according to the World Health Organization report on global burden of disease.[3] OA knee has an increasing prevalence noted in the middle ages and women are more predisposed than men.[4] Prevalence of OA knee in India is 30% and maximum of OA knee affected population were individuals aged between 40 and 60 years and 19-30% of the total affected population were sedentary or unemployed.[5] The knee joint consists of two articulations: Tibio-femoral and Patello-femoral, the tibio-femoral joint is the weight-bearing joint of the knee.[6]

There are three compartments of the knee: medial (inside) tibio-femoral compartment, lateral (outside) tibio-femoral compartment & patella-femoral compartment and the most common place to get arthritis is in the medial compartment.[7] The management of knee OA intended to control pain while improving function and quality of life.[8] The most well-known clinical interventions incorporate pharmacological agents and joint replacement surgery, which likewise has high risk, particularly in older

patients.[9,10] In contrast, less obtrusive management, for example, targeted manual therapy and exercise, are cost-effective and can be safely administered to older patients with OA.[11]

Nevertheless, clinical guidelines report that the efficacy of manual therapy and electrotherapeutic modalities is ill-defined in patients with knee OA[12], recent extremely good studies[13, 14] have reported that manual therapy decreases pain, increases range of motion (ROM) and improves physical function. The Osteoarthritis Research Society International (OARSI) recommended non-pharmacological methods including patient education programs, weight reduction, coping strategies, and exercise programs for treatment of knee OA.[15]

Physical therapy has known to play a vital role in pain relief and restoration of mobility and function in OA knee which includes exercises; patellar taping; electrotherapy modalities and more recently manual therapy techniques.[16]

Mulligan Mobilization with Movement (MWM) is based on the concept that minor position faults occur in articulating surfaces of joints following injury or strains resulting in movement restriction and pain exacerbated by active contraction of muscles within the faulty positions of the joint[17]. Thus, MWM involves passive accessory glide as a corrective technique, applied by the therapist perpendicular to the joint plane to correct the positional fault combined with the offending movement being performed actively by the subject and sustained for several repetitions, the pain should always be reduced and/or eliminated during the application and pain-free function should be restored.[17]

There is high quality evidence that exercise reduces pain and improves function health beliefs, depression, anxiety and quality of life in people with knee osteoarthritis.[18, 19] The isometric exercises have beneficial effect on quadriceps strength, pain and functional disability. These are found most appropriate and easy to understand by the patients and can be easily and safely performed at home because it requires no or minimal apparatus. Further, isometric exercise causes the least intra-articular inflammation, pressure, and bone destruction.[20]

Few studies have examined the effects of Mobilization with Movement (MWM) in patients with knee osteoarthritis (OA) compared to other procedures but the evidence concerning widespread hypoalgesic effects of MWM in patients with knee OA are lacking or least in numbers. Many of the treatments have been found to be beneficial as a treatment modality in its own way but which yields more effects has been the topic of debate for more than a decade. There is dearth of literature in quantifying the efficacy of the two treatments in comparison. Hence, the objective of our study is to find out effects of Mobilisation with Movement and conventional physiotherapy on pain and functions in management of unilateral medial compartment tibiofemoral knee osteoarthritis.

METHODS

Subjects

A total of 30 subjects with unilateral medial compartment tibiofemoral osteoarthritis knee diagnosed clinically who met inclusion and exclusion criteria were recruited from the Department of Physiotherapy, Sharda Hospital, Greater Noida. The present study has the approval of the Institutional Local Ethical Committee and informed consent was obtained from all the subjects. The subjects had to meet the following inclusion criteria: age between 45 - 70 years,[21] both male and female, unilateral knee OA according to Kellgren and Lawrence (K&L) grade $\geq$ 2,[22] pain and crepitus in the knee joint during knee movements, medial knee pain, duration of pain more than 2 months whereas exclusion criteria were patient have taken any intra-articular injection within 3 months, metallic implant around knee joint, suspicious of malignancy around knee joint, significant cardiovascular disease, knee

injury.

Procedure

The selected subjects were randomly assigned by lottery method[23] to Group A for Mobilisation with Movement and Group B for Conventional Physiotherapy (short wave diathermy and exercises) along with home exercise program in both the groups. The folded papers of same shape and size were marked either Group A or Group B equally in numbers and were kept in the box. Paper drawn by the patient allocate the mode of treatment. After group allocations, respective subjects were treated either by MWM or conventional physiotherapy. Both treatments were given as individual treatment by the same physiotherapist for two weeks (except Sundays). The whole procedure of the study was explained to all the subjects. The demographic characteristics such as age, weight, height, BMI (body mass index), the side affected of the two treatment groups were assessed at baseline before randomization. Outcome measures such as Visual Analogue Scale (VAS) for pain and Oxford Knee Score (OKS) for function was taken on day 0 (pre) and after two weeks (post). Subjects were asked not to take any other treatment along with these intervention for OA knee.

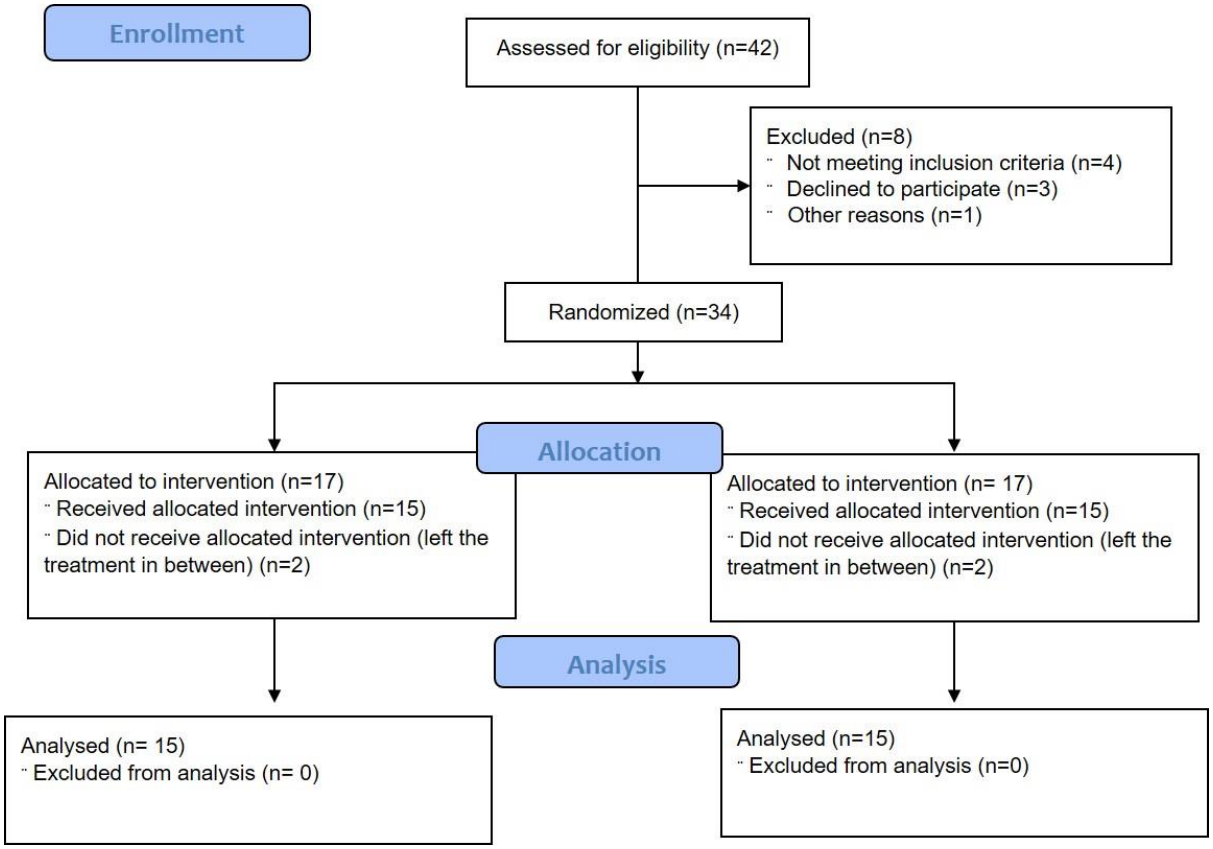

Figure 1: CONSORT flow chart describing participants flow during study

Intervention protocol

Mulligan's Mobilization with Movement (MWM) [24, 25] (Group A)

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.

Rotation MWM: The patient lies supine. Then grasp the lower leg and the tibia is internally rotated 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 the movement pain free 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. 10 repetitions were given two times per session with 30 seconds of rest was given in between the sessions. Total 5 session/week for the period of 2 weeks.

Conventional Physiotherapy (Group B)

Shortwave diathermy (SWD): Before we start the treatment the therapist evaluated the safety measures of the shortwave diathermy device. Patient's thermal sensation of the treatment part was evaluated and all metal objects, materials, clothing and electronic devices from treatment part were removed. Patient was positioned in supine lying and short wave diathermy pads were applied in contra-planner (AP) method for 20 minutes with frequency of 27.12MHz in continuous mode (CSWD, thermic) on affected knee. The spacing between the pads and treatment part is maintained by the placing of eight folded towels. Intensity was maintained and adjusted to produce comfortable warmth based on patient's feedback. Total 5 session/week for the period of two weeks.[26]

Exercises[21]: Each contraction was of 10 seconds hold followed by a 3 sec rest and repeated ten times.

1. Static quadriceps exercise: Patient is positioned in supported long sitting position. He pushes the knee down by contracting the quadriceps femoris muscle.
2. Vastus Medialis Oblique exercises: (i) Last 15^{o} extension - Patient is in long sitting position with the affected knee flexed to 15^{o}. He then straightens his knee fully by contracting the quadriceps muscle. (ii) Supine -. With the patient in supine position, he flexes his hip to 15^{o}, adducts it 10^{o} and then externally rotates it with the knee extended.
3. Resisted quadriceps exercise: Patient is in high sitting position. Then extends his knee fully against resistance given by the therapist or by the weight cuff (whichever is tolerated by the patient) tied to the ankle.
4. Hamstrings strengthening exercises: Patient is in a prone lying position. He then bends his knee in the available range against the resistance given by the therapist or by the weight cuff tied to the ankle.
5. Hip abductors strengthening exercises: Patient is in side lying position. He then abducts his hip with the knee extended (against the resistance of weight cuff or the therapist).

Home Exercise Program

The subjects in both the groups (A and B) were advised to do the home exercise program. These exercises were taught to the subjects and their attendants under the supervision of Physiotherapists and follow up was taken daily. The home exercise program[27] are as follows:

a. Quadriceps isometric strengthening exercises - Hold 10 seconds followed by 3 sec rest x 10 times x 2 sets.
b. Range of motion exercises of knee, heel sliding and dragging - 10 times x 3sets.
c. Active stretching exercises applied to hamstring and quadriceps muscle - Hold 30 seconds x 3 times x 3 sets.
d. Hamstring muscle isometric exercises - Hold 10 seconds followed by 3 sec rest x ten times x 2 sets.
e. Active ankle pump – 10 times x 3 sets.

Outcome measures

The assessment of pain was done according to Visual Analogue Scale (VAS), a self-assessing questionnaire was used to assess the severity of pain. A 10-cm line was drawn on a paper and divided into ten equal sections, where 0 represents "no pain" and 10 represents "unbearable pain." Each participant was asked to mark the level

of pain in his or her knee joint before and after treatment on the scale. The patient indicating on the scale themself indicating as a subjective experience.[28]

The functions of knee were measured by Oxford Knee Score (OKS), which consists of 12 questions about an individual's activities of daily living and how they have been affected by pain over the preceding four weeks. Each question score from 0-4 where four is the best outcome and total scores range from 0 (worst outcome) to 48 (best outcome).[29] The patient is first asked to date their questionnaire and confirm which side/leg they are receiving treatment. If both knees are involved, a questionnaire is done for each leg. If there are more than two missing answers, it is recommended that the overall score should not be calculated. In the event one or two questions are unanswered, it is recommended that clinicians put in a mean answer from the patient's other answer, If a question has more than one answer, the worst response i.e. smallest number is used for calculations. The OKS has demonstrated strong test-retest reliability in its original testing.[30]

Statistical analysis

The statistical analysis of the study was done by using software SPSS version 16.0. The paired and un-paired t-test was used for statistical analysis to compare within and between the groups respectively. Probability (*P*) value between 0.05 ($P<0.05$) & 0.01 was considered statistically significant and $P>0.05$ had no significance (ns). Continuous data were summarised in Mean ± SD (standard deviation).

RESULTS

A total of 34 subjects were assigned out of 42 patients enrolled from the Department of Physiotherapy. Four subjects dropped out for different reasons (see Fig 1). Of these 30 subjects who completed the study, 15 were treated with Mulligans Mobilization with Movement and 15 with conventional physiotherapy. The mean age of the subjects was 51.63 ± 4.42 years. In 12 patients, right knee was affected.

Table 1: Demographic characteristics of two groups

Variable	Group A (n=15) (%)	Group B (n=15) (%)	t/χ^2 value	*p* value
Age (years): Mean ± SE	51.33 ± 2.64	51.93 ± 6.19	0.17	0.732
BMI (kg/m2) : Mean ± SE	25.40 ± 3.72	24.89 ± 2.46	0.86	0.395
Gender:				
Female	6 (40.0)	5 (33.3)	0.14	0.705
Male	9 (60.0)	10 (66.7)		
Side affected:				
Right knee	6 (40.0)	6 (40.0)	0.00	1.000
Left knee	9 (60.0)	9 (60.0)		

Age and BMI of two groups were summarized in Mean ± SE and compared by independent Student's t test (t value) whereas distribution of gender and side affected were summarized in number (n) and percentage (%) and compared by χ^2 test (χ^2 value) presented in Table 1. On comparing, the baseline demographic characteristics were found similar ($p>0.05$) between the groups suggesting that both the groups were demographically matched and the outcomes would not be influenced by these parameters.

The baseline measurement (day 0) of the outcome measure is presented in Table 2, which shows that there was no significant difference between the scores of the dependent variables of VAS ($p=0.8787$) and OKS ($p=0.3416$) (Fig. 3 (a)).

Table 2: Baseline comparison of outcome measures (Mean ± SE) between the two groups

Group	Group A (n=15)	Group B (n=15)	Mean change	*t*-value	*p*- value
VAS	8.53 ± 1.30	8.60 ± 1.06	-0.07 ± 0.43	0.15	0.8787
OKS	28.33 ± 4.92	30.20 ± 5.62	-1.87 ± 1.92	0.98	0.3416

The pre and post VAS and OKS of two groups are summarized in Table 3 and Table 4 respectively and also depicted in Fig 2. Both the groups shown statistically significant difference (p<0.001) in the outcome measures with the time.

Table 3: Pre and post VAS score (Mean ± SE) of two groups

Group	Pre (n=15)	Post (n=15)	Mean change (Post-Pre)	*t*-value	*p*- value
Group A	8.53 ± 1.30	2.47 ± 0.64	-6.07 ± 0.27	22.75	<0.001*
Group B	8.60 ± 1.06	4.20 ± 0.86	-4.40 ± 0.16	26.94	<0.001*

Table 4: Pre and post OKC score (Mean ± SE) of two groups

Group	Pre (n=30)	Post (n=30)	Mean change (Post-Pre)	*t*-value	*p*- value
Group A	28.33 ± 4.92	40.33 ± 4.70	-12.00 ± 0.26	46.47	<0.001*
Group B	30.20 ± 5.62	36.20 ± 5.78	-6.00 ± 0.22	27.49	<0.001*

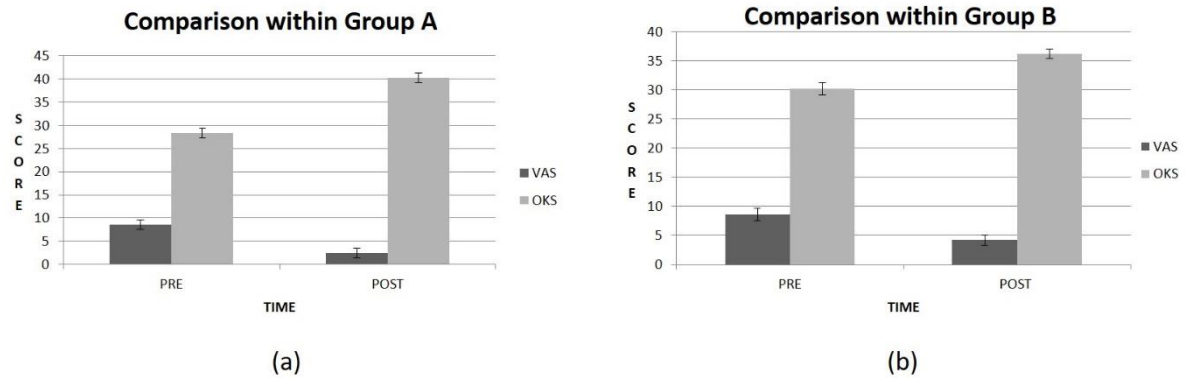

Figure 2: Comparison of outcome variables within group A (a) and Group B (b) with time

After two weeks of intervention on comparison between the two groups the outcome measures VAS (p<0.001) and OKS (p=0.040) presented in Table 5 were found statistically significant which depicts that Group A has shown better improvement than Group B (Fig. 3 (b)).

Table 5: Post VAS and OKS comparison (Mean ± SE) between the two groups

Group	Group A (n=15)	Group B (n=15)	Mean change	*t*-value	*p*- value
VAS	2.47 ± 0.64	4.20 ± 0.86	-1.73 ± 0.27	6.25	<0.001*
OKS	40.33 ± 4.70	36.20 ± 5.78	-4.13 ± 1.92	2.15	0.040*

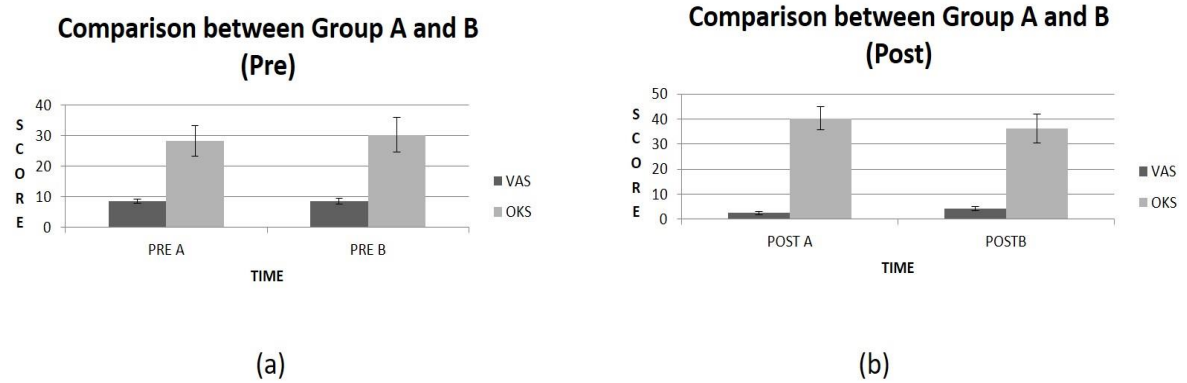

Figure 3: Comparison of outcome variables VAS and OKS between the groups on day 0 (a) and post intervention (b)

DISCUSSION

This study hypothesized that Mobilisation with Movement may be beneficial than conventional physiotherapy in improving pain and functions among patients with unilateral medial compartment tibiofemoral knee osteoarthritis which is found to be true. These improvements may be due to the reversion of reflex pain inhibition. Alteration in motor activity may also be a sign of a reaction that is intervened at the level of the central nervous system.[31] The joint mobilization techniques were found to modulate pain and also improve extensibility of contractile tissues and movement of joints.[32] Its neurophysiological effects are mechanoreceptor mediated pain gate analgesia blocking nociception at spinal cord dorsal horn; periaqueductal grey matter and rostro-ventral medulla mediated descending pain inhibition mostly through activity of noradrenaline and to some extent opioids and serotonin causing reduction in maladaptive cognitive-affective mechanisms observed in pain neuromatrix.[33]

A case series[34] and RCT[35] reported immediate improvements after Mulligan's mobilization alone, on passive knee flexion range of motion and knee pain scores in OA. Beselga et al.[36] reported immediate improvement after a single treatment of MWM on hip flexion and internal rotation ROM in patients with hip OA, moreover the time needed to walk 6 m was reduced during functional test. Mulligan's concept allows us to safely apply end range techniques that are under the full control of the patient, remain at end range for several seconds with no pain and provide a mechanical effect based pain inhibition by silencing the slow conducting articular nociceptor afferents due to activation of the fast conducting mechanoceptor afferents.[37]

Another randomized crossover study by Rao et al[38] found equal effectiveness of Mulligan's and Maitland mobilization techniques on knee pain, function, and pain-free squat angle. There is evidence from Cochrane reported by Moss that accessory mobilization to knee immediately provide local and widespread reduce pain stimuli[19].

The improvement in conventional physiotherapy group is also supported by two of the studies[39, 40] that evaluated the effects of deep heating exclusively with physical agents, observing positive effects on outcome variables, such as those measured by WOMAC index, pain, joint movement amplitude or muscle strength. However, authors are not sure about its isolated efficacy. It is generally believed that the increase in tissue temperature achieved using continuous (CSWD, thermic) induces vasodilatation, an increase in cellular activity, pain threshold and soft tissue extensibility and a reduction in muscle spasm[26]. Also the Fitness Arthritis and Seniors Trial reported a modest 8% to 10% improvement in pain and functioning scores as a result of 18 months of aerobic or resistance exercise among their sample of knee OA patients.[41]

Exercise program suggestive of holding stretch for 15 seconds has a greater improvement in active ROM[42]. The previous study done by Aoki et.al[43] suggest that stretching was effective in improving knee ROM and gait in knee osteoarthritis. The quadriceps isometric has beneficial effect on pain, muscle strength and functional disability, these improvement may be due to improved quadriceps strength and increased stability of knee[44]. Similar findings by Lange et.al[45] suggest that resistance training improve muscle strength, pain and physical function.

Thus, this study suggest that both the treatments were found effective but Group A has shown better result compared to Group B.

Limitations

There is no long term follow-up for the treatment groups in order to check the magnitude of improvement. The study was conducted in a small group of population so cannot be generalised to whole population. Hence a larger group is required and also

recommended to have further study to see the long term effects of MWM.

CONCLUSION

This study concluded that MWM is found to more effective in improving pain and function than conventional physiotherapy in patients with unilateral medial compartment tibiofemoral OA knee. However, both the treatment has shown improvement. Hence, with this outcome taken into consideration, Mulligan's MWM techniques can be implemented as an adjunct to the treatment in patients with OA knee pain.

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Conflict of Interest: None

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