# Effects of Maitland and medial/lateral mulligan mobilization in knee osteoarthritis: a randomized clinical trail

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# Abstract-

Objective: To determine the effects of maitland and medial/lateral mulligan mobilization on pain, function and range of motion in Knee osteoarthritis.

Methods: A randomized clinical trial was performed. 20 subjects were recruited according to sample selection criteria and were assigned to Group A and B, Group A received conventional physical therapy and Maitland mobilization. Group B received conventional physical therapy and Mulligan medial/lateral glide. Assessment of pain, function and Knee range of motion (ROM), was taken using Numeric pain rating scale (NPRS), Modified Western Ontario and McMaster Universities Arthritis Index (WOMAC) and Goniometer. Total 18 sessions were given to each patient in 6 weeks with 3 sessions per week. Both groups were reassessed after 3 weeks and 6 weeks of treatment. Follow up was taken 3 weeks after completion of treatment. Data was analysed by using SPSS 21.

Results: There was a significant change within both groups in terms of NPRS, WOMAC and ROM with p- value of < 0.05 Both were effective but Maitland mobilization showed clinical statistical significance as compared to Mulligan mobilization.

Conclusion: Both treatment strategies were effective in decreasing pain, improving ROM and regaining functional status but using Maitland mobilization is more efficient to treat Knee osteoarthritis.

Clinical Trial Registration No: IRCT20200619047835N1

*Index Terms*- osteoarthritis, Maitland mobilization, Range of motion (ROM).

# I. INTRODUCTION

In US a leading cause of disability is arthritis with OA as its most common type. Most common OA of lower extremity is OA of knee (1). Pathology of osteoarthritis involves cartilage disruption and bony spur formation due to thickening of bone below degenerated cartilage Radiographs are traditional choice of diagnosis as it shows pathology as narrowing of joint space, sclerosis of subchondral bone and bony spur formation. X-ray changes can be classified on the basis of location in joint [two tibiofemoral and patellofemoral joints] and severity (2).

In older age, most common type of arthritis is OA. Approximately 18% of women and 9% of men over 65 years of age have knee OA

symptoms experienced by individual with OA includes pain, restricted range of motion of joints and firmness which impairs ability of a person to stand up, stand easily, walk and stairs climbing (3).

In United States knee osteoarthritis accounts for majority of total knee replacements, according to new evidence in elderly patients it causes lower extremity disability as any other disease. Little is known about incidence of OA in population despite its greater influence on involved persons and on society as a whole. As the incidence of OA has been studied recently but the radiographic and symptomatic findings were poorly characterized about development of disease over time and its progression rate (4). In initial researches radiographs were used only for diagnostic criteria like Kellgren and Lawrence scale (K-L), it has been noted that many patients with radiographic findings of OA have no symptoms contemporary on the other hand many patients have normal radiographic findings but have severe symptoms. These findings have started an establishing movement by clinical and public health communities, that there is a need to include joint symptoms into clinical and symptomatic osteoarthritis definition. Other suggestion is that the joint pain symptom is important itself while there is some misclassification exit for other inflammatory conditions e.g., tendonitis, bursitis etc (5).

Nonthrust joint manipulation used by physiotherapists for treatment of joint discomfort and pain, also known as joint mobilization, involves the application of rhythmic oscillatory motions within normal range of joint (6). Joint mobilization is a type of manual physiotherapy also known as nonthrust manipulation, is a technique used by physiotherapists in the management of many disorders related to musculoskeletal and neurological structures, also involving osteoarthritis. Maitland et al identify several traditional manual mobilization strategies used by physiotherapists for managing different knee conditions. On the basis of patient's condition, mobilization is defined as a vibratory manual force applied on tibiofemoral, proximal tibiofibular, or patellofemoral joints in various directions and locations. Various types of handling techniques are used to apply mobilization to knee joint. As defined by Maitland et al. and Grieve on the basis of intent of treatment, physiotherapists choose 1 of the 4 grades of mobilization on basis of varying resistance and intensity of movement. For pain modification grade 1 and 2 joint mobilization are used before resistance is reached and grade 3, 4

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are intended for increasing motion. In addition, grades I and IV are known as small movements and large movements are grades II and III. Irrespective of particular explanatory model under consideration, the extraneous forces applied by physiotherapists are considered to have most important role in mechanism of impact of treatment strategy. Forces may not be considered as reliably successful, if the forces applied during knee mobilization differ greatly among physiotherapists because this non validity may greatly influence patient's outcomes. No optimum joint mobilization dosage for knee has been yet established. Loss of standardization for those interventions can contribute to varying results in studies that determine the efficacy of manual therapy as an intervention (7).

Most commonly used treatment approach by physiotherapists to treat various painful conditions is joint mobilization. The techniques include rhythmical oscillatory movements. There are four grades of mobilization: at starting of range scale, Grade 1 occurs; at the mid-range there is Grade 2 and at the end of range large amplitude is considered to be Grade 3 and small amplitude is considered to be of Grade 4. A variety of studies in humans have shown mobilization induced analgesia (8). Maitland defined widely used techniques and a grading scheme for knee joint mobilization. Mobilizations of Grade I and II are carried out before joint resistance, while mobilizations of Grade III and IV are carried out within joint resistance range. Most important and significant part of treatment strategy are the extraneous forces applied by joint mobilization (9).

According to Mulligan's concept, end range techniques should be safely applied. It should be under the full control of the patient. It should be applied at the end range for several seconds causing no pain. It provides a unique mechanoreceptive afferent impulse to the central nervous system. Mulligan's mobilization with movement (MWM) is the kind of joint mobilization that consists of a pain free accessory gliding force provided by therapist combined with active movement (10). MWM consisted of a sustained manual glide of the tibia (either medial, lateral, anterior, posterior or rotation) during active knee flexion and extension. These techniques are described in detail in a textbook of MWM (Mulligan, 2004). Each patient 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 ROM was pain-free (11).

As Knee OA is a major cause of Knee pain. Literature shows that both mulligan mobilization and Maitland technique as a whole play a vital role to reduce the knee pain and functional mobility. However, Mulligan mobilization found to be more effective in decreasing pain and increasing functional status by limiting disability in osteoarthritic patient.

In Previous studies there are comparison between Mulligan Mobilization and Maitland mobilization with kinesio taping, proprioceptive exercises mostly on female patients. There was also a lack of longevity effect of mobilization treatment. This study compared Mulligan Mobilization specifically medial/lateral mobilization and Maitland mobilization with conventional physiotherapy treatment on patients with knee osteoarthritis including both genders and age above 60 years.

#### **II.** Materials and METHODS

This study was Randomized Controlled trial and was approved by Research Ethical Committee. The study was conducted in Khurseed Majeed hospital, Lahore from June 2020 to September 2020.

Sample size of 20 was calculated from previous study after addition of 10% attrition rate, with 10 in each group by using G power analysis software with 5% margin of error and 95% confidence interval with 0.80 power of study (12). The purpose of the study was explained, written and informed consent was taken from willing participants which was in both English and Urdu. Non-probability convenient sampling technique was used to recruit the individuals for the study and then randomization was done by sealed envelope method to divide the individuals in control and experimental groups. Study was approved by ethical committee

Old adults (age 60 to 80 years), Male and female, Patients who met the American College of Rheumatology clinical criteria for knee osteoarthritis, Radiological evidence of knee OA grades 0, 1 and 2 as per Kellgren Lawrence grading system, Pain intensity of at least 3 on Visual Analogue Scale (VAS) and Willing to participate in research project were included. Patients with any Infection or inflammatory disorder, History of surgery or trauma on knee, Malignancy, Systemic illness, Rheumatoid Arthritis, Fracture, any situation which is contraindicate mobilization, Osteoporosis, Current use of any medication or physiotherapy treatment, Cognitive impairments were excluded.

Outcome measures studied were the pain, function disability and Knee ROM. Pain was assessed using numeric pain rating scale (NPRS). Modified Western Ontario and McMaster Universities Arthritis Index (WOMAC scale) was used to assess the functional performance and active Knee ROMs were measured by using Universal goniometer.

Group A received Maitland mobilization with conventional physical therapy

Tibiofemoral posterior glide: Patient in supine lying with the knee flexed on which glide is to be applied and therapist sit on the table with the therapist's thigh fixing the patient's foot. Grasp around the tibia with your both hands in such a way that fingers are pointing posteriorly and thumb anteriorly around the patellar tendon. Apply force and push the tibia in the posterior direction with leaning forward and elbows extended.

Tibiofemoral anterior glide: Patient prone with the knee in resting position (25 degrees of flexion) then move the knee to the end of available range. To avoid patellar compression, place a small towel under the femur. To perform anterior glide at knee drawer test positioning can also be employed. Therapist place one hand at the distal end of tibia and other one grasping proximal tibial end. With a hand on proximal hand apply force in the anterior direction, 3 sets of 10 repetitions were performed (13). 3 sessions per week on alternate days were given for 6 weeks.

Group B received medial/lateral mulligan mobilization with conventional physical therapy)

MWM at the knee primarily comprises of a continuous glide applied either in the medial or lateral direction during passive, active, or active-assisted movements at knee joint. During active

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tibiofemoral movements every individual was examined with continuous mobilization performed in all directions, in supine lying position. Mobilization with movement was carried out during active tibiofemoral movements (three sets with 10 repetitions). In the beginning, painless manual glide was performed on shin bone while tibiofemoral joint in middle-range position. With continuous manual mobilization maintained at the same time subject smoothly performed active tibiofemoral flexion and extension in full range, 10 repetitions were done (13). Total 18 sessions were conducted over time duration of 6weeks.Treatment time was 20-30 minutes and 3 sessions per week was applied on alternate days for up to 6 weeks.

Conventional Physical therapy included stretching and strengthening (isometrics to isotonic) of hamstring, quadriceps, adductor, abductor and calf muscles.

10 reps of individual group of muscles were applied on alternate days for up to 6 weeks.

Evaluation was done before treatment, during treatment at 3rd week and after treatment at 6th week. Follow up was in 9th week. Outcomes was measured by NPRS, WOMAC and Goniometer.

#### **III. RESULTS**

Data was analyzed using SPSS version 21 using statistical significance p=0.05. Shapiro-Wilk Test was applied to check the normality of data. For Descriptive Statistics (mean, S.D) Frequency tables, pie charts and bar charts were used. Repeated Measure ANOVA and independent t test was used to show change in measurement over time and to measure difference between two groups and within each group. The CONSORT diagram shows the progress of participants at each stage of the study. 34 participants were assessed according to the eligibility criteria. 14 of them were excluded. 10 of them were not fulfilling the inclusion criteria and 4 of them refused to participate. 20 subjects were included in study. Baseline values of demographic data variables like age, gender, weight, height and BMI of participants across both groups were comparable on basis of mean± std. deviation. In Maitland group the mean age of participants was 66.90±4.149 years and in Mulligan group mean were 67.10±3.542 years. There were 7 (70%) females and 3 males (30%) in Maitland group and 6 (60%) females and 4 (40%) males in Mulligan group. Mean weight and height of Maitland group was 71.90±10.723 and 2.68±0.218 respectively and mean weight and height of Mulligan group was 71.80±12.164 and 2.69±0.156 respectively. Body Mass Index (BMI) in Maitland group was 26.85±3.41kg/m2 and in Mulligan group was 26.63±3.956 kg/m2.

Groups were homogenous at baseline and not statistically significant in all the parameters including NPRS, WOMAC and ROMs with p value> 0.05 (Table 1).

After the analysis, it was found that within group analysis showed a statistically significant (p < 0.001) improvement in all the outcome measures including NPRS, WOMAC and ROMs over a period of 9 weeks in both MET group and Bowen therapy group. (Table 2)

The between-groups analysis showed statistically significant differences in NPRS and WOMAC with p-values of 0.00 and 0.00 respectively. (Table 2) Significant differences were also present in Knee ROMs having p-values <0.05 (flexion=0.001, extension=0.001) at end of the treatment.

The results of this study states that using Maitland mobilization is more effective than Mulligan mobilization in correcting knee osteoarthritis in terms of outcome measures.

Table 1:	Baseline	measurement of	эf	outcome	variables	5.
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Variable	Maitland Mobilization (n=10)	Mulligan Mobilization (n=10)	P value
	Mean $\pm$ SD	Mean $\pm$ SD	
NPRS	7.7±0.82327	8.1±0.73786	.268
WOMAC	70± 6.09189	72±5.48128	.367
Flexion	101±7.74597	100±9.53415	.939
Extension	8.7±2.83039	8.4±2.79682	.814

\*SD=Standard deviation

DATA COLLECTION PROCEDURE (CONSORT DIAGRAM):



Table	e 2: Betweer	ı group	comparison	of NPRS,	WOMAC an	d
ROM	among the	groups	5.			

NPRS	Maitland (mean±S.D)	Mulligan (mean±S.D)	P- value
Pre- treatment	7.7±0.82	8.1±0.73	0.26
During treatment	5.2±0.63	5.6±0.96	0.29
Post- treatment	3.2±0.78	4±0.81	0.039
Follow up	1.4±0.69	3.7±0.94	.000

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WOMAC					
Pre- treatment	70±6.09	72.4±5.48	0.367		
During- treatment	51±6.60	55.7±8.64	0.217		
Post- treatment	33.5±4.19	42.3±6.78	0.03		
Follow up	14.3±3.05	23.6±3.62	.000		
Flexion					
Pre- treatment	101±7.74	100.7±9.53	0.30		
During treatment	109.3±7.33	107.7±8.68	0.661		
Post- treatment	119.3±5.10	113±8.47	0.59		
Follow up	127.5±3.65	117.2±7.53	0.001		
Extension					
Pre- treatment	8.7±2.83	8.4±2.79	0.814		
During treatment	6.3±1.82	6.4±2.98	0.929		
Post- treatment	4.2±1.13	5.1±2.28	0.279		
Follow up	1.8±1.31	4.6±1.95	0.001		

#### **IV. DISCUSSION**

This study aimed primarily to evaluate the effects of Maitland mobilization and Mulligan mobilization in old patients with knee Osteoarthritis in terms of reducing pain, reducing functional disability. Results indicated significant improvement in both groups receiving intervention regarding all outcome measures. However, mean change in values of Maitland group is more improved as compared to Mulligan group.

Present study shows a statistically significant difference between two groups with p- value < 0.05 in terms of all outcome measures by using repeated measure ANOVA. But there is more improvement in the group receiving Maitland mobilization and conventional physical therapy as compared to that of other group

# V. Conclusion

The study concluded that both Maitland group and Mulligan group were effective in reducing pain, enhanced functional performance and improves knee range of motion. The results were significant for both groups, but Maitland group is found better than Mulligan group in terms of mentioned outcome measured on the basis of mean differences. in which participants were treated with Mulligan mobilization and conventional physical therapy. There is marked reduction in pain and improvement in functional status and knee ROM. In contrast to this a study in 2018 on effects of Mulligan mobilization and Maitland mobilization with conventional physical therapy on patients with age range 45-60 years on pain, ROM and function in knee osteoarthritis concluded that both techniques Maitland and Mulligan were effective(14)

The results of present study indicated significant improvement in both groups receiving intervention regarding all outcome measures i.e., pain, ROM and functional disability in patients above 60 years with knee osteoarthritis. However, mean change in values of Maitland group is more improved as compared to Mulligan group. In contrast to this a previous study conducted in 2017 by ANGIE LALNUNPUII to compare the effects of Maitland and Mulligan mobilization along with supervised exercise program with average mean age 49 years, 48 years and 47 year in three groups, Mulligan mobilization with supervised exercise program, Maitland mobilization with supervised exercise program and supervised exercise program alone respectively in knee osteoarthritis patient stated that Mulligan mobilization with supervised exercise program is more effective than Maitland along with supervised exercise program in terms of all outcomes, pain, ROM, function and strength(15) Present study results for within group analysis using repeated measure ANOVA indicated that subjects receiving treatment with Maitland mobilization showed statistically significant reduction in pain, improvement in functional status and knee ranges of motion with p- value<0.05 and these results are similar to previous study of Priya Singh Rangey in 2015 in which there is statistically significant difference in terms of pain and range of motion values after Maitland mobilization(16)

Present study showed within Maitland group comparison of pain, range of motion and function by repeated measure ANOVA. Results were statistically significant for both within group and between group analysis with p < 0.05 and these results are similar to the previous study of Shin-Jun Park in 2016 on knee osteoarthritis by joint mobilization and kineso-taping in terms of pain, range of motion and function which it is concluded that joint mobilization statistical improvement in all outcome compare to kineso-taping(17) This proves that Maitland mobilization to be more useful for treating individuals with knee osteoarthritis

### **Conflict of Interest**

There was no conflict of interest.

# **Financial Statement**

No fundings were given by any authorities; it was a project thesis of doctor of physical therapy.

## Data availability

Data will be provided on the demand by corresponding author

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