

# Comparing The Effectiveness of Maitland Mobilization, Proprioceptive Exercise and Conventional Therapy on Pain, Functional Ability and Proprioception in Patients with Primary Osteoarthritis Knee – A Randomized Controlled Trial

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## ABSTRACT

**Background:** Osteoarthritis is a degenerative joint disorder affecting the weight bearing area of the joints and the leading cause of pain and disability in world wide. Most common in the middle and elderly population and tends to worsen with age if not treated. This study is to compare the effectiveness of Maitland mobilization, proprioceptive exercise and conventional therapy on pain, functional ability and proprioception in patients with primary OA knee.

**Methods:** It was a single blinded randomized controlled trial. 29 individuals with Osteoarthritis knee with Kellgren Grade II and III, age group ranging from 40 -60 years were participated. Based on the selection criteria individuals were randomly assigned using computer software generator into three groups by simple random sampling method. Group A received Maitland mobilization, Group B received proprioceptive exercise and Group C received conventional therapy for 3 days in a week for 4 weeks. After 4 weeks the pain proprioception and functional ability were evaluated using Visual Analogue Scale, modified Western Ontario and McMaster Universities and Active angle reproduction test.

**Conclusion:** Maitland mobilization is more beneficial compared to proprioceptive exercise and Conventional therapy on pain and proprioception.

**Keywords:** Maitland mobilization, Osteoarthritis, Proprioception, Range of motion, Visual Analogue Scale

## INTRODUCTION

The subcommittee on osteoarthritis of American college of Rheumatology diagnostic and therapeutic criteria committee defined OA as 'A heterogeneous group of condition that leads 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<sup>[1]</sup>. OA is the second most common Rheumatologic problem and is the most common cause of locomotor disability in the elderly<sup>[2]</sup>. It affects the weight bearing areas

of the joint and the leading cause of pain and disability. The cause of osteoarthritis is believed to be Multifactorial including genetic, Environmental, metabolic and biomechanical. The degenerative or progressive loss of normal Structure and function of articular cartilage is the fundamental tenant of osteoarthritis. Clinically the condition is characterized by joint pain, tenderness, limitation of Movement, crepitus, occasional effusion and limited ability to use stairs, stand comfortably, walk and complete activities of living [11]. Most common in the middle and elderly population and tends to worsen with age if not Treated. It affects approximately 1/3rd of adults with the disease prevalence increasing with advancing age. Among adults with 45-74 years of age or older, symptomatic disease occurs in approximately 12.1% population [4]. Before 50 years of age the prevalence of OA in most joints is higher in men than in women. After about 50 years of age, women are often affected with hand, Foot and knee OA than men [12]. The prevalence rate was significantly higher among women than in men and increased significantly with age [16]. Pain is the most frequent reason for patients with OA knee to seek medical attention and Rehabilitation. If left untreated, pain and stiffness will result in loss of physical function and self Independence. The decreased Proprioceptive acuity has recently been demonstrated in patients with knee OA and proposed as a factor in the pathogenesis or progression of the condition [10]. Proprioceptive activity system is essential for maintenance of balance, and production of smooth stable gait [18]. Potential association between impaired knee proprioception and pathologic changes during the early stages of knee OA [3,9-14]. Management of OA knee is a multidisciplinary approach. Physiotherapy in OA knee involves use of thermal agents, TENS, traditional Chinese acupuncture, Taichi programs, taping manual therapy, Aerobic land based exercise, Aquatic

exercise, weight loss and orthotics in the form of medial or lateral insoles [10]. APTA's guide to physical therapy practice has defined mobilization or manipulation as a manual therapy technique comprises of continuum of skilled passive movement that are applied at varying speed and amplitude, including a small amplitude / high velocity therapeutic movement [6]. The intensity of mobilization is commonly categorized based on a V grade classification system defined by Maitland. According to Maitland classification, Grade I and II joint mobilizations are performed primarily to decrease joint pain and Grade III and IV joint mobilizations are performed to increase joint range of Motion [7, 8]. Proprioceptive exercise is based on the notion that when a patient performs balance Keeping exercise on constant surface, proprioceptive response occurs first among those generate by the somatic sense [9]. Proprioceptive training improves knee function in OA patients and quadriceps muscle strengthening is known to mitigate the symptoms of OA and improve function [5]. This will improve kinesthetic sensation and movement in the lower extremities enhanced functional movement [25].

There are only few evidences that compare the effectiveness of Maitland mobilization, Proprioceptive exercise and Conventional therapy in patients with primary osteoarthritis knee. The aim of the study is to compare the effectiveness of Maitland mobilization, Proprioceptive exercise and Conventional therapy in patients with primary Osteoarthritis knee

## **MATERIALS & METHODS**

It is a single blinded, Randomized Controlled Trial. The study was conducted in the Department of Orthopedics & Department of Physical Medicine and Rehabilitation, PSG hospitals, Coimbatore, during the period between June 24, 2019 – December 21, 2019. The study were reviewed and approved by Institutional Human Ethics Committee at PSG IMSR,

Coimbatore

(PSG/IHEC/2019/Appr/FB/030).

The sample size was calculated using G power 3.1.9.2. Effect size = 0.10,  $\alpha = 0.05$  Power= 0.90. Sample size calculated was 47 with 10% dropout, so the sample size was 76. The Inclusion criteria were Age 40- 60 years, Both male and female, Unilateral primary OA Knee, Radiographic findings of Kellgren grading 2&3, Difficulty in walking level ground and stairs, Patients under medications for OA Knee. The Exclusion Criteria were Knee ligament sprain. Meniscal tear, referred pain from hip or spine to knee, past history of metal implants around the knee, any neurological conditions, unstable cardiac and vascular problems, Rheumatoid arthritis, Secondary osteoarthritis. 29 individuals with Osteoarthritis knee with Kellgren Grade II and III, age group ranging from 40 -60 years were participated. Based on the selection criteria individuals were randomly assigned using computer software generator into three groups by simple random sampling method. The patients were blinded to the treatment.

**Group A** were given Maitland mobilization technique (25min/session/per day for 3 days in a week)

Accessory movements in Grade 1, 2 and 3  
Distraction

Antero posterior glide

3-6 repetitions with 5-10 sec rest for 20min  
Quadriceps strengthening exercise - 10 repetition, 6 sec hold, 10 sec rest

**Group B** were given Proprioceptive exercises (25min/session/per day for 3 days in a week)

One leg balance -2 repetition, 1 min hold, 10 -20 seconds rest

Blind advanced one leg balance - 2 repetition, 1 min hold, 10 -20 seconds rest

Toe walking - 20m, 2 repetition, 10- 20 seconds rest

Heel walking - 20m, 2 repetition, 10 -20 second's rest

Cross leg body swing -15 repetition, 10 second's rest

**Group C** were given Conventional therapy 25min/session/per day for 3 days in a week)

Wax therapy 3 dips

Quadriceps strengthening exercise, 10 repetition, and 10 second's hold

All the group received treatment for 3 days in a week for 4 weeks. After 4 weeks the pain, proprioception and functional ability were evaluated using Visual Analogue Scale, modified Western Ontario and McMaster Universities and Active angle reproduction test.

## STATISTICAL ANALYSIS

Descriptive statistics were used for all variables. Data were evaluated using Multivariate analysis (MANOVA). It assesses the independent factors on three dependent variables (VAS, WOMAC (CRD Pune), Active Angle Reproduction Test).

Box M value interpreted to test the equality of covariance matrices. Homogeneity was tested using the Levene's statistics. The effective size for each MANOVA model were produced using partial eta square. A value of  $p < 0.05$  were considered significant. SPSS statistical software 16.0 window were used for all analyses.

## RESULT

Data were analyzed using MANOVA. In the descriptive analysis, among the three groups the mean values of Maitland Mobilization (A) group were VAS (pre=7.33, post=3.44), WOMAC (CRD Pune) (pre=60.00, post=47.56) and Active angle reproduction test (14.44, post =3.89), which shows statistically significant compared to Proprioceptive exercise(B) and

Conventional therapy groups(C). Prior to conducting a series of follow up MANOVA, the homogeneity of variance assumption was treated for all the three variables. Table 1. shows Box's M value of 75.937 was associated with a  $p = 0.203 (p > 0.05)$ , which

was interpreted as non significant .Thus the covariance matrices between the groups were assumed to be equal for the purpose of the MANOVA. Based on a series of Levene’s test, the homogeneity of variance of all scales VAS (F=1.918, p=0.167

(p>0.05), WOMAC (CRD Pune) (F=2.236, p=0.127 (p>0.05), Active angle reproduction test (F=0.354, p=0.705 (p>0.05) assumption shows that the variances are equal

**Table 1**

**Homogeneity of variance**

Box test of equality of covariance matrices		Levene’s test of equality of error variances			Wilks lambda	
		Variable	F	p		
M	75.937	VAS	1.918	0.167	value	0.111
F	1.178	WOMAC	2.236	0.127	F	7.023
p	0.203	AART	0.354	0.705	p	0.000

Multivariate analysis of variance was conducted to test the hypothesis. Table 2 shows a statistically significant MANOVA effect were obtained with F= 7.023, p=0.000 (p<0.05), wilks lambda= 0.111.

In between subjects’ analysis, the independent variable has a statistically significant effect on VAS (F=8.538, p=0.001 (p<0.05), Active angle reproduction test F=7.785, p=0.002 (p<0.05). But not significant in WOMAC (CRD Pune) (F=2.172, p=0.134 (p>0.05)

**Mean, Standard deviation, Test of between subjects (Groups A, B & C)**

Dependent variable	GROUP	Mean (cms)	Standard Deviation	'F' Value	'p' Value
VAS Pre test	A	7.33	1.000	0.053	p>0.05
	B	7.20	1.033		
	C	7.20	1.033		
VAS Post-test	A	3.44	.882	8.538	p<0.05
	B	4.90	.994		
	C	4.90	.738		
WOMAC Pre-test	A	60.00	5.979	0.207	p>0.05
	B	61.10	8.517		
	C	62.60	11.067		
WOMAC Post-test	A	47.56	4.773	3.410	p>0.05
	B	55.90	9.219		
	C	57.30	10.678		
AART Pre test	A	14.44	4.640	0.683	p>0.05
	B	12.00	3.496		
	C	13.00	5.375		
AART Post test	A	3.89	4.167	7.785	p<0.05
	B	5.50	3.689		
	C	10.50	3.689		

**Table. 2**

Finally a series of post hoc (Scheffe’s) analysis were performed to examine the

individual mean difference comparison across all the three levels of variables. The

results reveal that, VAS were statistically significant between group A and B and group A and C  $p=0.005$  ( $p<0.05$ ), but between group B and C,  $p=1.000$  ( $p>0.05$ ). Active angle reproduction test was statistically significant between group A and C,  $p=0.004$  ( $p<0.05$ ) and Group B and

C  $p=0.026$  ( $p<0.05$ ), but not between group A and B,  $p=0.664$  ( $p>0.05$ ). WOMAC (CRD Pune) was not statistically significant between the group A and B,  $p=0.284$  ( $p>0.05$ ), group A and C  $p=0.165$  ( $p>0.05$ ), group B and C,  $p=0.941$  ( $p>0.05$ ).

Table.3 Group A , B & C – POST HOC Analysis

Dependent Variable	(I) Group	(J)Group	Mean Difference ( I - J )	'p' Value
VAS	Group A	Group B	-1.46	$p<0.05$ $p>0.05$ $p>0.05$
		Group C	-1.46	
	Group B	Group A	1.46	
		Group C	0.00	
	Group C	Group A	1.46	
Group B	Group C	0.00		
WOMAC	Group A	Group B	-6.68	$p>0.05$
		Group C	-8.08	
	Group B	Group A	6.68	
		Group C	-1.40	
	Group C	Group A	8.08	
Group B	Group C	1.40		
AART	Group A	Group B	-1.61	$p>0.05$ $p<0.05$ $p>0.05$ $p<0.05$ $p<0.05$ $p<0.05$
		Group C	-6.61	
	Group B	Group A	1.61	
		Group C	-5.00	
	Group C	Group A	6.61	
Group B		5.00		

Based on the statistical analysis, Group A shows significant in VAS and Active angle reproduction test compared to group B and C. Hence alternate hypothesis is accepted and null hypothesis is rejected. Thus we conclude that Maitland Mobilization is more beneficial compared to Proprioceptive exercise and Conventional therapy on pain and proprioception.

## DISCUSSION

Osteoarthritis is one of the most prevalent conditions resulting in disability. Particularly in elderly population. OA is the most common articular disease of the developed world and a leading cause of chronic disability mostly as a consequence

of knee OA and or hip OA [4]. Patients with OA knee who were treated with the manual physical therapy and exercise showed improvement in pain, stiffness and functional ability. OA commonly affects middle to elderly population. 23 female and 6 males with mean age of  $50 \pm$  fulfilled the inclusion criteria. This shows the prevalence of knee OA in men is lower compared with women. This was shown in a Meta analysis of incidence of OA in male and female, in which the incidence of knee OA in males aged  $<55$  years was lower than female [3]. The dropout rate was higher in the group A than in other two groups, due to various reasons such as environmental obstacles, perceived improvement, inconvenience in

timings and travel, had undergone PRP injection and were out of station. However the reasons given for withdrawal were unrelated to the treatment. Physical therapy to strengthen the quadriceps muscle had showed reduction in pain in patients with OA knee. Birmingham et al (2001) stated that quadriceps sensory dysfunction, i.e. decreased proprioceptive acuity, has recently been demonstrated in patients with knee OA and proposed as a factor in the pathogenesis or progression of the condition. Restoration of these sensorimotor deficits with strengthening may retard the progression of knee OA and reduce the disability<sup>[15]</sup>. The purpose of this study were to determine the comparative effectiveness of Maitland mobilization, Proprioceptive exercise and conventional therapy on pain, functional ability and proprioception in patients with primary OA knee individuals. The finding of the study suggests that Maitland mobilization showed better improvement in proprioception and pain reduction than other two groups. Statistical analysis revealed that all the groups had homogenous distribution of patients. The outcome measures used in this study were VAS, WOMAC (CRD Pune version) and Active angle reproduction test. In most of the studies, they have used WOMAC score which is suitable for foreign population and not for Indian population. Chopra A et al (2012) conducted a study on Validation and usefulness of Indian version (CRD Pune) health assessment questionnaire. They concluded that Indian (CRD Pune) was a valid and useful patient outcome measure and improved compliance in Indian population. In this study, WOMAC (CRD Pune version) is used which is best suitable for the Indian population<sup>[14]</sup>. Lokhande MV et al (2013) compared the assessment of joint proprioception in weight bearing and non weight bearing position using a goniometer. They concluded that comparatively non weight bearing position is better for measurement of proprioception. In this study proprioception were measured

using Active angle reproduction test in non weight bearing position using a goniometer<sup>[13]</sup>. Vaishnavi et al (2017) compared the effects of Maitland mobilization and Proprioceptive exercise along with ultrasound in stage II and III OA knee patients. They concluded that Maitland mobilization with ultrasound showed highly significant improvement in VAS and WOMAC score compared to Proprioceptive exercise along with ultrasound<sup>[11]</sup>. Deyle GD et al conducted a study on comparing the effectiveness of manual therapy and exercise in OA knee on pain, stiffness, function & six minute walk test. They concluded that combination of manual physical therapy and supervised exercise yields functional benefits for patients with osteoarthritis of the knee and may delay or prevent the need for surgical intervention<sup>[17]</sup>. In this study Maitland mobilization shows better improvement in stage II and III OA patients. And the study concludes that Maitland mobilization showed significant improvement in VAS and Active angle reproduction test score compared to Proprioceptive exercise and Conventional therapy. Rangey PS et al (2018) compared the immediate effects of two different Maitland mobilization protocol in pain and range of motion in subjects with OA knee. The study suggests that Maitland mobilization given thrice were beneficial in pain relief and improvement<sup>[10]</sup>. Maggo et al (2011), in their study compared the effectiveness of Proprioceptive exercise and strengthening exercise in OA knee subjects. Proprioceptive exercise group demonstrated greater improvement in VAS and WOMAC scores as compared to other groups<sup>[12]</sup>. In this study group A showed statistically significant in VAS and proprioception in individuals with primary OA. WOMAC score showed clinically significant improvement but not statistically significant. Almost all the patients in this group reported gradual reduce in pain during the course of the treatment. Group B, were given Proprioceptive exercise, VAS,

WOMAC and Active angle Reproduction test shows clinically significant improvement but not statistically significant. The exercise program was simple and adequately addressed the lower limb physical findings that are common in patients with OA knee. Group C were conventional therapy /usual care of treatment, it shows clinically significant improvement but not statistically significant.

The limitations of this study were, it included only primary unilateral OA and 40 to 60 aged people and it were not gender specific. Can consider these for future studies and can be compared with other outcome measures.

## CONCLUSION

This study concludes that Maitland mobilization group shows significant improvement on Pain and proprioception when compared to Proprioceptive Exercise group and Conventional therapy, whereas there was no significant difference in WOMAC (CRD Pune) on Maitland mobilization, Proprioceptive exercise and Conventional therapy.

## Declaration by Authors

**Ethical Approval:** Approved

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**Conflict of Interest:** The authors declare no conflict of interest.

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