



## COMPARE THE EFFECTIVENESS OF MAITLAND MOBILIZATION AND MULLIGAN MOBILIZATION WITH MOVEMENT ON FUNCTIONAL INDEX IN FEMALES WITH KNEE OSTEOARTHRITIS

DR.SADDAM HUSSAIN SHAIK <sup>1\*</sup> | DR.C.SHANTI <sup>2</sup> | DR.K.SENTHIL KUMAR <sup>3</sup> | DR. K.MADHAVI <sup>4</sup>

<sup>1</sup> MPT (ORTHOPAEDICS), PG STUDENT, COLLEGE OF PHYSIOTHERAPY, SVIMS.

<sup>2</sup> MPT (ORTHOPAEDICS), PHD, ASSISTANT PROFESSOR, COLLEGE OF PHYSIOTHERAPY, SVIMS.

<sup>3</sup> MPT (ORTHOPAEDICS), ASSISTANT PROFESSOR, COLLEGE OF PHYSIOTHERAPY, SVIMS.

<sup>4</sup> PHD, PROFESSOR, PRINCIPAL, COLLEGE OF PHYSIOTHERAPY, SVIMS.

### ABSTRACT:

#### **Background:**

Osteoarthritis is defined as a heterogeneous group of conditions that lead to major public health problems that causes functional impairment and reduced quality of life.

#### **Objectives:**

To find out the effectiveness of Maitland mobilization and Mulligan mobilization with movement on muscular strength by Iso-kinetic analyzer, and functional performance by knee injury and osteoarthritis outcome scale (KOOS).

#### **Method:**

40 female subjects were randomly assigned into Maitland mobilizations and mulligan mobilization with movement along with conventional therapy for 3sessions per week for 6 weeks. Patients were evaluated of KOOS and Peak torque of knee extensors by Isokinetic were measured at pre , 3rd week and 6th week of treatment.

#### **Results:**

KOOS shows statistically significant ( $p < 0.05$ ) improvement in 2 groups. In right Knee extension at 30 degrees shows highly significant ( $p < 0.01$ ) between the groups, but left KE at 30 degrees shows insignificant

#### **Conclusion:**

The present randomized control trial has investigated the effectiveness of Maitland mobilization and mulligan MWM along with conventional therapy on pain, symptoms, ADL, QOL, sports and recreations, and peak torque of the quadriceps in female subjects with knee osteoarthritis.

The study shows improvement in both groups but Mulligan mobilization MWM is more effective than Maitland mobilization.

Thus, this study concludes that the Mulligan's MWM is more effective in treating the subjects with knee OA.

#### **KEYWORDS:**

KNEE OSTEOARTHRITIS, MAITLAND MOBILIZATION, MULLIGAN MOBILIZATION WITH MOVEMENT, KNEE INJURY AND OSTEOARTHRITIS OF KNEE(KOOS).

### INTRODUCTION:

Osteoarthritis is defined as a heterogeneous group of conditions that lead to joint symptoms and signs which are associated with defective integrity of articular cartilage, in addition to related changes in the underlying bone at the joint margins(ACR).<sup>[1]</sup>

The worldwide osteoarthritis (OA) knee prevalence is 3.8%, overall prevalence of OA knee in India found to be 28.7%. The prevalence was higher in villages (31.1%), big cities (33.1%) as compared to towns (17.1%) and small cities (17.2%). OA knee was found to be more prevalent in females (31.6%) than in males (28.1%).<sup>[2]</sup>

The degeneration occurs due to disarrangement in the usual process of repair of a joint. When the process breaks

the synchronicity, there is seen deterioration of the articular cartilage. As a result, the biomechanical influences on the joints are also changed due to loss of normal joint line of gravity. This ultimately leads towards symptomatic changes which are a focal loss of the cartilage covering the articular ends, loss of normal joint space requires for smooth grating, osteophyte formation in joint and remodeling of bone on peripheral areas and along the articular sides.<sup>[3]</sup> It results in weakening of the mobility patterns and resulting pain and swelling around the knee.<sup>[4]</sup>

The knee joint consists of two sets of articulating surfaces, the tibiofemoral joint and the patellofemoral joint. To perform most activities of daily living, these two joints surfaces most permit at least 110 degrees of motion in the

sagittal plane, 15 degrees in the frontal plane and 15 degrees in rotation.<sup>[5]</sup>

Symptomatically the most commonly affected joint in osteoarthritis is the knee joint because of its weight bearing requirement, high mobility and loss of intrinsic stability.<sup>[6]</sup>

Furthermore, in people with knee pain, the most common compartmental distribution of radiographic osteoarthritis was a combination of tibiofemoral joint and patellofemoral joint disease (40%), followed by located patellofemoral OA (24%) and isolated tibiofemoral OA (4%).<sup>[7]</sup>

Many factors can increase risk of OA, age (above 40), gender (more common in women), obesity, joint injury and joint pathology. The knee OA affects the ability for sitting on the chair, standing, walking and climbing stairs and influences almost one third of this group, knee OA is highly accompanied by morbidity in the community.

There are several treatment options for OA, despite the benefits of exercise and the various modalities. Manual therapy (MT) techniques have also been reported to be effective when used in conjunction with joint morbidity and strengthening exercises.<sup>[8]</sup>

Mobilization with movement (MWM) is a manual therapy technique advocated by brain mulligan for treating joint pain, stiffness and dysfunction.<sup>[9]</sup>

Mulligan's concept of mobilization with movement is a contemporary form of joint mobilization, consisting of a therapist applied pain free accessory gliding force combined with active movements (mulligan, 2004). It is related to correct minor positional faults that occur secondarily to injury and that lead to mal tracking of the joint, resulting in symptoms such as pain, stiffness or weakness.<sup>[10]</sup>

Maitland concept is a process of examination; assessment and treatment of musculoskeletal disorder by manipulative physiotherapy where a chain of oscillatory joint mobilization grades based on the pathological limit of tissue are used.<sup>[11]</sup>

### NEED OF THE STUDY:

Previous studies proved that Maitland mobilizations and Mulligan mobilization with movement, showed improvement in female OA knee patients separately. But there are very few comparative studies available between Maitland mobilizations and Mulligan mobilization with movement available. By doing this study, It will help therapist to prescribe exercises appropriately.

### AIM OF THE STUDY:

This study aims at the comparison of the effectiveness of Maitland mobilization and mulligan mobilization on functional performance, muscle strength and to reduce pain intensity in females with OA knee individuals.

### OBJECTIVES OF THE STUDY:

1. To find out the effectiveness of Maitland mobilization

and Mulligan mobilization with movement on muscular strength by Iso-kinetic analyzer.

2. To find out the effectiveness of Maitland mobilization and Mulligan mobilization with movement on functional performance by knee injury and osteoarthritis outcome scale (KOOS).

### HYPOTHESIS

#### NULL HYPOTHESIS:

There is no significant difference between Maitland mobilizations and Mulligan MWM subjects with knee osteoarthritis.

#### ALTERNATE HYPOTHESIS:

There is significant difference between Maitland mobilizations and Mulligan MWM subjects with knee osteoarthritis.

#### Materials used:

1. Biodex Isokinetic analyzer.
2. Quadriceps curls machine.
3. Leg press machine.
4. KOOS calculator.
5. Wax therapy unit.
6. Ultrasound therapy apparatus.

### METHODOLOGY

**Study design:** Randomized controlled trial

**Study duration:** 6 weeks

**Sample size:** 40 subjects were taken and equally divided into two experimental groups.

**Ethical Committee Approval:** Ethical approval was obtained from the SVIMS UNIVERSITY, COLLEGE OF PHYSIOTHERAPY.

**Source of data:** This study was conducted in physiotherapy department of Sri venkateswara institute of medical sciences (SVIMS), Tirupati, Andhra Pradesh.

All the subjects were referred from orthopedic surgeons, BIRRD hospital, Tirupati. As per the criteria of radiological classification by Kellgren and Lawrence (Grade I and II) osteoarthritis. Divided into two groups, 20 subjects in each group.

#### Inclusion criteria:

1. Women with age group from 40 to 65 years
2. Radiological and clinical case of grade II bicompartamental knee osteoarthritis according to Kellgren & Lawrence (1957) classification.
3. Along with bilateral OA knee were included in this study.

#### Exclusion criteria:

1. Women with age group <40 and > 65 years

2. Any history of trauma to the knees, ligaments injuries or neurological impairments.
3. Subjects with Previous knee or hip surgery.
4. Subjects with Rheumatoid arthritis.
5. The subjects who injected intra articular corticosteroids.

#### Outcome measures :

1. Peak torque of the quadriceps muscle.
2. Functional performance.

At the day of assessment and post intervention data ( after 3<sup>rd</sup> week and 6<sup>th</sup> week ) were taken by using Biodex isokinetic analyser , KOOS calculator.

**Procedure:** The complete orthopedic assessment was done on 40 subjects who were found suitable for participation in the study were requested to sign consent forms at first day of treatment.

Pre participation evaluation form consisting of KOOS scale and Isokinetic analyzer(Dynamometer) were assessed. KOOS scale used to assessed pain, symptoms, activity of daily living(ADL), sports and recreation and quality of life(QOL). Isokinetic analyzer(Dynamometer) used to assessed the quadriceps strength.

Then the subjects were allocated randomly by lottery method into two groups (Group A and Group B) with 20 subjects in each group. The data about the outcome measures were collected at before treatment, post treatment 3<sup>rd</sup> week and 6<sup>th</sup> week.

#### Measurement of peak torque in isokinetic analyzer:

Each subject performed the knee extension in 30 degrees of angular velocity. The subject was made to sit on the isokinetic analyser seat with back support and the supporting straps were tied for stabilizing the upper trunk and instructed not to bend forward to compensate the abdominal muscle force. Later dynamometer was kept near the joint axis, as the knee in 90 degrees flexion and dynamometer has to be parallel to it. The supporting straps were tied in the thigh region, preventing hip movements. Some more supporting straps were tied at the leg region. The protocol has been set in isokinetic unilateral mode with 30° extension.

Then, while setting ROM , calibration of the machine was done initially and flexion ROM and extension ROM was set and the protocol was started. Protocol included 10 repetitions of isokinetic contractions of knee flexion and extension. Later the straps were removed one by one and the subject was asked to get down of the isokinetic analyser. After analysing the peak torque of knee extensors of one limb, the same procedure was done for measuring the same for the other limb.

The subjects were allowed to continue their daily activities but were asked not to sit on the floor and not to take pain killers throughout the course of the study

#### Intervention:

Group A: received Maitland mobilization (MT) and conventional therapy.

Group B: received Mulligan's mobilizations with movement (MWM) and conventional therapy.

Both the groups attended 6 weeks , each week consisted of 3 sessions with one hour intervention in the physiotherapy department of SVIMS, Tirupati.

#### Conventional therapy protocol:

Both groups received conventional therapy. That consisted of hot packs, ultrasound application, self stretching's, quadriceps curls, leg press.

- Hot packs wrapped in a towel was placed on the bilateral osteoarthritic knee for 5 minutes each side
- During 5 minutes of ultrasound therapy, continuous ultrasonic waves with a frequency of 1MHz and 1Watt/cm<sup>2</sup> power were selected; the transducer head was applied to the treatment region at right angles to ensure maximum absorption of energy.
- Resistance training (RT) for 30 minutes: it is based on De Lorme's method of PRE regimen.

Before RT program, 10RM was calculated in a lower limb exerciser to find strength of lower limb. The 10RM was calculated once in a week and resistance is progressed every week accordingly.

De Lorme's method of strengthening:

10 repetitions @ 50% of RM.

10 repetitions @ 75% of RM.

10 repetitions @ 100% of RM.

3 sets of 10 repetitions each were performed in a lower limb exerciser, one session/day, for 3days/week, for a period of 6 weeks.

- Quadriceps curls in (knee extension chair) multi gym, 10 repetitions in one set , 3 sets in each session
- Leg press exercise in multi gym, 10 repetitions in one set, 3 sets in each session.

#### Maitland mobilization protocol:

The subjects in group A received an intervention which consisted of tibiofemoral anteroposterior glide, medial glide, medial rotation.

#### Technique:

- Anteroposterior(AP) glide performs in supine lying with active knee flexion, the therapist place the both hands on the proximal tibia and apply AP glide. 25 glides in each session.
- Medial glide: For medial glide the patient was made to lie supine , the therapist then kept the

palmar aspect of the hand medially to the distal end of femur(proximal to knee joint) to stabilize and the other hand on the lateral side of the upper end of tibia to mobilize the joint, then the therapist applied medial glide to the knee joint. 25 glides in each session.

- Medial rotation : for medial rotation the therapist grasped upper aspect of tibia with both hands, rotated tibia medially, 25 glides in each session.

**Mulligan’s mobilization with movement (MWM) protocol:**

The subjects in group B received an intervention which consisted of medial glide mobilization with movement and medial rotation MWM.

**Technique:**

- For medial glide MWM, the patient was made to lie supine(for non weight bearing position). the therapist then kept the palmar aspect of the hand medially to the distal end of femur(proximal to knee joint) to stabilize and the other hand on the lateral side of the upper end of tibia to mobilize the joint, then the therapist applied medial glide to the knee and asked the patient to perform knee flexion and extension maintaining the medial glide throughout the range of motion(ROM)
- Medial rotation MWM: for medial rotation the therapist grasped upper aspect of tibia with both hands (keeping thenar aspect posteriorly and fingers anteriorly) rotated tibia medially and asked the patient to flex and extend the knee while maintaining the medial rotation throughout the ROM.
- 10 repetitions of MWM with 2 sets, after this session of MWM, conventional physical therapy was given to these subjects.

**STATISTICAL ANALYSIS AND RESULTS**

Of the 40 subjects 20 were randomized in to Group I and 20 were randomized into Group II . All the 40 subjects received the treatment as defined by 6 weeks of treatment in alternate sessions. The outcome measures of the study were KOOS and Quadriceps peak torque.

To compare both groups treatment effect of the parameters within the group and between the groups, Repeated measures of ANOVA (RMANOVA) used.

**PAIN**

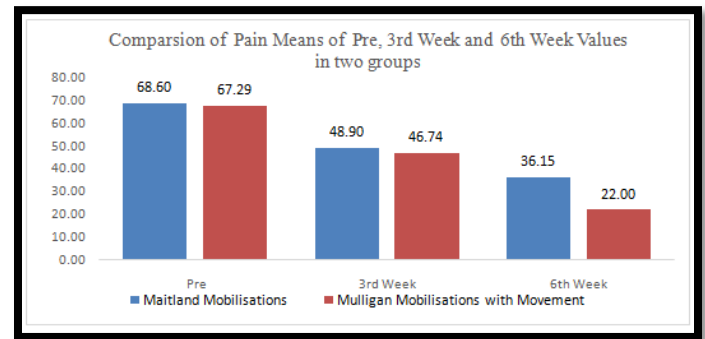
The group wise mean pain scores with SD and pair wise comparison of mean pain score at the different observation times is shown below

PAIN	MEAN/SD GROUP- I	MEAN/SD GROUP-II	MEAN DIFFERENCE	P VALUE
Pre-3 <sup>rd</sup> week	68.60 ± 4.535	67.29 ± 8.457	20.12	0.000
	48.90 ± 3.824	46.74 ± 7.505		
3 <sup>rd</sup> -6 <sup>th</sup> week	48.90 ± 3.824	46.74 ± 7.505	18.74	0.000
	36.15 ± 2.815	22.00 ± 5.375		
Pre-6 <sup>th</sup> week	68.60 ± 4.535	67.29 ± 8.457	38.87	0.000
	36.15 ± 2.815	22.00 ± 5.375		

**Results:**

Using RMANOVA the following results are found

1. There is a significant change in the pain score during the study period (F = 814.377, p <0.01) irrespective of the group.
2. There is a significant effect of group on the overall pain score (F= 16.502, p <0.01).
3. There is a joint effect of treatment group and duration (F= 27.787, p <0.01).

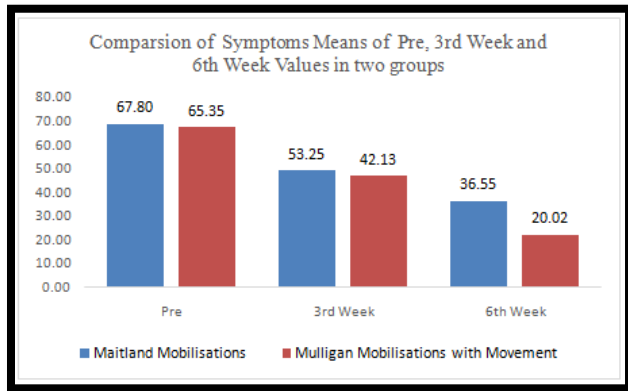


**FIG4: COMPARISON OF PAIN MEANS DIFFERENCE IN TWO GROUPS.**

**Symptoms**

The group wise mean symptoms scores with SD are shown below and pair wise comparison of mean symptoms score at the different observation times is shown below

SYMPTOMS	MEAN/SD GROUP- I	MEAN/SD GROUP-II	MEAN DIFFERENCE	P VALUE
Pre-3 <sup>rd</sup> week	67.80 ± 3.563	65.35 ± 6.862	18.89	0.000
	53.25 ± 4.399	42.13 ± 6.595		
3 <sup>rd</sup> -6 <sup>th</sup> week	53.25 ± 4.399	42.13 ± 6.595	19.405	0.000
	36.55 ± 3.268	20.02 ± 3.068		
Pre-6 <sup>th</sup> week	67.80 ± 3.563	65.35 ± 6.862	38.290	0.000
	36.55 ± 3.268	20.02 ± 3.068		



**FIG5: COMPARISON OF SYMPTOMS MEANS DIFFERENCE IN TWO GROUPS.**

**ACTIVITES OF DAILY LIVING:**

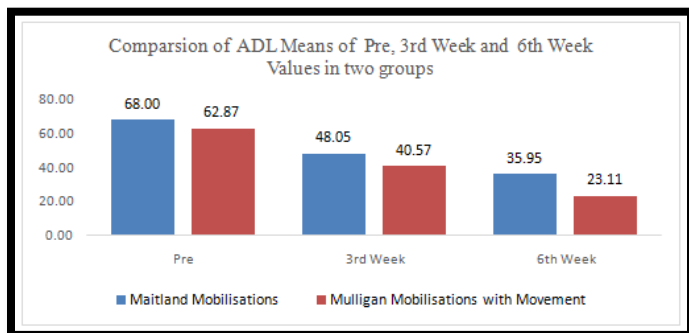
The group wise mean ADL scores with SD and pair wise comparison of mean ADL score at the different observation times is shown below

ADL	MEAN/SD GROUP- I	MEAN/SD GROUP-II	MEAN DIFFERENCE	P VALUE
Pre-3 <sup>rd</sup> week	68.00 ± 4.845	62.87 ± 7.894	21.23	0.000
	48.05 ± 5.256	40.57 ± 5.768		
3 <sup>rd</sup> -6 <sup>th</sup> week	48.05 ± 5.256	40.57 ± 5.768	14.78	0.000
	35.95 ± 3.154	23.11 ± 4.394		
Pre-6 <sup>th</sup> week	68.00 ± 4.845	62.87 ± 7.894	35.	0.000
	35.95 ± 3.154	23.11 ± 4.394		

**Results:**

Using RMANOVA the following results are found

1. There is a significant change in the ADLscore during the study period (F = 586.844, p <0.01) irrespective of the group.
2. There is a significant effect of group on the overall ADLscore. (F= 49.578, p<0.01).
3. There is joint effect of treatment group and duration(F= 7.038, p<0.01).



**FIG6: COMPARISON OF ADLS MEANS DIFFERENCE IN TWO GROUPS.**

**SPORTS/REC**

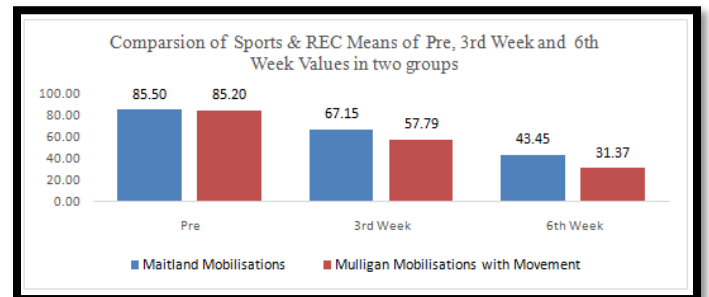
The group wise means SPORTS/REC scores with SD and pair wise comparison of mean SPORTS/REC score at the different observation times is shown below

SPORTS/REC	MEAN/SD GROUP- I	MEAN/SD GROUP-II	MEAN DIFFERENCE	P VALUE
Pre-3 <sup>rd</sup> week	68.00 ± 4.845	62.87 ± 7.894	21.23	0.000
	48.05 ± 5.256	40.57 ± 5.768		
3 <sup>rd</sup> -6 <sup>th</sup> week	48.05 ± 5.256	40.57 ± 5.768	14.78	0.000
	35.95 ± 3.154	23.11 ± 4.394		
Pre-6 <sup>th</sup> week	68.00 ± 4.845	62.87 ± 7.894	35.	0.000
	35.95 ± 3.154	23.11 ± 4.394		

**Results:**

Using RMANOVA the following results are found

1. There is a significant change in the ADL score during the study period (F = 586.844, p <0.01) irrespective of the group.
2. There is a significant effect of group on the overall ADL score. (F= 49.578, p<0.01).
3. There Is joint effect of treatment group and duration (F= 7.038, p<0.01).



**FIG7: COMPARISON OF SPORTS & REC MEANS DIFFERENCE IN TWO GROUPS.**

**QUALITY OF LIFE:**

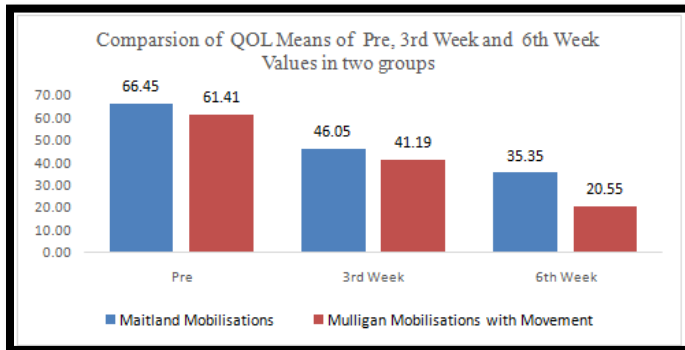
The group wise means QOL scores with SD and pair wise comparison of mean QOL score at the different observation times is shown below

QOL	MEAN/SD GROUP- I	MEAN/SD GROUP-II	MEAN DIFFERENCE	P VALUE
Pre-3 <sup>rd</sup> week	66.45 ± 3.993	61.41 ± 8.653	20.31	0.000
	46.05 ± 2.874	41.19 ± 4.612		
3 <sup>rd</sup> -6 <sup>th</sup> week	46.05 ± 2.874	41.19 ± 4.612	15.67	0.000
	35.35 ± 2.739	20.55 ± 3.910		
Pre-6 <sup>th</sup> week	66.45 ± 3.993	61.41 ± 8.653	35.98	0.000
	35.35 ± 2.739	20.55 ± 3.910		

**Results:**

Using RMANOVA the following results are found

1. There is a significant change in the QOL score during the study period ( $F = 588.885, p < 0.01$ ) irrespective of the group.
2. There is a significant effect of group on the overall QOL score ( $F = 74.321, p < 0.01$ ).
3. There is joint effect of treatment group and duration ( $F = 14.634, p < 0.01$ ).



**FIG 8: COMPARISON OF QOL MEANS DIFFERENCE IN TWO GROUPS.**

**GLOBAL SCALE**

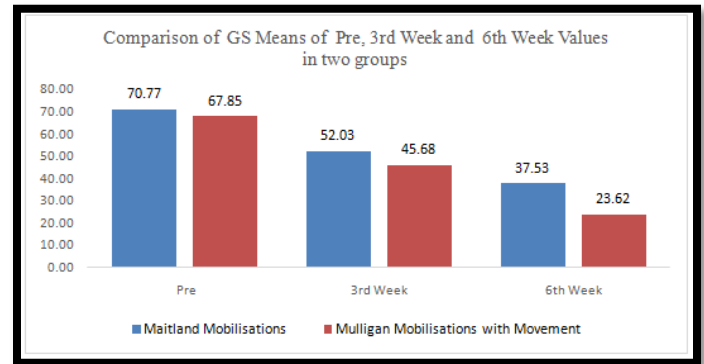
The group wise mean GS scores with SD and pair wise comparison of mean GS score at the different observation times is shown below

GS	MEAN/SD GROUP-I	MEAN/SD GROUP-II	MEAN DIFFERENCE	P VALUE
Pre-3rd week	70.77 ± 3.597	67.85 ± 5.417	20.46	0.000
	52.03 ± 3.123	45.68 ± 3.839		
3rd-6th week	52.03 ± 3.123	45.68 ± 3.839	18.28	0.000
	37.53 ± 1.718	23.62 ± 2.045		
Pre-6th week	70.77 ± 3.597	67.85 ± 5.417	38.74	0.000
	37.53 ± 1.718	23.62 ± 2.045		

**Results:**

Using RMANOVA the following results are found

1. There is a significant change in the GS score during the study period ( $F = 1654.281, p < 0.01$ ) irrespective of the group.
2. There is a significant effect of group on the overall GS score ( $F = 95.291, p < 0.01$ ).
3. There is joint effect of treatment group and duration ( $F = 34.849, p < 0.01$ ).



**FIG9: COMPARISON OF GS MEANS DIFFERENCE IN TWO GROUPS.**

**RIGHT KE 30°**

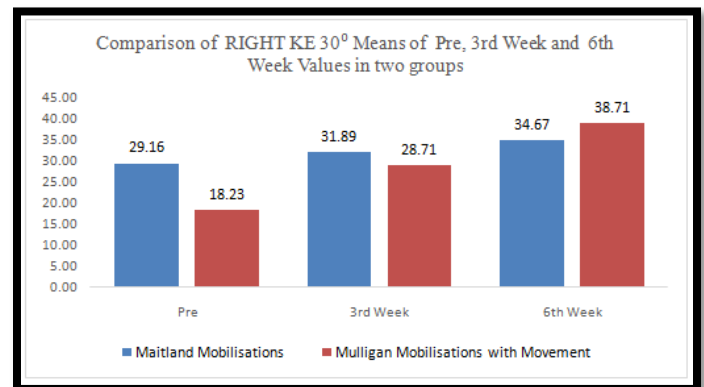
The group wise means RIGHT KE 30° scores with SD are shown below

RIGHT KE 30°	N	Maitland Mobilisations		Mulligan Mobilisations with Movement	
		Mean	SD	Mean	SD
Pre	20	29.16	6.498	18.23	2.589
3rd Week	20	31.89	6.558	28.71	2.855
6th Week	20	34.67	6.515	38.71	4.182

**Results:**

Using RMANOVA the following results are found

1. There is a significant change in the RIGHT KE 30° score during the study period ( $F = 473.043, p < 0.01$ ) irrespective of the group.
2. There is a significant effect of group on the overall RIGHT KE 30° score ( $F = 4.639, p < 0.05$ ).
3. There is a joint effect of treatment group and duration ( $F = 156.869, p < 0.01$ ).



**FIG 10: COMPARISON OF RIGHT KE 30° MEANS DIFFERENCE IN TWO GROUPS.**

**LEFT KE 30°**

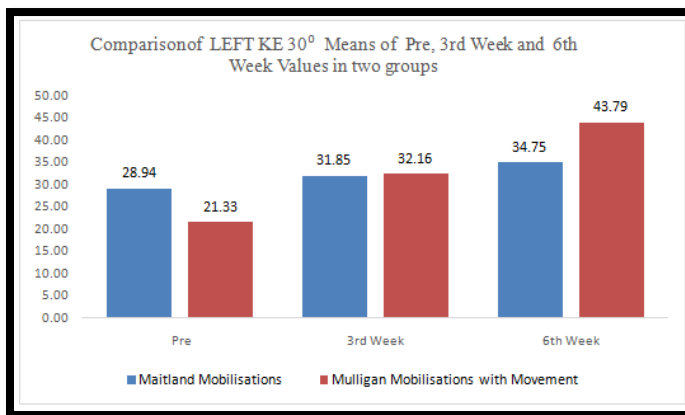
The group wise means LEFT KE 30° scores with SD are shown below

LEFT KE 30°	N	Maitland Mobilizations		Mulligan Mobilizations with Movement	
		Mean	SD	Mean	SD
Pre	20	28.94	7.206	21.33	4.765
3rd Week	20	31.85	7.174	32.16	4.961
6th Week	20	34.75	6.748	43.79	4.814

**Results:**

Using RMANOVA the following results are found

1. There is a significant change in the LEFT KE 30° score during the study period (F = 392.924, p <0.01) irrespective of the group.
2. There is not significant effect of group on the overall LEFT KE 30° score (F= 0.103, p=0.751).
3. There is a joint effect of treatment group and duration (F= 136.371, p <0.01).



**FIG 11: COMPARISON OF LEFT KE 30° MEANS DIFFERENCE IN TWO GROUPS.**

**DISCUSSION**

The study attempted focus our attention towards the effectiveness of Maitland mobilization (group A) and Mulligan MWM (group B) along with conventional therapy program in females with knee OA on the functional index, knee extensors strength and to determine which of the two maneuvers is more effective in the treatment of knee OA.

Pain (KOOS) shows significant change at baseline values, post values at 3<sup>rd</sup> week and 6<sup>th</sup> week in group-A and group-B. Mulligan MWM shows statistically more significant in improve pain compared to Maitland Mobilization

In the Group-B for pain intensity could be attributed to the rationale that Mulligan mobilization with movement sedates an agitated, facilitated nervous system, particularly the dorsal horn by bombarding it with painless normality it has been patterned to receive. The mechanisms by which MWM achieves pain relief are not well understood, however biomechanical and neurophysiological mechanisms may be involved (Vicenzino, Hall, Hing, and Rivett, 2011 [19])

The effect of Maitland mobilization in reducing pain has been explained by Kumar A (2012) that Grades I and II of

Maitland mobilization techniques are helpful for treating joints limited by pain because the oscillations may have an inhibitory effect on the perception of painful stimuli by repetitively stimulating mechanoreceptors that block nociceptive pathways at the spinal cord or brain stem levels. Mobilization has an effect on fluid flow as blood flow in the vessels supplying the nerve fiber and synovial fluid flow surrounding the avascular articular cartilage. This, by a pressure gradient, is generated which helps in facilitating exchange of fluid, that is, increased venous drainage and dispersing the chemical irritants. This causes a reversal of the ischemia, edema, and inflammation cycle and reduces joint effusion and relieves pain by reducing the pressure over the nerve endings (Maitland 1983). [20]

Cheraladhan E. Sambandam et al. they studied on effect of Mulligan Mobilization and Maitland Mobilization in subjects with unilateral tibiofemoral osteoarthritis. A randomized controlled trail shows, Mulligan group showed greater improvement when compared with Maitland mobilization and controlled group on pain.[27]

Exploratory studies also show that resistance exercise can positively increases the knee injury and osteoarthritis outcome score(KOOS) in the domains of pain, symptoms, activities of daily living, and quality of life.[26] Also symptoms, ADLs ,QOL ,Sports and recreation shows significant change at baseline, 3<sup>rd</sup> week and 6<sup>th</sup> week in Maitland group and mulligan MWM group, when compared the mean difference between two groups Mulligan MWM shows significant improvement than the Maitland group.

The Global score of the KOOS shows significant difference at baseline, 3<sup>rd</sup> week and 6<sup>th</sup> week in each group. When compared the mean differences between two groups at baseline, 3<sup>rd</sup> week and 6<sup>th</sup> week Mulligan mobilization shows more significant difference than the Maitland group

The mean values of the quadriceps peak torque at 30° in right and left knee shows significant difference at pre and post( 3<sup>rd</sup> and 6<sup>th</sup> week) values within the group. When compared the both groups Mulligan MWM statistically showed more significant in right quadriceps peak torque at 30° than Maitland group. Fransen M et al (2007) stated that muscles are important for shock absorption and help in stabilizing the joint. Exercise regimes that strengthen the quadriceps muscle may, in addition to decreasing joint pain, slow the progression of joint damage in patients with knee OA. [21]

The mechanism responsible for this increase is believed to be the arthrokinetic reflex, defined as the influence of joint mechanoreceptor afferents on muscles around the joint.[22] We suggest that knee joint mobilization decreases the inhibitory input on quadriceps muscles in the same manner as was postulated in previous studies for the effects of mobilization on other body muscle.[22,23,24,25]

**CONCLUSION:**

The present randomized control trial has investigated the effectiveness of Maitland mobilization and mulligan MWM

along with conventional therapy on pain, symptoms, ADL, QOL, sports and recreations, and peak torque of the quadriceps in female subjects with knee osteoarthritis.

The study shows improvement in both groups but Mulligan mobilization MWM is more effective than Maitland mobilization.

Thus, this study concludes that the Mulligan's MWM is more effective in treating the subjects with knee OA.

## LIMITATIONS AND RECOMMENDATIONS

### Limitations of the study

- Only Female subjects has considered in this study.

### Recommendations

- Study can be conducted with both genders.

## REFERENCES

1. Altman R, Asch E, Bloch D, Bole G, Borenstein D, Brandt K et al. Development of criteria for the classification and reporting of osteoarthritis Classification of osteoarthritis of the knee. Diagnostic and Therapeutic Criteria Committee of the American Rheumatism Association. *Arthritis & Rheumatism* 1986; 29(8):1039- 1049.
2. Chandra Prakash Pal, Pulkesh Singh, and Ashok Vij. Epidemiology of knee osteoarthritis in India and related factors. *Indian J Ortho.* 2016 Sep; 50(5): 518-522.
3. Banks K, Hengeveld E. *Maitland's Clinical Companion: An Essential Guide for Students.* Elsevier Health Sciences; 2009.
4. Aniq Kiran, Muhammad Junaid Ijaz et al. Comparison of Efficacy of Mulligan's Mobilization with Movement with Maitland Mobilization along with Conventional Therapy in the Patients with Knee Osteoarthritis: A Randomized Clinical Trial. 2018;10.232.74.27
5. Kettel Kamp DB: Clinical implication of knee biomechanics. *Arch surg* 1973; 107; 406.
6. Cicuttini FM, Spector TD. Genetics of osteoarthritis. *Ann Rheum Dis* 1996; 55(9):65-67.
7. Angie lalnunpuii; bibhuti sarkar; sarfaraz alam; ameed equebal; abhishek biswas. Efficacy of mulligan mobilisation as compared to maitland mobilisation in females with knee osteoarthritis: a double blind randomized controlled trial.2016; 6(2): 37-45
8. Reepa avichal ughreja , yagna u shukla, mulligan's mobilisation with movement (mwm) relieves pain and improves functional status in osteoarthritis knee int j physiother. Vol 4(2), 132-138, april (2017)
9. Mulligan , B., *Manual therapy ,-"NAGS", "SNAGS", "MWMS" etc.*5thed 2004.
10. Hing W, Bigelow R, Bremner T: Mulligan's mobilisation with movement: a review of the tenets and prescription of MWMs. *New Zealand Journal of Physiotherapy* 2008;36 (3):144-164.
11. Maitland GD, Hengeveld E, Banks K, editors. *Maitland's peripheral manipulation.* 4th ed. Oxford: Butterworth- Heinemann; 2005
12. BD Chaurasias human anatomy.vol.2;143-149
13. Hawker GA, Mian S, Kendzerska T, et al. measures of adult pain. *Arthritis care research.* 2011 ;63:240-252.
14. Shubhranshu S Mohanthy, Hithesh Garg. Text book of orthopaedics and trauma. Vol.4;pg: 2988-293.
15. J.H.Kellgren, J.S.Lawrence. kellgren-Lawrence grading scale to assess severity of knee osteoarthritis.
16. Jagmohan singh. Textbook of electrotherapy . superficial heating modalities. Chapter 7;pg.220-225.
17. John Low, Ann reed. Therapeutic conduction heating. *Electrotherapy explained principles and practice.*3rd edition;pg:241-254.
18. Dena Gardiner. Principles of exercise therapy. 4th edition;pg82-83.
19. Takasaki H, Hall T, and Jull G. Immediate and short-term effects of Mulligan's mobilization with movement on knee pain and disability associated with knee osteoarthritis – A prospective case series *Physiotherapy Theory and Practice, Informa Healthcare USA* 2012;1-9.
20. Kumar A ,Ganesh B.R Combined effectiveness of Maitland mobilization and patellar taping in patellofemoral osteoarthritis. A randomized clinical trial .*Indian Journal of Physiotherapy and Occupational Therapy.* 2011; 5(1):45-47.
21. Shenouda M.M.S.S Efficacy of Extracorporeal Shock Wave Therapy Versus Mobilization with Movement on Pain, Disability and Range of Motion In Patients With knee Osteoarthritis. *Bull. Fac. Ph. Th. Cairo Univ* 2013; 18(1): 65-72.
22. Makofsky H, Panicker S, Abbruzzese J, Aridas C, Camp M, Drakes J, et al. Immediate effect of grade IV inferior hip joint mobilization on hip abductor torque: a pilot study. *J Manual Manipulative Ther.* 2007;15(2):103



23. Yerys S, Makofsky H, Byrd C, Pennachio J, Cinkay J. Effect of mobilization of the anterior hip capsule on gluteus maximus strength. *J Manual Manipulative Ther.* 2002;10(4):218- 224
24. Liebler EJ, Tufano-Coors L, Douris P, Makofsky H, McKenna R, Michels C, et al. The effect of thoracic spine mobilization on lower trapezius strength testing. *J Manual Manipulative Ther.* 2001;9(4):207-12. 12.
25. Hanrahan S, Van Lunen BL, Tamburello M, Walker ML. The short-term effects of joint mobilizations on acute mechanical low back dysfunction in collegiate athletes. *J Athl Train.* 2005;40(2):88.
26. Ivarsson A, Andersen MB, Johnson U, Lindwall M(2013) To adjust or not adjust: Nonparametric effect sizes, confidence intervals, and real-world meaning. *Psychol Sport Exerc* 14: 97-102.
27. Cheraladhan E. Sambandam, Sejal N.Sailor, Jagatheesan Alagesan 2011. Effect of Mulligan mobilization and maitland Mobilization in subjects with unilateral Tibiofemoral Osteoarthritis-Randomized Controlled Trail / *JPBMS*, 2011, 11[17].
28. Hiroshi Takasaki, Toby Hall, and Gwendolen Jull, Immediate and short-term effects of Mulligan's mobilization with movement on knee pain and disability associated with knee osteoarthritis – A prospective case series. 2012.
29. Monika sharma, Harpreet kaur, Parul rathore, Kopal pajnee,2014 Effect Of Proximal & Distal Fibular Glide In The Subjects With Knee Osteoarthritis.
30. D. Oskay, H. Altmiş, I. Düzgün, B. Elbasan immediate effects of mulligan's concept mobilization with movement on knee pain and functions in patients with knee osteoarthritis
31. Ravi Kumar Gupta, Anand Heggannavar Quantitative Effects Of Proprioceptive Exercises And Mulligan's Mwm In Subjects With Osteoarthritis Knee-A Randomized Controlled Trial
32. Sonya Arshad, Dr. Syed Hasan Abbas Rizvi & Muhammad Nisar, To Evaluate the Effectiveness of Maitland Technique in Treatment of Knee Osteoarthritis in Female Patients. June 2017.
33. Ramya V. Rao, Ganesh Balthillaya, Anupama prabhu, Asha Kamath, 2017. Immediate effects of Maitland mobilization versus Mulligan Mobilization with movement in osteoarthritis Knee-A Randomized Crossover Trial.