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**Shawn Thomas Vinu Thomas**  
BPT Student, PPG College of  
Physiotherapy Affiliated to  
the Tamil Nadu Dr. M.G.R  
Medical University, Chennai,  
Tamil Nadu, India

**Ilakiya Subramani**  
MPT Student, PPG College of  
Physiotherapy Affiliated to  
the Tamil Nadu Dr. M.G.R  
Medical University, Chennai,  
Tamil Nadu, India

**Sivakumar Chinnusamy**  
Principal, PPG College of  
Physiotherapy Affiliated to  
the Tamil Nadu Dr. M.G.R  
Medical University, Chennai,  
Tamil Nadu, India

**Pradeepa Mani**  
Vice Principal, PPG College of  
Physiotherapy Affiliated to  
the Tamil Nadu Dr. M.G.R  
Medical University, Chennai,  
Tamil Nadu, India

**Correspondence Author:**  
**Shawn Thomas Vinu Thomas**  
BPT Student, PPG College of  
Physiotherapy Affiliated to  
the Tamil Nadu Dr. M.G.R  
Medical University, Chennai,  
Tamil Nadu, India

## Effectiveness of mulligan's mobilization and lateral heel wedges on pain and physical function among knee osteoarthritis subjects: A simple experimental study

**Shawn Thomas Vinu Thomas, Ilakiya Subramani, Sivakumar Chinnusamy and Pradeepa Mani**

### Abstract

**Background:** Osteoarthritis is a chronic disorder of synovial joints in which there is progressive softening and disintegration of articular cartilage and accompanied by new growth of cartilage and bone at the joint margins (osteophytes), cyst formation and sclerosis in the subchondral bone, mild synovitis and capsular fibrosis. It is primarily a non-inflammatory disorder but inflammation occurs eventually.

**Objectives:** The study's primary objective was to find out the efficacy of multiple therapeutic interventions consisting of Mulligan's Mobilization and Lateral Wedge Insole on Pain and Physical Function in Osteoarthritis Subjects.

**Subjects and Methods:** The study design was a simple experimental study. The subjects with knee osteoarthritis were selected for this study. It is a convenient sampling technique and sample size is 15 subjects. Subjects with the age group between 45-60 years were enrolled for this study. The study duration was 6 months. The objective and the aim of the study were clearly explained to the ethical committee of PPG college of physiotherapy and permission was obtained. Treatment group was subjected to the movement with mobilization and lateral heel wedges for 12 weeks. Mobilization techniques were given totally 3 sessions per week and Lateral heel wedges were made to wear for 12 weeks. Before starting the treatment, instructions were given to the patient. Subjects were selected according to the selection criteria. Subjects were given with Mulligan's Mobilization and Lateral heel wedges to reduce pain and to improve physical function. The pre-test and post-test were taken using VAS scale and WOMAC index. The treatment duration was 12 weeks.

**Results:** The statistical analysis states that the all subjects showed improvement in VAS and WOMAC scale scores with the calculated 't' value using the paired 't' test of VAS and WOMAC were 14.02 and 24.6 respectively, which was greater than the table value of 2.145 ( $p < 0.05$ ). They showed significant differences in pain intensity, and knee physical function after Movement with mobilization and Lateral heel wedges.

**Conclusion:** There is a significant reduction in pain intensity and improvement in physical function following the application of 12 weeks of Mulligan's Mobilization techniques along with Lateral heel wedges in Knee Osteoarthritis Subjects.

**Clinical Implications:** Mulligan's MWM along with Lateral Heel Wedges improves the mechanical alignments of the knee, reducing knee pain and improves the physical functional ability of the primary knee osteoarthritis subjects. Increasing physical function controls knee OA symptoms and improve joint function.

**Keywords:** Knee Pain, Osteoarthritis, Movement with Mobilization (MWM), Lateral heel wedges., Physical function

### Introduction

Osteoarthritis is a chronic disorder of synovial joints in which there is progressive softening and disintegration of articular cartilage and accompanied by new growth of cartilage and bone at the joint margins (osteophytes), cyst formation and sclerosis in the subchondral bone, mild synovitis and capsular fibrosis. It is primarily a non-inflammatory disorder but inflammation occurs eventually [1]. This generally occurs in weight bearing joints such as hip, knee and lower back. Factors that contribute to OA include genetic disposition, age, injury, weight, and stress on the joint, previous surgery involving joint [2].

The knee plays an important role in stabilization of the body in erect position. The function of the knee joint primarily depends upon its static and dynamic stability, the biomechanics of the knee joint is locking and unlocking movements [7].

In Worldwide 100 million people have Osteoarthritis in age over 45 years. It is estimated that 10 to 15% of all aged over 60 has symptomatic Knee Osteoarthritis [9].

In India Knee Osteoarthritis was found to be more prevalent in females (31.6%) than Males (28.1%). Andhra Pradesh (India) is the leading (64%) in India. Overall prevalence of Knee OA was to be 28.7% [10]. The associated factors were founded to be female gender (31.6) have (P-0.007) Obesity (P-0.04) age (P-0.001) and sedentary work (P-0.001) [10]. Excessive weight (Obesity) puts pressure on knee joint which tends to be a risk of Osteoarthritis. Osteoarthritis is classified as primary and secondary. Primary Osteoarthritis is idiopathic phenomenon and it is related to the aging process. (It typically occurs in older individuals.)

**Secondary Osteoarthritis:** Obesity, Abnormal joints at birth, Gout, Rheumatoid Arthritis, Diabetes and hormone disorder [11].

Cartilage is the slippery tissue that covers the ends of bones in a joint. Healthy cartilage allows bones to glide over each other. It also helps absorb the shock of movement. In Osteoarthritis, the top layer of cartilage breaks down and wears away. This allows the bones under the cartilage to rub together. The rubbing causes pain, swelling and decrease function of the joint. Over time, the joint may lose its normal shape. Also, bone spurs may grow on the edges of the joint. Bits of bone or cartilage can break off and float inside the joint space, which causes more pain and damage [12].

Pain is the earliest symptom. It occurs intermittently in the beginning, but becomes constant over months or years. A coarse crepitus may be complaint by some subjects. Swelling of joint is usually a late feature, and is due to effusion caused by inflammation of the synovial tissues. Stiffness is initially due to pain and muscle spasm but later capsular contracture and incongruity of the joint surface contribute to it [14].

Other symptoms are, a feeling of instability of the joint, and locking resulting from loose bodies and frayed menisci, muscle weakness, joint stiffness and decrease in range of motion that occurs in daily activities. Due to Osteoarthritis there will be reducing quadriceps function which will affects balance and gait, and also their mobility and function [15].

The MWM treatment technique produces its effects by correcting positional faults of joints. Mulligan's concept (MWM) is contemporary form of Joint mobilization consisting of therapies applied pain free accessory gliding force combined with active movements. MWM relocates joint in correct alignment therefore immediate pain relief occurs [17]. The lateral wedge insoles are made of sponge rubber materials which will be inserted into ordinary shoes. In the treatment for patients with OA lateral wedge insoles are used to reduce knee pain, to improve the alignment and to increase the knee joint ROM, and reduces the knee joint Varus moment, improves the configuration of the loads applied to the knee, and decreasing pain during walking. There are only few studies available in lateral wedge insoles and its impact on OA [17]. Pain is the most crippling feature in Osteoarthritis, Osteoarthritis is claimed to cause more damage to mobility in the elderly than the any other disease. Factors that increase risk of osteoarthritis include older age-risk of OA increases with age, Sex- women are more likely to develop OA. Obesity-increased weight adds stress to

weight bearing joints such as hip and knees. Joint injuries Repeated stress on joints, Genetics, Bone deformities, Certain metabolic diseases-includes diabetes and hemochromatosis.

### Methodology

**Study design:** A pre-test, post-test experimental study design was used with two different intervention groups to assess the effectiveness of mulligan's mobilization and lateral heel wedges on pain and physical function among knee osteoarthritis subjects.

**Subjects:** Those subjects with medical history of knee osteoarthritis. 15 subjects with knee osteoarthritis were selected for this study. Subjects were selected using convenience sampling. Subjects with the age group between 45-60 years were enrolled for this study. This study was conducted at Outpatient Department of PPG College of physiotherapy. The period of study was for 6 months. The treatment duration was for 12 weeks. The inclusion criteria for this study are: Clinically diagnosed OA knee, Age group between 45-60 years, Gender: Both males and females, Kellgren-Lawrence Grading Scale –Grade 3 [moderate multiple osteophytes defined narrowing of joint space and some sclerosis and possible deformity of bone ends], Willingness to participate in this study. The exclusion criteria are Neurological Disorder\Disease such as parkinsonism, multiple sclerosis, muscular dystrophy etc., Any oncologic or cardiac disease that would affect walking, any foot deformities that could exacerbated by the wedged orthotic device such as hallux valgus and or rigidus and bunion deformities, Assisted ambulation [orthosis, canes], Recent fracture, Bilateral osteoarthritis patients.

**Methods:** After getting approval, the study was planned to be conducted at outpatient department of PPG college of Physiotherapy. Treatment procedure was clearly explained to the patient and the inform consent form was received from the patient prior to the study. 15 subjects were used in a sample of convenience. They received movement with mobilization and lateral heel wedges for 12 weeks. Pre-test and post-test evaluation score for pain and physical function was taken using VAS scale and WOMAC index were recorded for statistical analysis.

### Description of experimental intervention

#### Mulligan's movement with mobilization

Mobilization with Movement (MWM) is the concurrent application of sustained accessory mobilization applied by a therapist and an active physiological movement to end range applied by the patient. Passive end of the range overpressure or stretching is then delivered without any pain as a barrier. The concept of MWM of the extremities and sustained natural apophyseal glides of the spine was first coined by B. Mulligan.

#### Lateral wedge insoles

The treatment for patients with OA using lateral wedge insoles, which have been used to reduce knee pain, to improve the alignment and to increase the knee joint ROM, reducing the knee joint Varus moment, improving the configuration of the loads applied to the knee, and decreasing pain during walking. The lateral wedge insole which is made of sponge rubber materials inserted into ordinary shoes [20].

The use of this orthosis was firstly reported by Sasaki and

Yasuda to alter the mechanical alignment of the lower limb, to reduce loading in the medial compartment of the knee, and to correct the valgus inclination at the calcaneus.

Under the research, reported that 82% of their patients with knee OA had some lessening of pain with an inserted insole. Moreover, 61% of patients which reported some pain reduction with lateral wedge insole. It was shown that 5- and 10-degrees lateral wedge insoles significantly decreased the knee Varus torque and effectively reduce the load at the medial compartment of the knee <sup>[19]</sup>.

Treatment techniques were Mulligan’s Mobilization and Lateral heel wedges. Total Treatment duration - 35 mins, Wax therapy – 10 mins, Warm up – 10 mins, Mulligan’s Mobilization – 10 mins, Rest interval – 5 mins, Cool down exercise – 5 mins. Subjects received Mulligan’s mobilization for 35 minutes and were prescribed to wear the lateral wedge insoles into shoes for 12 weeks. The total treatment duration was 12 weeks and each week of 3 days\week, a total of 36 sessions.

**Statistical analysis**

The result was analyzed for pre and post-test values using paired ‘t’ test favored for alternate hypothesis. The statistical tools used in the study are paired t-test. The paired ‘t’ test was used for within group analysis. Pre-test and post-test values were calculated using paired ‘t’ test at significant level of p<0.05 with t value of 2.145.

**Results**

The demographical presentation of subjects is shown in table 1. The group consists of 6 males and 9 females. The age range of the group is 45-60 years. The calculated ‘t’ value for pain and physical function using VAS and WOMAC Scales were 14.02 and 24.6 respectively which was greater than the table value of 2.145 with P<0.05. Thus, the resultant of the study shows that there was significantly improvement and difference between pre-test and post-test values.

**Table 1:** Demographic characteristics of subjects

Age	45 – 60 45 – 50 = 3 members 1 male, 2 females 50 – 55= 7 members 3 males, 4 females 55– 60 = 5 members 2 males, 3 females
Gender	Male – 6 Female - 9
Duration	12 weeks

**Table 2:** within group analysis for pain and physical function with knee osteoarthritis during preintervention and post-intervention phase.

Outcome parameters	Group	Mean	SD	T Value
VAS WOMAC index	Pre-test	5.48	0.73	14.02
	Post-test	3.05	0.65	
	Pre-test	49.8	1.004	24.6
	Post-tes	37.06	0.92	

The table 2 analysis showed that the calculated ‘t’ value using the paired ‘t’ test for pain and physical function using VAS and WOMAC index were 14.02 and 24.6 which was greater than the table value of 2.145. Hence, the statistical

reports states that there was significant improvement in pain and physical functions in knee osteoarthritis subjects.

**Discussion**

Osteoarthritis is a chronic disorder of synovial joints in which there is progressive softening and disintegration of articular cartilage and accompanied by new growth of cartilage and bone at the joint margins (osteophytes), cyst formation and sclerosis in the subchondral bone, mild synovitis and capsular fibrosis. It is primarily a non-inflammatory disorder but inflammation occurs eventually.

The study revealed the treatment obtained successful outcomes, as measured by significant reductions in WOMAC and VAS (p<0.05), Subjects in the group appeared to be more satisfied with the overall outcome of their rehabilitative treatment. These results suggest that clinical intervention consisting of Mulligan's MWM as a form of manual therapy along with rehabilitation exercise program was more effective for decreasing pain in subjects with knee OA.

Wei-Ching Hsu *et al.* (2022): Patients with knee osteoarthritis have a unique plantar-pressure during walking and lateral-wedge insoles are one of the treatment options. Participants were randomly assigned either the lateral-wedge insole group or the ordinary insole group. The Visual Analog Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and plantar pressure test scores were evaluated at the baseline and at 20 weeks. In the ordinary insole group and the function and total WOMAC scores decreased significantly.

Masound Rafiaee *et al.* (2012): The treatment for patients with OA are using lateral wedge insoles, which have been used to reduce knee pain, to improve the alignment and to increase the knee joint ROM, reducing the knee joint Varus moment, improving the configuration of the loads applied to the knee, and decreasing pain during walking. The lateral wedge insole which is made of sponge rubber materials inserted into ordinary shoes, to alter the mechanical alignment of the lower limb, to reduce loading in the medial compartment of the knee, and to correct the Varus inclination at the calcaneus. Under the research, reported that 82% of their patients with knee OA had some lessening of pain with an inserted insole. Moreover, 61% of patients which reported some pain reduction with lateral wedge insole. It was shown that 5- and 10-degrees lateral wedge insoles significantly decreased the knee Varus torque and effectively reduce the load at the medial compartment of the knee.

Dimitrova *et al.* (2008) conducted a study to provide evidence-based recommendations for prescription of MWM. This study demonstrated that strengthening of knee musculature was more effective after the MWM and was associated with significant improvement in quadriceps strength and function, when compared with controls in effective in reducing pain and improving function in individuals diagnosed with OA knee.

MWM which is a combination of an active movement with simultaneous passive accessory mobilization which helps in restoration of movement. MWM is effective by neurophysiological mechanism of production of initial hypoalgesia based on stimulation of peripheral mechanoreceptors and inhibition of nociceptors and altering sympathetic nervous system and biomechanical concept of positional fault correction. The active movement stimulates

the proprioceptive tissues, such as Golgi tendon organ by stretch. MWM repositions the joint, causing it to track normally.

The biomechanical effect of lateral wedge insoles on dynamic knee joint loading will be reviewed. The assumption that a significant effect on knee joint loading would also translate to symptom relief and functional recovery will be addressed. From a clinical perspective, symptom reduction and functional improvement are the ultimate goal. The effect of lateral wedge insoles improves structural progression. The effects on symptom relief, functional improvement and structural progression. In knee osteoarthritis patients, the lateral wedge insoles with an inclination between 5 and 10° significantly reduced the peak knee adduction moment during walking. While doing foot exercises, reduced joint motion is associated with joint instability and it is mainly a manifestation of the narrowing of the inner and outer gaps of the knee joint.

Lateral wedge insoles have effects of decreasing knee adduction movement and knee ground reaction force lever arm. In lateral heel wedge insole conditions, the change in knee adduction movement was positively correlated with the change in knee ground reaction force lever arm. Therefore, this study has demonstrated that the primary mechanism of the biomechanical effects of lateral wedge is related to a reduced knee ground reaction force lever arm.

Therefore, the result of the study showed that Mulligan's MWM along with Lateral Heel Wedges improves the mechanical alignments of the knee, reducing knee pain and improves the physical functional ability of the primary knee osteoarthritis subjects. Increasing physical function controls knee OA symptoms and improve joint function. Statistical analysis is also evidence for significant improvement.

### Limitations

1. In this study grade III primary knee osteoarthritis subjects were only included.
2. This study consists of only small sample size.
3. This study assessed only the short-term progress of subjects.
4. No follow up was added.

### Further directions of this study

1. To make the result more valid, a long-term study may be carried out.
2. Further studies can be conducted as comparative study.
3. Further studies can be conducted with more subjects.
4. Future research can be conducted with a bigger sample size, wider age group, different variables, more consistent outcome measures and different treatment durations.
5. Other grades of primary knee osteoarthritis can be included in the further study.
6. Follow up can be needed in the protocol.

### Conclusion

There is a significant reduction of pain and improvement of physical functional ability following the application of 12 weeks of Movement with mobilization along with Lateral Heel wedges effective in the knee osteoarthritis Subjects. The present study adds value to the literature that Movement with mobilization along with Lateral Heel wedges improves reduction of pain and improvement of physical functional ability in subject with primary knee osteoarthritis.

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