


Effects of Mulligan Rotational Movement versus Medial Gapping Technique on Pain, Range of Motion and Disability in Patients with Knee Osteoarthritis

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ABSTRACT

Background and Aim: To compare the effects of mulligan rotational movement and medial gapping technique on pain, range of motion and disability in knee osteoarthritis patients.

Methodology: This study was a Randomized Clinical Trial. The data was collected using a convenience sampling technique. Data was collected from Jinnah Hospital Lahore, from 15th December – 30th June 2022. 36 subjects (males and females) were recruited in two groups. The first group received Mobilization with movement along with a conservative treatment protocol. The second group received the Medial gapping technique along with conservative treatment protocol. Each group was treated for four weeks in which three sessions per week were given. Numeric pain rating scale and the disability index were used as outcome

measures. Data was analyzed through statistical package for the social sciences (SPSS) version 25.

Results: Within-group comparison by paired t-test showed the p-value was significant $<.05$, indicating that both treatment was effective in improving symptoms. Between groups, comparison by independent t-test showed that Mulligan Mobilization Technique is more effective than the medial gapping technique in improving pain disability and quality of life.

Conclusion: The study concluded that Mulligan Mobilization Technique provides more clinical benefits regarding pain, disability and range of motion in osteoarthritis patients than Medial Gapping Technique.

Keywords: *Arthritis, knee osteoarthritis, movement, pain, patients, range of motion.*

INTRODUCTION

Osteoarthritis is also known as an outcome of some joint's inability to restore itself after facing abnormal forces due to any deviations of the joint or periarticular structures from normal stability. Osteoarthritis affects the whole joint, despite the fact that the loss of cartilage is its primary symptom. Within a knee and amongst individuals, the rate of advancement changes over time. Osteoarthritis of knee joint presents with the symptoms that include joint pain, knee stiffness, decreased joint motion, and weakness of muscles. Due to high level of mobility and lack sufficient stability, knee joint is more prone to osteoarthritis³. Knee osteoarthritis affects three parts of the

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knee joint (medial, lateral, and patellar-femoral joints) and progresses slowly, usually over 10-15 years, restricting our daily activities. Regardless of the intrinsic mechanism, OA means damage to articular cartilage, bone spur formation, hardening of subchondral bone and loss of joint space. Many factors play a role in the etiology of knee osteoarthritis. Most general factors include morbidly obese people, ageing of a person, sex of person (more frequent in females), people who carry out heavy weight training and climbing stairs daily, genes and hereditary also play significant role in the causation of disease. Exercise, stretching, transcutaneous electrical nerve stimulation and manual therapy are recommended in all clinical guidelines because knee osteoarthritis is correlated with relatively few side effects. Quadriceps strengthening has traditionally been a main part of the knee osteoarthritis exercise program. This is because quadriceps weakness is a frequent complaint in people with knee osteoarthritis. Therefore, it is clear that a substitute exercise program is needed to decrease knee tension and lessen the symptoms of patients with medial compartment OA and varus deformity. Neuromuscular training is a relatively expanded category of exercise plans, including programs termed as functional training. Neuromuscular exercise is usually performed in an active, weight-supporting position that emphasizes the quality and efficiency of the exercise and the positioning of the trunk and lower limb joints⁶.

Mulligans Bent Leg Raise method with a heat pack and the MET with a hot pack is also effective in reducing pain intensity and increasing hamstring flexibility in osteoarthritis patients⁷. Manual Traction is also a good treatment option in treating the condition⁸. Exercise treatment, electrotherapy, and manual therapy are among the therapeutic methods used in the rehabilitating of OA patients (MT). Among these methods, manual therapy (MT) is a physical therapy technique that helps patients feel less pain and perform better. The body's musculoskeletal components, including the joints, soft tissues, and nerve tissues, are treated by manual therapists to activate various biomechanical, neurophysiological, and psychological processes⁹. To the best of the researcher's knowledge, limited data was available on the effects of Mulligan rotational movements vs the Medial gapping technique. As a result, this study would add knowledge to the growing body that if these two treatment techniques yield similar outcomes and if one is better than the other, which should be an alternative choice of treatment in the field of physiotherapy for the treatment of knee osteoarthritis through evidence-based approach.

METHODOLOGY

The current study was a Randomized Clinical Trial. The study was performed at the Physiotherapy Department of Jinnah Hospital, Lahore and Riphah Rehabilitation Centre, Lahore. The study was completed six months after the approval of synopsis.

By entering the following pain data from prior research into the online EPITOOL sample size calculator, the sample size of 40 was determined²⁷.

T Tests-Means: Difference between two independent means (two groups)

Inputs

Mean 1= 24

Mean 2= 22.67

Variance = 2

Confidence level = 0.95

Power = 0.8

Tails =2

Results

Sample size

Sample size (per group) = 18

Total sample size (both groups) = 36

After the attrition rate of 10%, the sample size will be 40²⁷

A convenient sampling technique was used to collect data.

Inclusion Criteria

- ✓ Unilateral Knee OA
- ✓ Males and females between 30 and 60 years of age
- ✓ Patients suffering from Grade II osteoarthritis of the knee using the Kellgren Lawrence grading Scale.
- ✓ Patients with restricted ROM.
- ✓ Patients are having more than grade III strength of knee muscles.

Exclusion Criteria

- ✓ Patients having unstable knee joint after Total Knee Arthroplasty.
- ✓ Joint infection of hip and knee.
- ✓ Soft tissue injuries around knee joints, including tendinitis and bursitis.
- ✓ Any fracture including patellar fracture, femur or tibia.

The participants were divided into two groups, i.e., Group A was given Mobilization with movement, whereas Group B was given the Medial Gapping Technique.

Baseline treatment

Modalities:

Transcutaneous Electrical Nerve Stimulation TENS (F=100Hz, I=12mA, T=high TENS, T=20min), hydro collateral hot pack for 40 minutes and strengthening and stretching exercise for Quadriceps and hamstrings, respectively irrespective of the cause or region involved in knee OA.

Exercise Program:

1. Quads strengthening (knee press ball)

5 seconds/ 20 repetitions 2 times a day.

2. Hamstring stretching (Straight Leg Raise)

5 seconds and repeat it 10 times.

3. Strengthening of hip abductors

Gravity eliminated=10 times without hold

Against gravity=10 times each.

Group A: Mulligan rotational movements for 4 weeks, 3 sessions per week.

Protocol for Group A

Mulligan Rotational Movements:

The patient was in a supine position, and the therapist stood next to the affected knee. The therapist put both hands on the flexed knee, fingers interlaced, with the heel of one hand resting over the tibial tuberosity and the heel of the second hand resting over the lower end of the femur. The tibial plateau was then glided posteriorly, and the patient was instructed to bend their knee as the glide was maintained with mild overpressure. A Mulligan belt was used to help the patient, significantly to enhance flexion. One end of the belt was wrapped around the ankle joint on the limited side, while the other was gripped by the patient's hands¹⁷.

Group B: Medial gapping technique was applied for 4 weeks, 3 sessions per week.**Protocol for Group B****Medial Gapping Technique:**

The patient is laid supine with the hip in flexion, adduction and internal rotation. The therapist is standing lateral to the patient knee. The therapist holds the calcaneus from the medial side, externally rotating the patient's foot and ankle using his forearm. At the same time, therapist is holding the lateral part of patient's knee over the joint space. At this point, therapist applies valgus stress in the knee on the joint space. As a result, "Gapping up" the medial side of knee joint. Then he gradually extends the knee or asks the patient to extend his knee actively.

Home Plan

- To help soothe stiff joints and relax muscles, use hot packs for 10 to 15 minutes.
- Avoid Cross Leg Sitting.
- Always warm up your joint before standing from sitting to lying by straightening and bending your leg for 10 to 15 minutes so that the knee is prepared well to take the pressure.
- Wear knee cap when the knee is in weight bearing position, e.g., stair climbing and long standing.
- Place cushion between knees in side lying position when sleeping.
- Try to take a healthy diet that assists Weight loss.
- Exercise including SLR, Quads and VMO strengthening 10 repetitions 3 times daily.
- Pain relievers' drugs when pain exacerbates.

The SPSS for Windows program, version 21, was used to analyze the data. $P = 0.05$, was chosen as the threshold for statistical significance. Following tests were used:

- ✓ A parametric test was applied to compare two populations at varied intervals.
- ✓ Descriptive Statistics: To show a summary of group measures collected over time, frequency tables, pie charts, and bar charts were used.
- ✓ Difference between Groups: Independent sample t-test was used to compare two populations at various intervals.
- ✓ Difference within Groups: paired t test was used to compare a single group at various intervals.

RESULTS

According to the normality test (Shapiro-Wilk: because sample size less than 50). After applying the test of normality, data was normally distributed with a significant p-value (>0.05). The parametric test was used, independent t-test applied for group comparison. Paired t-test applied for within-group comparison. The average mean age of participants was 48.9 ± 7.159 years. In group A and group B was 46.3 ± 8.392 . The mean height of participants was 6.66 ± 0.395 years. In Group A and Group B mean height was 5.67 ± 0.336 . The participants' mean weight was 56.8 ± 5.61 kg, in Group A it was 64.6 ± 10.72 and in group B it was 69.5 ± 1.261 . In group A, 25% were male and 75% were female. In group B 30% were male and 70% were female. In group A, 30% of patient was underweight, 40% were of normal weight, 25% were overweight and 5% fall under the category of obese. In group B, 15% of patient was underweight, 50% were of normal weight, 30% were overweight and 5% fall under the category of obese. The findings showed that, for pre-treatment p-value = $.182 > .05$ which is insignificant and indicated that the Mulligan Mobilization Technique and Medial Gapping Technique were same for disability scale. Whereas the post-treatment data suggested that the Mulligan Mobilization was effective, with significant outcomes of $.001$ to $.05$ and Medial Gapping Technique were significant for disability scale. However, mean difference for group A 32.6 ± 4.373 shows the more improvement than group B 17.85 ± 5.107 , that

shows the more effectiveness of Mulligan Mobilization Technique than Medial Gapping Technique in improving disability in osteoarthritis.

The findings showed that, for pre-treatment p-value = $.690 > .05$, which is insignificant and indicated that the Mulligan Mobilization Technique and Medial Gapping Technique were the same for pain scale. Whereas the after treatment showed the significant results as $.001 < .05$ and indicated that the Mulligan Mobilization Technique and Medial Gapping Technique were significant for pain scale. However, mean difference for group A 4.65 ± 1.217 shows the more improvement than group B 1.15 ± 0.678 , that shows the more effectiveness of Mulligan Mobilization Technique than Medial Gapping Technique in improving pain in osteoarthritis. The findings showed that, for pre-treatment p-value = $.580 > .05$ which is insignificant and indicated that the Mulligan Mobilization Technique and Medial Gapping Technique were same for Knee flexion. While the post-treatment analysis revealed significant findings of $.001$ to $.05$ and demonstrated the effectiveness of the Mulligan Mobilization Technique and Medial Gapping Technique were significant for Knee flexion. However, mean difference for group A 80.5 ± 0.37 shows the more improvement than group B 29.9 ± 1.087 , that shows the more effectiveness of Mulligan Mobilization Technique than Medial Gapping Technique in improving knee flexion in osteoarthritis.

The findings showed that, for pre-treatment p-value = $.765 > .05$ which is insignificant and indicated that the Mulligan Mobilization Technique and Medial Gapping Technique were same for Knee Extension. Whereas the after treatment showed the significant results as $.001 < .05$ and indicated that the Mulligan Mobilization Technique and Medial Gapping Technique were significant for Knee Extension. However, mean difference for group A 2.6 ± 0.224 shows the more improvement than group B 0.95 ± 0.537 , that shows the more effectiveness of Mulligan Mobilization Technique than Medial Gapping Technique in improving knee extension in osteoarthritis. The Disability Scale, Pain Scale, and Paired Sample T Test were utilized to evaluate the pre-post effects. In Group A (Mulligan mobilization Technique) the p-value for each instrument was less than $.05$, indicating that the treatment was successful and the patients had improved following it. For group B (Medial Gapping Technique), the p-value for each tool was also less than $.05$, indicating that the therapy was successful and that the patients' conditions had improved.

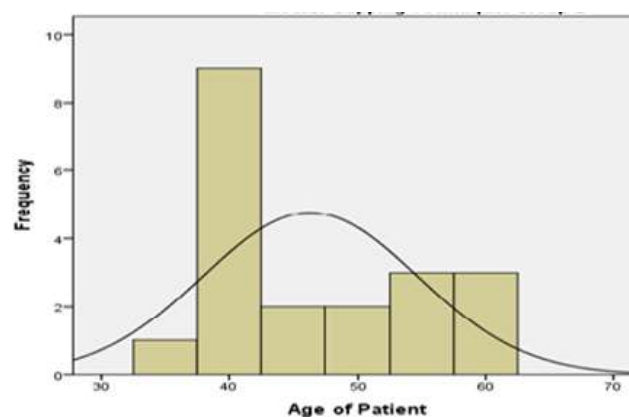


Figure 1 Histogram of Age

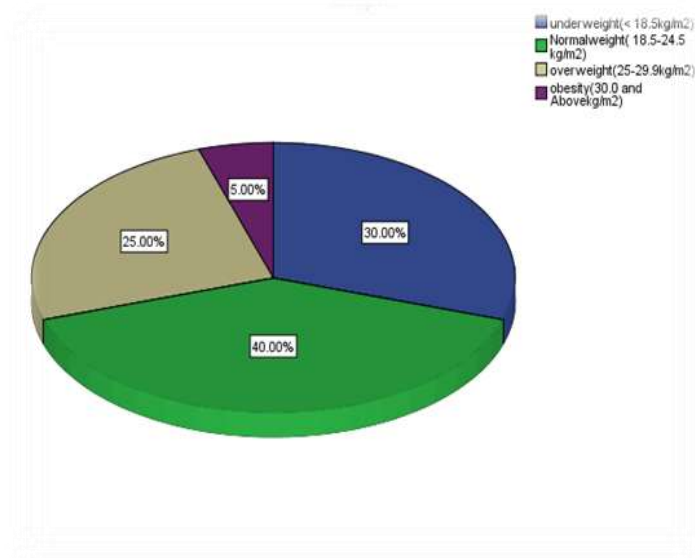


Figure 2 Pie chart of Group A BMI

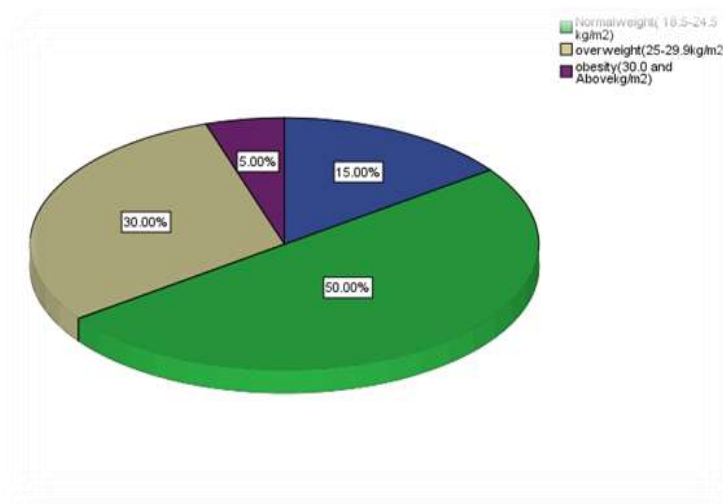


Figure 3 Pie chart of Group B BMI

Variables	Shapiro-Wilk		
	Statistic	Df	Sign.
NPRS	.959	40	.150
NDI	.913	40	.046
Flexion Knee ROM	.951	40	.082
Extension Knee ROM	.877	40	.090

Table 1: Test of Normality

Sr. No	Treatment	Groups	Mean \pm S.D	Mean Difference	t-statistic	p-value
1	Pre-Treatment	A	42.10 \pm 6.958	32.6 \pm 4.373	1.360	.182
		B	39.10 \pm 6.995			
2	Post-Treatment	A	9.50 \pm 2.585	17.85 \pm 5.107	-16.413	0.001
		B	21.25 \pm 1.888			

Table 2: Comparing Pre-Post Disability Index with Group A (Mulligan mobilization Technique) & Group B (Medial Gapping Technique)

Sr. No	Treatment	Groups	Mean \pm S.D	Mean Difference	t-statistic	p-value
1	Pre-Treatment	A	6.70 \pm 1.976	4.65 \pm 1.217	-.402	.690
		B	6.95 \pm 1.959			
2	Post-Treatment	A	2.05 \pm .759	1.15 \pm 0.678	-11.26	0.001
		B	5.80 \pm 1.281			

Table 3: Comparing Pre-Post Pain level with Group A (Mulligan mobilization Technique) & Group B (Medial Gapping Technique)

Treatment	Groups	Mean \pm S.D	Mean Difference	t-statistic	p-value
Pre-Treatment	MWM	36.65 \pm 4.332	80.5 \pm 0.37	1.360	0.580
Knee Flexion	MEDIAL GAPPING TECHNIQUE	37.45 \pm 4.718			
Post-Treatment	MWM	117.15 \pm 4.095	29.9 \pm 1.087	-16.413	0.001
Knee Flexion	MEDIAL GAPPING TECHNIQUE	67.35 \pm 3.631			
Pre-Treatment	MWM	2.45 \pm 1.050	2.6 \pm 0.224	1.360	0.765
Knee Extension	MEDIAL GAPPING TECHNIQUE	2.55 \pm 1.050			
Post-Treatment	MWM	5.05 \pm .826	0.95 \pm 0.537	-16.413	0.001
Knee Extension	MEDIAL GAPPING TECHNIQUE	3.50 \pm .513			

Table 4: Comparing Pre-Post Range of Motion within Group A & Group B

Tools	Group A			Group B		
	Pre-treatment Mean \pm S.D	Post-Treatment Mean \pm S.D	p-values	Pre-Treatment Mean \pm S.D	Post-Treatment Mean \pm S.D	p-values
Disability index	42.10 \pm 6.958	9.50 \pm 2.585	0.000	39.10 \pm 6.995	21.25 \pm 1.888	.000
Pain scale	6.70 \pm 1.976	2.05 \pm .759	0.000	6.95 \pm 1.959	5.80 \pm 1.281	.001
Knee Flexion	36.65 \pm 4.332	117.15 \pm 4.095	0.000	37.45 \pm 4.718	67.35 \pm 3.631	.000
Knee Extension	2.45 \pm 1.050	5.05 \pm .826	0.000	2.55 \pm 1.050	3.50 \pm .513	.003

Table 5: Paired sample t-test for within-group comparison

Outcome measures

- ✓ Goniometer (Validity=0.97, Reliability=0.98)
- ✓ Numeric Pain Rating Scale (NPRS) (Validity=, Reliability=)
- ✓ Disability Index (Validity=, Reliability=)

DISCUSSION

Mulligan mobilization has been shown to enhance mechanical loading, joint stability, and endurance of weak muscles through mechanical, self-confidence, and motivational aspects for

ROM. In a cohort trial, KOA patients were given a manual physical therapy programme that focused on passive extension mobilization of the knee, and the restorative benefits in the Mulligan mobilization group were not superior to those in the exercise group. Current study concluded the same result that Mulligan mobilization Technique provide more clinical benefits regarding pain, disability and range of motion in osteoarthritis patient's³¹. Ola Grimsby, in his book "Science, Theory and Clinical Application in Orthopedic Manual" discussed about different manual techniques. Some of these were used for assessment and some were for the treatment purposes. Among those techniques, he used a medial gapping technique for the increase in knee range of motion. In the current study, medial gapping technique is applied to see its beneficial effects on knee osteoarthritis in comparison with mulligan's mobilization technique. It showed that medial gapping technique is effective but less than mulligan's mobilization technique⁴⁰. Gupta et al. discovered that mobilization significantly improved pain reduction, physical impairment, including knee joint proprioception. This might imply that the expelling out of fluid during each compression and consuming of fluid when the compression is released has a favorable effect on joint nourishment. Squeezing happens when the mobilization method is used, and fluid ingesting happens when the joint is lax. This might be the cause of the pain decrease and subsequent eventually betterment in ROM and function observed at the completion of the therapy session³⁴.

Current study concluded the same result that Mulligan mobilization Technique improve pain Kaya Mutlu et al. discovered that mulligan mobilization is more effective than the control group in lowering pain, enhancing quadriceps muscular power, knee range of motion, and functional level in knee OA participants³⁷. Current study concluded the same result that Mulligan Mobilization Technique provide more clinical benefits regarding pain in osteoarthritis. Bhagwat and colleagues when compared to the placebo group, mobilization reduced knee discomfort and improved physical mobility in knee OA patients. This might be linked to the biomechanical mechanics of Mulligan's MWM notion. The treatment glides utilized in the intervention group may have immediately changed the osteoarthritic knee's typical kinematics. resulting in immediate pain relief³⁸. Current study concluded the same result that Mulligan mobilization Technique improve pain, ROM in osteoarthritis patients Alkhawajah and Alshami discovered that Mobilization surpassed the sham group in terms of pain relief, physical function (TUG), and knee flexion. In contrast, WOMAC demonstrated no noticeable impact on knee patients OA (P=0.067). This might be because of the fact that the OA grade was relatively low, indicating little limitation of functional activities.³² Current study concluded the same result that Mulligan Mobilization Technique provide more clinical benefits regarding pain ROM in osteoarthritis. Saddam Hussain Shaik et al the reduction in pain in the intervention group might be attributed to the idea that Mobilization calms a concerned, accelerated system, particularly the dorsal horn, by shocking it with pain free normality that it has been freckled to receive. One more likely cause is that central processes are implicated, because the no opioid mediate CNS pain restricting system is activated. Furthermore, the arthrokinetic reflex, which is characterized by joint mechanoreceptor afferent activity on muscles surrounding the joint, is assumed to be the mechanism responsible for quadriceps peak torque augmentation³⁹. Current study concluded the same result that Mulligan Mobilization Technique provides more clinical benefits regarding pain in osteoarthritis.

CONCLUSION

The study concluded that Mulligan Mobilization Technique provide more clinical benefits regarding pain, disability and range of motion in osteoarthritis patients than Medial Gapping Technique.

AUTHORS' CONTRIBUTION:

The following authors have made substantial contributions to the manuscript as under:

Conception or Design: Hina Gul, Iqra Tahir

Acquisition, Analysis or Interpretation of Data: Hina Gul, Iqra Tahir

Manuscript Writing & Approval: Hina Gul, Iqra Tahir

All authors acknowledge their accountability for all facets of the research, ensuring that any concerns regarding the accuracy or integrity of the work are duly investigated and resolved.

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