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## Effectiveness of dry needling with mulligan mobilization on pain, function and range of motion in patients with knee osteoarthritis: A randomized controlled trial

**Chelsea Lobo and Tejas Suryavanshi**

### Abstract

**Question:** Which among the mulligan mobilization with dry needling, mulligan mobilization alone and conventional therapy will be more effective on pain, function, and range of motion in patients of knee osteoarthritis?

**Design:** Randomized controlled trial with chit method.

**Participants:** Eighty six participants with knee osteoarthritis.

**Intervention:** group A-Patient lies supine with the knee flexed distal femur is stabilized laterally with one hand. While the glide is sustained, the patient actively moves the knee into extension from the starting position and then returns to starting position, group B-DN will be performed in a supine position for knee extensors the pecking technique was performed on selected MTrPs in multiple directions. Group C-Ultrasound therapy, strengthening exercise is given by holding maximal isometric contractions, and stretching exercises will be given.

**Outcome measures:** Visual Analogue Scale, Range of Motion, Modified WOMAC score.

**Results:** 86 participants were randomly allocated to 3 groups. After 4 weeks, Pain, range of motion, and functional parameters were compared in these 3 groups, significant improvements were found in all three groups in post-intervention assessment, but Group 1 showed more significant improvement than the other groups.

**Conclusion:** This study concludes that mulligan mobilization combined with dry needling was more effective than the other two groups.

**Registration:** CTRI/2023/07/054767

**Keywords:** Mulligan mobilization, dry needling, conventional therapy

### Introduction

Osteoarthritis is a degenerative joint disease which is associated with degradation of articular cartilage eventually affecting the underlying bone causing osteophytes formation at the joint margins<sup>[1]</sup>. The word Osteoarthritis arrives from the Greek word “osteo” meaning bone, “arthro” meaning joint and “itis” meaning inflammation<sup>[3]</sup>. It is the most common inflammatory disease in people over 45 years of age<sup>[4]</sup>. Pain and disability linked with knee osteoarthritis is the second most prevalent musculoskeletal Disorder<sup>[5]</sup>. As it is related to ageing, it has caused a greater burden on economic and social conditions and has impacted the quality of life of these people<sup>6</sup>. The most affected joint in osteoarthritis is the knee joint because of its weight bearing requirement, high mobility, and lack of intrinsic stability<sup>3</sup>. Followed by knee, hip and thumb are most affected joints by OA<sup>[6]</sup>.

The prevalence of OA knee is rising, especially in middle age and women are more susceptible than men. Prevalence rate of OA knee in India is 30%<sup>[1]</sup>. Crude prevalence of diagnosed knee OA was higher in urban areas (5.5%) than the rural area (3.3%)<sup>[7]</sup>.

The signs and symptoms of OA are joint pain, stiffness, crepitation, restricted range of motion, limitations of functions like walking, squatting and sit to stand activities<sup>[9]</sup>. Factors that lead to OA knee are obesity, previous joint trauma, progressive malalignment, quadriceps muscle weakness and tibial malrotation<sup>[4]</sup>. The two main muscles that move the knee joint are the hamstrings and quadriceps<sup>[10]</sup>.

Therefore, the research question for this randomized trial was: Which among the mulligan mobilization with dry needling, mulligan mobilization alone and conventional therapy will be more effective on pain, function, and range of motion in patients of knee osteoarthritis?

## Methods

### Design

The study got the Ethical approval from Institutional Ethics Committee (IEC) of Pravara Institute of Medical Sciences (PIMS/DR.APJAKCOPT/IEC/2023/165). The trial was registered in the Clinical Trial Registry of India (trial number CTRI/2023/07/054697). A total of 86 participant meeting the selective criteria were participated voluntarily in this single blinded randomized controlled trial. Eligible people who were willing to participate in the study were provided with informed consent before undergoing baseline assessment and being allocated to a group. Sample size was calculated with open-epi, the previous article was referred having common intervention but different population. Participant allow to pick available envelope for group allotment before starting the intervention. Before the intervention period, demographic data and baseline assessment of the study outcome measures were recorded. Participants in the experimental group were prescribed a 8-week Muscle Energy Technique and those in the control group received brief, basic exercises for 8 weeks. In order to limit the impact of knowing whether they were in the experimental or control group, participants were advised that the study would compare two exercise regimens and they received no information about the exercise intervention to which they were not allocated. After completion of the 8-week intervention period the outcome measures were reassessed. Data were analysed with an intention-to-treat approach.

### Participants

Participant age group 40-60 years, Both males and female participant, Participant with Kellgren and Lawrence knee osteo arthritis grade 1 – 3, Participant with Diagnosis of Tibio-femoral OA knee confirmed by a Radiologist, Participant with Pain intensity >3 on a Visual Analogue scale (VAS), Participant with WOMAC score > 25 moderate level of difficulty performance ADL, Participant with restricted range of motion, Participant having pain while walking and ascending stairs. Patients volunteered to participate in the study and signed informed consent.

### Intervention

#### Conventional therapy

Therapeutic pulsed ultrasound therapy, strengthening exercise, and stretching exercises will be given.

Ultrasound was administered using a 1-MHz frequency. It will be applied to the medial and lateral part of the knee in circular movements for a duration of 5 minutes with the patient in a supine position.

The strengthening exercises consists of quadriceps strengthening by holding maximal isometric contractions for 10 sec and performing 10 repetitions.

Stretching exercises for the Gastrocnemius–Soleus and Hamstring muscle will be performed by asking patient to stretch the muscle for 30 sec and to complete three repetitions for each muscle group.

All exercises will be supervised by the same physiotherapist and last for 20 minutes<sup>[7]</sup>.

## Experimental Group

### Mulligan Mobilisation

#### Lateral glide MWM for knee Extension

Patient lies supine with the knee flexed short of the limitation; leg elevated sufficiently at the foot such that the posterior knee cannot touch the plinth upon full extension. The distal femur is stabilized laterally with one hand. While the glide is sustained, the patient actively moves the knee into extension from the starting position and then returns to the starting position. Full, active pain-free extension is complemented with over-pressure from the therapist. The glide is applied for 6-10 repetitions in a set, with 3-5 sets in a treatment session<sup>[9]</sup>

### Dry Needling

The therapist looks for trigger points around the hip and knee joint. At least 2 hyperalgesic points showing radicular pain, jumping sign or abrupt response were marked for treatment using DN technique. The DN technique consisted of insertion of a disposable 0.25\*40 mm stainless steel needle. The pecking technique (in-and-out motion) was performed on selected MTrPs in multiple directions. DN will be performed in supine position for hip adductors/abductors, flexors, and knee extensors. The technique continued in prone positions for hip adductors/abductors, extensors, popliteus, and knee flexors. The therapist held the guide of needle between the thumb and index finger of perpendicular to the MTrP and then inserted the needle with the swift push by the second finger. The therapist probed the needle in different angles until he perceived a twitch response, or pain response, or referral pain of the MTrP otherwise, the technique lasted about 5 to 10 s depending on the patient's tolerance. Three sessions of DN will be performed in a week.

### Outcome measures

- **Modified Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC):** it is one of the most widely used outcome scale for patients with knee osteoarthritis. It consists of 27 questions with responses to each given on a likert scale: 0-none, 1- mild, 2- moderate, 3- severe, 4- extreme. Total score is 108. It has 3 subscales based on pain, stiffness, and functional impairment<sup>18</sup>.
- **Visual Analogue scale (VAS):** It consists of a 10 cm line. It starts with a line indicating the least “no pain” and ends with a line that indicates most “worst pain”. A higher score indicates greater pain intensity. It is considered the most reliable and stable pain measurement scale. The Icc coefficient of VAS score is 0.9719.
- **Range of motion (ROM) of knee (by universal goniometer):** Knee extension range of motion was taken by using universal goniometer. The Icc coefficient of universal goniometer is 0.94.20

### Data analysis

Analysis of data was done using commercial statistical software graph pad instat trial version 13.3 applications. Descriptive statistics for all outcome measures were expressed as mean, SD, and test significance such as Paired t test used to compare data within each group and Unpaired t test for comparing the data between groups. The confidence interval was set at 95%.

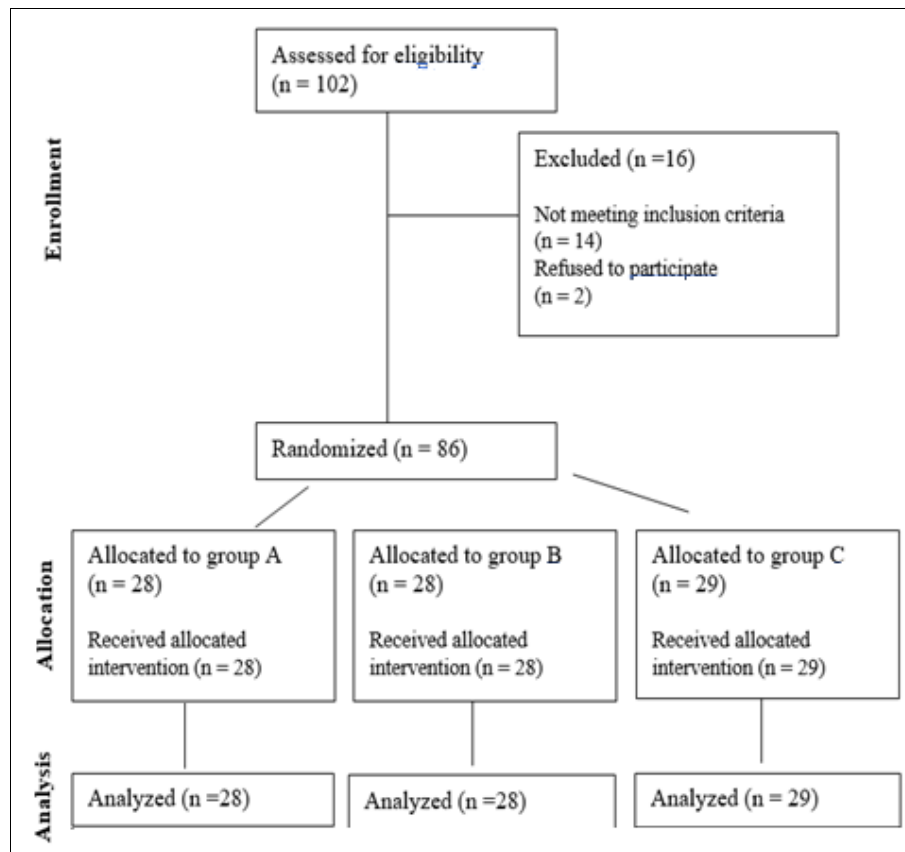
## Results

### Flow of participants

Among the 102 people who were screened for the study, 86

met the eligibility criteria and were randomized into three groups: 28 in the group A, 28 in the group B, and 29 in group

C (Figure 1). The groups were comparable at baseline, as presented.



**Fig 1:** CONSORT Flow chart representing procedure of selection of participants

### Effect of intervention

**Performance variables:** Both groups showed improvement in Range of motion and Constant score, decrease the pain at end of 8-week protocol. Muscle Energy Technique is estimated to be more effective than conventional methods for Scapular Dyskinesia. After 8 weeks, the participants in the experimental group decreased the visual analogue score from 7.39 to 1.26, Range of Motion also increased Flexion from 95.39 to 132.43, Abduction from 104.69 to 147.3, Internal Rotation from 60.04 to 68.56, External Rotation from 71.69 to 85.91 more than the control group (95% CI) and it also showed improvement in Constant Murley Score from 55.93 to 88.66 compared to control group (95% CI). Exercise training in both groups was well tolerated and there were no adverse events. Individual participant data for all outcomes is presented in (Table 2).

### Discussion

Objective of the study was to see the study effectiveness of dry needling with mulligan mobilization on pain, function and range of motion in patients with knee osteoarthritis effectiveness of dry needling with mulligan mobilization on Pain using Visual Analogue Scale, Range of Motion using Goniometer, Functional Disability among patients with knee osteoarthritis. 102 participants were assessed out of which 14 participants did not meet the inclusion criteria and 2 participants refused to participate in the study, Group A received mulligans technique with dry needling, and conventional treatment, Group B received mulligans technique and conventional treatment and Group C received conventional therapy. The mean age of the participants in GROUP A was (50.75 + 5.7), in GROUP B was (50.1+ 6.1)

and in GROUP C was (51 +6.21). In GROUP A, there were 13 males and 15 females and in GROUP B there were 14 males and 14 females and GROUP C there were 14 males and 15 females. Three sessions of treatment were given per week for a duration of 4 weeks.

Data was collected post treatment at week 4 and statistical analysis was done. One way ANOVA result of this study showed improvement in result in pain, range of motion and WOMAC scale. All the outcomes, the VAS score, Knee ROM, and the modified WOMAC questionnaire were measured before the intervention, and post intervention at week 4 weeks in three groups.

Means of the pre-intervention and post-intervention of visual analog scale (VAS), range of motion (ROM), and WOMAC were compared using a paired t-test, and the p-value was calculated. In this study all the three groups showed significant difference in pre and post- intervention mean values of all the outcomes (VAS, modified WOMAC score and knee extension ROM.) Study showed that there was significant difference in VAS and Knee extension ROM between group A and B but group A showed more decrease in pain and increase in ROM than group B. Between group B and C there was significant difference in VAS but group B showed more decrease in pain than group C. and between group A and C, all outcomes showed significant difference, but group A showed more decrease in pain and functional disability and more increase in Extension ROM than group C. Mulligan's Positional fault theory tells that joint alignment alteration occurs due to injury or poor arthrokinematics which leads to inconsistent bony congruencies that occur after strain or injury [28]. MWM functions on the principle of prospective neurophysiological mechanisms which consists of changes in

central pain processing mechanisms and descending pain inhibitory systems. Additionally, the motion generated during joint mobilization has the potential to change the concentration of inflammatory mediators and deactivate nociceptors that are triggered by this process.

Dry needling is efficient in decreasing pain in knee osteoarthritis. By inserting a needle into the skin stimulates the A-delta fiber which releases the opioids peptides from dorsal horn neurons, these peptides block group IV sensory afferents from the MTrP from transferring nociceptive information to the spinal cord through the intradorsal horn. Needle insertion also stimulates A-delta fibers secondary to a low-intensity monophasic current of injury generated secondary to the difference in electrical potential between the needle and the skin [18].

The improvement in conventional physiotherapy group is also supported by two of the studies observing positive effects on outcome variables, such as those measured by WOMAC index, pain, joint movement. Exercise program suggestive of

holding stretch for 15 seconds has a greater improvement in active ROM. The previous study done by Aoki et.al suggest that stretching was effective in improving knee ROM and gait in knee osteoarthritis. The quadriceps isometric has shown beneficial effect on pain, muscle strength and functional disability and this improvement may be due to improved quadriceps strength and increased stability of knee.

**What was already known on this topic:** The scapula plays a crucial role in coordinating and maintaining complex shoulder kinematics. Although Scapular Dyskinesia may be asymptomatic, as the severity of the condition increases it typically becomes symptomatic and affects the biomechanics of the shoulder complex.

**What this study adds:** In people with knee osteoarthritis, a comprehensive 4-week exercise program (involving mulligan mobilisation, dry needling and conventional therapy) improved the pain, range of motion and functionality

**Table 1:** Demographic Data

Characteristics of participants	Group A n=28	Group B n=28	Group C n=29
Age	50.75(5.7)	50.1(6.1)	51(6.21)
Gender Male, n (%)	15(53.5)	14(50)	14(50)
Gender Female, n (%)	13(46.42)	14(50)	15(53.5)

**Table 2:** Outcomes Measures (VAS, ROM and modified WOMAC scores) at Week 0 and Week 4

Groups	VAS			WOMAC			ROM		
	PRE	POST	P-VALUE	PRE	POST	P-VALUE	PRE	POST	P-VALUE
Group A	7.607+ 0.95	4.892+ 1.13	<0.0001**	90.53+7.49	72.32+ 8.09	<0.0001	19.46+7.22	11.21+7.84	<0.0001*
Group B	7.21+0.91	5.39+0.91	<0.0001**	86.78+11.1	76.17+10.67	<0.0001*	21.64+6.71	15.46+6.76	<0.0001*
Group C	7.24+1.24	6.13+1.30	<0.0001*	88.06+9.58	80.17+10.09	<0.0001*	20.48+6.12	16.17+6.22	<0.0001*

\*Denotes a significant interaction \* ( $p < 0.0001$ ) and \*\* ( $p < 0.001$ )

## Conclusion

This randomized controlled trial investigated the effectiveness of Mulligan mobilization with dry needling, Mulligan mobilization alone, and conventional therapy on pain, function, and range of motion in patients with knee osteoarthritis. After a four-week intervention period, significant improvements were observed in all three groups across pain, range of motion, and functional parameters. However, Group A, which received Mulligan mobilization combined with dry needling, demonstrated superior outcomes compared to the other two groups.

Specifically, Group A showed the most substantial reductions in pain (VAS score) and the most significant increases in knee range of motion. The Modified WOMAC scores also improved more markedly in this group. These findings suggest that the combination of Mulligan mobilization and dry needling is more effective than either Mulligan mobilization alone or conventional therapy in alleviating pain, enhancing functional outcomes, and improving range of motion for individuals with knee osteoarthritis.

Therefore, clinicians may consider integrating Mulligan mobilization with dry needling into their treatment protocols for knee osteoarthritis to achieve better patient outcomes in terms of pain reduction, functional improvement, and increased joint mobility.

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**Competing interests:** NIL.

**Source(s) of support:** NIL.

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