



A Comparative Study To Determine The Effects Of Maitland Mobilization Vs. Mulligan Mobilization With Movement (Mwm) With Retro-Walking In Osteoarthritis.

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Abstract: Osteoarthritis (OA) is a chronic progressive degenerative disorder of multifactorial etiology causing greater disability and clinical symptoms among adults. Physiotherapy is the mainstay of non-pharmacological treatment in osteoarthritis. It has shown that manual therapy combined with supervised exercise program is effective in reducing pain, disability, improving range of motion and strength in patients with knee osteoarthritis. Our aim is to determine the comparative effects of Maitland mobilization vs. Mulligan mobilization with movement (MWM) with retro-walking in osteoarthritis. This is a comparative study where 30 subjects, both Male and Female with a primary diagnosis of osteoarthritis knee by the physician was recruited into two groups or intervention sequence with 15 subjects in each group. Group-A received Maitland mobilization with retro-walking and Group-B received Mulligan mobilization with retro-walking. Home exercise program was incorporated for both groups. All subjects received intervention thrice weekly for 4 weeks. Outcome measures were Visual Analogue Scale (VAS), Western Ontario and McMaster Universities Arthritis Index (WOMAC) and 6 -minute walk test. Pre-Test and Post-Test was carried out for both groups and analyzed using paired and independent t tests in an SPSS software. It is concluded that both group-A (Maitland mobilization with retro-walking) and group-B (Mulligan mobilization with retro-walking) showed improvement post-treatment. However, the intervention given in group-B (Mulligan mobilization with retro-walking) showed significant improvement in VAS in terms of pain and WOMAC in terms of pain, stiffness and dysfunction compared to group-A (Maitland mobilization with retro-walking) whereas 6-minute walk test was found to be equally effective in both group-A and group-B. It is recommended for long term treatment and follow-up and retro-walking should be included in the rehabilitation of OA knee since the level of pain has been reduced.

Keywords : Maitland mobilization, Mulligan mobilization, Retro-walking, Osteoarthritis, VAS, WOMAC.

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1. INTRODUCTION

OA is a chronic disorder of synovial joints in which there is progressive softening and disintegration of articular cartilage accompanied by new growth of cartilage and bone at the joint margins (osteophytes, cyst formation and sclerosis in the sub-chondral bone, mild synovitis and capsular fibrosis).¹ OA has a multi-factorial etiology and includes both generalized constitutional factors (e.g.: aging, sex, obesity, heredity, reproductive variables) and local adverse mechanical factors (e.g.: trauma, occupational and recreational usage, alignment).^{2, 3} Genetic factors play a key part in the etiology of OA. Participation of a gene associated with OA in the formation of an imperfect joint could occur during development and might affect the ability of mature cartilage to be repaired.⁴ The prevalence of OA is increasing because of the growing aging population and increased risk factors in both developed and developing countries. Its prevalence in India is 22% to 39%, where in rural it is 3.9 % and Urban 5.5%.^{5- 7} OA knee is twice as common than OA hips in people aged over 60 years causing significant pain and impairment in older adults.⁸ According to WHO, OA is the 4th most common cause of disability in women and the 8th in men.⁹ Knee pain typically accompanied by morning stiffness lasting less than 30 minutes is observed in OA. The pain tends to worsen with activity, especially following a period of rest due to transient stiffness called the gelling phenomenon.¹⁰ Joint involvement is often asymmetric with a severe, debilitating osteoarthritis of one knee with almost normal function of the opposite leg.¹¹ Plain radiography is the mainstay in the diagnosis of OA. Kellgren and Lawrence (KL) first introduced a radiographic classification scheme for OA in 1957.¹² Plain radiography may be 231 unremarkable in the early stages, but joints exhibiting classic disease demonstrate characteristic features, as noted by Kellgren and Lawrence and it is widely used clinical tool for the diagnosis of OA.¹³ Physiotherapy is a non-pharmacological intervention for knee osteoarthritis recommended by the American College of Rheumatology¹⁴ and plays a vital role in pain relief and restoration of mobility and function which are achieved by numerous treatment modes including manual techniques such as mobilization or manipulation, strengthening exercises, stretching of soft tissues and education to impart patient self management strategies.^{15,16} Mulligan mobilization with movement (MWM) coined by Brian Mulligan is based on the concept related to a 'positional fault' that occur following injury and lead to maltracking of the joint resulting in symptoms such as pain, stiffness or weakness within the faulty positions of the joint (Mulligan, 2004)¹⁷. MWM consist of therapist who applies passive accessory gliding force perpendicular or parallel to the joint combined with the active movement by the subject and sustained for several repetitions to restore pain free function and full range of motion in the joint.¹⁷ Maitland mobilization involves assessment of the nature of the disorder, examination and intervention. Passive physiological and accessory oscillatory movements are applied to the joint to reduce pain and improve ROM and the grade, frequency and dosage of mobilization is based on the severity, irritability and nature (SIN) of the disorder.¹⁸ Retro-walking (walking backwards) which is a part of closed kinetic chain exercise plays an important role in the management of OA. Retro-walking produces significantly lower patellar compressive force than forward walking and maximal vertical force and impulsive force are reduced on the knee because of Toe heel contact pattern.¹⁹ There were studies that Maitland mobilization and

Mulligan MWM are both equally effective in osteoarthritis in reducing pain and improving functional mobility immediately post treatment.²⁰ Studies also showed that retro-walking is effective in reducing pain and physical dysfunction and improved quadriceps muscle strength in OA.²¹ But, there is limited research on combined effectiveness of Mobilization with retro-walking in Osteoarthritis of knee. Therefore, this study is designed to determine the comparative effects of Maitland mobilization vs. Mulligan mobilization with movement (MWM) with retro-walking in osteoarthritis.

2. MATERIALS AND METHODS

2.1 Study design

The study was a Comparative study which was approved by the Institutional Research and ethical committee (AdtU/Ethics/stdnt-lett/2021/06). All the experimental procedures were in accordance with the University's guidelines.

2.2 Participants

A Total of 30 subjects fulfilling the inclusion criteria were allocated into Group-A and Group-B where Group-A (n=15) received Maitland mobilization with retro-walking and Group-B (n=15) received Mulligan mobilization with retro-walking. This study was carried out in the Department of Physiotherapy, Down Town Hospital Guwahati.

2.3 Inclusion criteria

Knee pain, Age 45-65, unilateral involvement of knee, morning stiffness lasting <30 min, crepitus, bony tenderness, bony enlargement, no palpable warmth, tibiofemoral Osteoarthritis, radiographic findings of Grade 0-2, according to Kellgren Lawrence.

2.4 Exclusion criteria

Any history of trauma to the knees/ligaments/neurological impairment, any other pathology (e.g. Fractures, bursitis, backache, radiating pain to the leg), history of recent steroid injection within 3 months, history of surgical intervention at the knee/hip joint, Uncontrolled hypertension, severe cardiopulmonary disease, signs of active infection or inflammation at the knee joint, impaired lower limb function due to stiff joint.

2.5 Procedure

The subjects were divided into two groups – Group-A and Group-B, Group A (Maitland mobilization with retro-walking) and Group B (Mulligan mobilization with retro-walking) consisting of 15 subjects in each group. Home exercise program were incorporated for both groups. Those fulfilling the criteria were explained in detail about the purpose of the study and a written consent form was obtained from each subject. Demographic data, Pre-test and Post-test for both Group-A and Group-B by Visual Analogue Scale (VAS)²² for assessing pain, Western Ontario and McMaster Universities Arthritis Index (WOMAC)²³ for pain, stiffness and dysfunction and 6 min walk test²⁴ for functional exercise capacity were collected and assessed for each subject. The data about the outcome measures were collected at day 0 and week 4 of intervention.

2.6 Intervention

Group-A received Maitland mobilization with retro-walking and Group-B received Mulligan mobilization with movement (MWM) with retro-walking. Both groups received 12 treatment sessions each with the frequency of 3 sessions in the Physiotherapy department, Down Town Hospital, Guwahati. Maitland mobilization consisting of grade 1-2 was given according to the condition of the subjects. For Distraction in (Fig: 1), the subject was asked to lie down and the therapist with both hands, grasped the distal tibia from the medial and lateral sides and moved the tibia distally away from the femur. For Tibiofemoral AP glide in (Fig: 2), the subject was asked to lie down and the therapist with both hands, grasped the proximal tibia from the dorsal side and glided the tibia in anterior direction. For Tibiofemoral P-A glide in (Fig: 3), the subject was asked to lie down and the therapist with the stabilizing hand, supported the femur from the dorsal side and with the manipulating hand, grasped the proximal tibia from the ventral side and glided the tibia in posterior direction. For Medial and Lateral glide in (Fig: 4), the subject was asked to lie down and the therapist with the stabilizing hand supported the femur in position and with the manipulating hand glided the proximal tibia in medial and lateral direction through the fibula. All these were given for 1 minute with 30 seconds break each minute with a total of 3 repetitions. Retro-walking (walking backward) on a flat surface for 10 minutes was given for both group A and group

B. 2 sessions of backward walking per day before and after mobilization at their maximum pace was given (Fig: 5 & 6). For Medial and Lateral glide MWM in (Fig: 7 & 8), the patient was asked to lie supine for non-weight bearing position and standing with one leg on a stool for weight bearing position. The palmar aspect of the right hand was placed on the upper aspect of the leg (distal to knee) and left hand on the lower aspect of the thigh (proximal to knee). Then, medial glide was applied to the knee and the patient was asked to perform knee flexion and extension maintaining the medial glide throughout the range of motion and similarly for lateral glide MWM, lateral glide was applied to the knee. For Medial rotation (MWM) in (Fig: 9), with the subject standing with one foot on a stool, the therapist grasped the upper aspect of tibia with both hands (keeping the thenar aspect posteriorly and fingers anteriorly), the tibia was rotated medially and the patient was asked to flex and extend the knee while maintaining the medial rotation glide throughout the range of motion. A total of 3 sets 10 repetitions were performed each session. Participants were asked to perform a home exercise program on a daily basis which included isometric strengthening of Quadriceps, Hamstrings & VMO with a hold for 10 seconds and 10 repetitions twice daily. Flexibility exercises were given such as hamstring stretch and calf stretch with a hold of 30 seconds and repeated 3 times twice daily. Knee Range of motion exercises such as flexion and extension 10 repetitions twice a day were included.



Fig 1: Distraction



Fig 2: AP glide



Fig 3: PA glide



Fig 4: Medial & Lateral glide



Fig 5: Retro-walking



Fig 6: Retro-walking



Fig 7: Medial glide



Fig 8: Lateral glide



Fig 9: Medial rotation MWM

3. DATA ANALYSIS

A paired t test and independent t test were used to analyze the variables pre-intervention and post-intervention in SPSS software. Level of significance with p value was set at 0.005, less than this is considered as statistically significant.

4. RESULTS

Table 1: Intra-group analysis of Group-A and Group-B of VAS							
Group	Visual Analog Scale	Mean \pm SD	N	t	df	p	Remark
Group A	Before Treatment(Pre-Test)	5.73 \pm .70	15	5.060	28	0.499	
	After Treatment(Post-Test)	2.60 \pm .63				0.000	S
Group B	Before Treatment(Pre-Test)	5.93 \pm .686				0.499	
	After Treatment(Post-Test)	3.73 \pm .59				0.000	S

**S = Significant*

p value of Group-A, pre-treatment is 0.499 & post-treatment is 0.000 and p value of Group-B, pre-treatment is 0.499 & post-treatment is 0.000. N value for both Group-A and Group-B is 15.

Table 2: Intra-group analysis of Group-A and Group-B of WOMAC							
Group	WOMAC	Mean \pm SD	N	t	df	p	Remark
Group A	Before Treatment(Pre-Test)	61.53 \pm 4.71	15	6.582	28	0.316	
	After Treatment(Post-Test)	35.40 \pm 4.17				0.000	S
Group B	Before Treatment(Pre-Test)	60.00 \pm 3.40				0.316	
	After Treatment(Post-Test)	44.93 \pm 3.75				0.000	S

**S = Significant*

p value of Group-A, pre-treatment is 0.316 & post-treatment is 0.000 and p value of Group-B, pre-treatment is 0.316 & post-treatment is 0.000. N value for both Group-A and Group-B is 15.

Table 3: Intra-group analysis of Group-A and Group-B of 6 MIN WALK							
Group	6 MIN WALK	Mean \pm SD	N	t	df	P	Remark
Group A	Before Treatment(Pre-Test)	293.80 \pm 64.34	15	-0.902	28	0.545	
	After Treatment(Post-Test)	368.06 \pm 63.89				0.000	NS
Group B	Before Treatment(Pre-Test)	280.33 \pm 55.65				0.545	
	After Treatment(Post-Test)	348.46 \pm 54.77				0.000	NS

**NS = Non Significant*

p value of Group-A, pre-treatment is 0.545 & post-treatment is 0.000 and p value of Group-B, pre-treatment is 0.545 & post-treatment is 0.000. N value for both Group-A and Group-B is 15.

Table 4: Inter-group analysis between Group-A and Group-B to compare the effectiveness of Maitland mobilization with Retro-walking vs Mulligan mobilization with movement (MWM) with Retro-walking in patients with osteoarthritis

SCALES	GROUP	Mean \pm SD	N	t	df	P	Remark
VAS	Group A	2.60 \pm .63	15	23.5	14	0.002	S
	Group B	3.73 \pm .59		20.579		0.000	
WOMAC	Group A	35.40 \pm 4.17		81.23		0.002	S
	Group B	44.93 \pm 3.75		60.712		0.000	
6 MIN WALK	Group A	368.06 \pm 63.89		-3.69		0.002	S
	Group B	348.46 \pm 54.77		-93.407		0.000	

***S = Significant**

p value of Group-A, pre-treatment is 0.002 & post-treatment is 0.000 and p value of Group-B, pre-treatment is 0.002 & post-treatment is 0.000. N value for both Group-A and Group-B is 15.

All the subjects received 12 treatment sessions where Group-A received Maitland mobilization with retro-walking and Group-B received Mulligan mobilization with movement (MWM) with retro-walking. Independent t-test was performed to determine the comparative effectiveness between Group-A and Group-B. Comparison between Group-A and Group-B in Table 1, with respect to VAS, $t = 5.060$ since p value < 0.05 which is statistically significant at 1% probability level, it has been shown that there has been a significant difference in Mulligan mobilization with retro-walking (Group-B) with p value 0.499 to 0.000 after treatment as compared to Maitland mobilization with retro-walking (Group-A). In Table 2, with respect to WOMAC, $t = 6.582$ which is statistically significant at 1% probability level, it has been shown that there has been a significant difference in Mulligan mobilization with retro-walking (Group-B) with p value 0.316 to 0.000 after treatment as compared to Maitland mobilization with retro-walking (Group-A). In Table 3, with respect to 6 min walk test, $t = -0.902$ has no significant difference between Group-A and Group-B since p value > 0.05 and has been inferred that Maitland mobilization with retro-walking (Group-A) and Mulligan mobilization with retro-walking (Group-B) are both equally effective with respect to 6 minute walk test post treatment. In Table 4, Paired t-test was performed to see the significant difference in VAS, WOMAC and 6 min walk and it has shown that there is a significant difference in VAS, WOMAC and 6 min walk with p value 0.002 to 0.000 in Maitland mobilization with retro-walking (Group-A) post treatment. Similarly, for Group-B Mulligan mobilization with movement (MWM) paired t-test was performed to see the significant difference in VAS, WOMAC and 6 min walk and it has shown that there is a significant difference in VAS, WOMAC and 6 min walk with p value 0.002 to 0.000 post treatment.

5. DISCUSSION

The primary purpose of this study was to determine the comparative effects of Maitland mobilization vs. Mulligan mobilization with retro-walking in osteoarthritis by measuring VAS for pain, WOMAC for pain, stiffness and dysfunction and 6 min walk test for functional exercise capacity. Manual therapy with supervised exercise program has proven to be effective in reducing pain, disability, improve range of motion and strength in patients with knee osteoarthritis.²⁵ Carol A Courtney et al., (2016) suggested that joint mobilization enhances conditioned pain modulation (CPM) in patients with painful knee OA with apparent global decrease in deep tissue sensitivity to pressure and enhanced somatosensory acuity, particularly at the knee receiving

intervention.²⁶ A study conducted by Falconer et al reported that there were improvements in ROM, pain and gait speed after 12 treatments of stretching, strengthening, and mobility exercises combined with manual therapy procedures performed for 4 to 6 weeks.²⁷ The results providing evidence showed that in Group B (Mulligan mobilization with retro-walking) mean VAS score decreased from 5.93 to 3.73, WOMAC decreased from 60.00 to 44.93 and 6 min walk test increased from 280.33 to 348.46. According to the mean values of all the outcomes, the results shows that Group-B (Mulligan mobilization with retro-walking) is more effective than Group-A (Maitland mobilization with retro-walking) in reducing pain, stiffness and dysfunction in osteoarthritis of knee but the p value i.e. $p > 0.05$ is not significant for all outcomes post intervention. Along with the improvement in functional status treated with MWM, there has been a significant reduction in pain and stiffness allowing the subjects to perform exercises and ADL's more independently. Deyle et al reported that manual therapy techniques and exercises produced a 52% improvement in function, stiffness, and pain as measured by the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scale and a 12% improvement in 6-minute walk test scores²⁵. Skyba et al 2003, stated that knee joint mobilization produces analgesic effect due to enhancement of the descending pain inhibitory pathway in the spinal cord which utilize serotonergic c5 – HTA and noradrenergic receptor.²⁸ Paul et al (2006) reported that Cyriax and medial glide MWM techniques is effective in improving knee flexion and improved functional status with anterior knee pain.²⁹ The combination of individualized manual physical therapy, supervised exercise and a home exercise program showed greater symptomatic relief than patients receiving only the home exercise program (Deyle et al, 2005).³⁰ Kisner and Colby, (2012) stated that 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 following mobilization. These non stretch motions help move synovial fluid to improve nutrition to the cartilage.³¹ Backward walking allows increased hamstrings activation which generates reduced patello-femoral and lower tibiofemoral compression load stress and ACL strain, and therefore BW reverses the shear forces in the knee joint (Neptune and Knautz (2000)).³² A study by Balraj et al suggested that Retro-walking should be included in the protocol of knee rehabilitation since there is a significant improvement in reduction of pain and disability in chronic OA.³³ Miyaguchi et al (2003) reported that strengthening exercise is clinically effective for the reduction of pain in knee OA as significant increase in muscle strength effects the

hyaluronan metabolism in arthritic knee joint. It has been widely believed that stabilization of the knee by muscle strengthening is the cause of pain relief in knees with OA.³⁴ Both Group-A (Maitland mobilization with retro-walking) and Group-B (Mulligan mobilization with retro-walking) obtained successful outcomes as measured by significant reductions in VAS, WOMAC and 6 min walk test but in comparison to Group-A, Group-B is more effective in improving all the outcome measures over a 4 week period.

6. CONCLUSION

Both group-A (Maitland mobilization with retro-walking) and group-B (Mulligan mobilization with retro-walking) showed improvement post-treatment. Hence, this study can be concluded that the intervention given in group-B (Mulligan mobilization with retro-walking) showed significant improvement in VAS in terms of pain and WOMAC in terms of pain, stiffness and dysfunction compared to group-A (Maitland mobilization with retro-walking) whereas 6-minute walk test was found to be equally effective in both group-A and group-B. It is recommended for long term treatment and follow-up and retro-walking should be included in the rehabilitation of OA knee since the level of pain has been reduced.

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7. AUTHOR CONTRIBUTION STATEMENT

Khriesakuonuo Chadi, MPT Scholar carried out the research work in data collection, review of literature and prepared the thesis as a part of the curriculum of Masters in Physiotherapy. Dr. Abhijit Dutta, Associate Professor, Assam down town University guided as the main supervisor in the whole study along with methodology, result analysis and discussion of the study. Dr. Abhijit Kalita, Assistant Professor, Dept.of Physiotherapy helped in the review of literature and in the methodology of the research work. All the authors read and approved the final version of the manuscript.

8. LIMITATION

The duration of the treatment was short consisting of 4 weeks, the sample size was small (Group A : n=15, Group B : n=15), knee ROM and muscle strength were not measured , home program taught to the patients were not supervised and there was no long term follow up of patients.

9. CONFLICT OF INTEREST

Conflict of interest declared none.

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