

Original Article

# Efficacy of Mulligan MWMs along with Conventional Physical Therapy in Knee Osteoarthritis

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## ABSTRACT

**Background:** Knee osteoarthritis is a prevalent degenerative joint disease that impairs mobility and causes significant pain, particularly in the aging population. Conservative management, including physical therapy, remains a cornerstone of treatment. The addition of Mulligan Mobilization with Movement (MWM) to conventional therapy has been proposed to improve outcomes, though its efficacy had not been robustly quantified.

**Objective:** The objective of this study was to compare the efficacy of Mulligan MWM in conjunction with conventional physical therapy to conventional physical therapy alone in reducing pain and stiffness and improving functional outcomes in patients with grade 2 knee osteoarthritis.

**Methods:** This randomized clinical trial included 28 participants with grade 2 knee osteoarthritis, randomly allocated into two groups: one receiving Mulligan MWM alongside conventional physical therapy and the other receiving only conventional physical therapy. The intervention lasted one month, with assessments conducted at baseline, two weeks, and four weeks using the Visual Analogue Scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) as outcome measures. Statistical analysis was performed using SPSS version 25.

**Results:** The MWM plus physical therapy group exhibited a greater reduction in VAS scores (baseline: 6.71, SD 1.729 to week 4: 2.21, SD 1.051) compared to the physical therapy alone group (baseline: 7.14, SD 1.562 to week 4: 3.86, SD 0.663), with a significant mean difference ( $P < 0.001$ ). Similarly, WOMAC scores for pain, stiffness, and physical function significantly improved in the MWM group compared to the physical therapy group at week 4 (Pain: 2.79 vs. 6.86, Stiffness: 1.14 vs. 3.36, Function: 9.79 vs. 27.57, all  $P < 0.001$ ).

**Conclusion:** Mulligan MWM combined with conventional physical therapy was more effective than conventional physical therapy alone in reducing pain, stiffness, and improving functional outcomes in patients with grade 2 knee osteoarthritis. These results support the inclusion of MWM in the management of knee osteoarthritis.

**Keywords:** Knee Osteoarthritis, Mulligan Mobilization with Movement, Physical Therapy, Non-Pharmacological Treatment, Pain Management, Joint Stiffness, Functional Outcomes, Rehabilitation, Randomized Clinical Trial.

## INTRODUCTION

Osteoarthritis (OA) represents a prevalent degenerative condition affecting the knee joint, primarily characterized by the progressive deterioration of articular cartilage alongside changes in the subchondral bone, synovia, ligaments, and surrounding musculature. This condition is particularly common among the female population and stands as a leading cause of pain and functional impairment, especially in older individuals. The etiology of knee OA is multifaceted, encompassing factors such as injury, aging, excessive body weight, and biomechanical stresses resulting from joint malalignment or repeated use, which collectively contribute to the mechanical strain and subsequent degeneration within the joint (1). Clinically, knee OA manifests through a constellation of symptoms including pain, stiffness, crepitation, swelling, tenderness, a sensation of joint instability, and restricted movement, which progressively undermine the quality of life of affected individuals (2). The condition primarily impacts the medial tibio-femoral

compartment and is characterized by a slow, insidious onset over a span of 10 to 15 years, earning descriptors such as "wear and tear arthritis," "primary osteoarthritis," and "age-related arthritis" due to its association with advancing age and the cumulative effects of joint wear (3, 4).

Biomechanical integrity plays a crucial role in the health of the knee joint, with mechanical loading under abnormal conditions leading to matrix damage, enhanced catabolic activity, and mechanical failure. Variations in the loading patterns, ranging from excessive to insufficient, can precipitate a range of tissue responses, including collagen fiber network disruption and alterations in the proteoglycan content, thereby contributing to the pathogenesis of OA (5-8). The pathophysiology of OA is complex, involving not only the degradation of cartilage but also bone remodeling and inflammatory responses that affect the non-cartilaginous structures of the joint, such as the capsule, synovium, ligaments, and subchondral bone. These changes are marked by bony spur formation, muscle deterioration, and ligament elasticity reduction, with synovial fluid inflammatory mediators playing a pivotal role in collagen breakdown and cartilage erosion (9-12).

Management strategies for knee OA span both conservative and non-conservative approaches, with an emphasis on alleviating symptoms and improving joint function. Conservative treatments include aquatic therapy, conventional physical therapy, manual therapy, and footwear modification, whereas more advanced cases may necessitate surgical interventions such as knee arthroplasty (13). Conventional physical therapy plays a fundamental role in this spectrum of management, incorporating stretching exercises to mitigate muscle tightness, range of motion exercises to enhance flexibility and functional capacity, and strengthening exercises aimed at bolstering muscle power around the knee. Additionally, the application of electrotherapy modalities like TENS, ultrasound, and heating pads has been substantiated within the therapeutic regimen for knee OA, providing muscle relaxation and pain relief according to established guidelines (14, 15).

Within the realm of manual therapy, mobilization techniques, particularly Mobilization with Movement (MWM) as pioneered by Brian Mulligan, have garnered attention for their efficacy in addressing pain, improving joint mobility, and facilitating muscle strength and stability. The Mulligan concept, which combines patient-initiated movement with therapist-applied joint glide, although not widely adopted in certain clinical settings, such as in Pakistan, offers a promising adjunct to conventional physical therapy. This study aims to underscore the benefits of integrating Mulligan's MWM into the treatment paradigm for knee OA, advocating for its broader recognition and application in clinical practice to enhance patient outcomes and functional independence (14, 16-19). Through promoting awareness and understanding of this technique among practitioners, the study endeavors to enrich the therapeutic arsenal available for managing the complexities of knee osteoarthritis, ultimately contributing to improved patient care and quality of life.

## MATERIAL AND METHODS

This study embarked on a comparative analysis of the efficacy of Mulligan Mobilization with Movement (MWM) techniques alongside conventional physical therapy versus conventional physical therapy alone in the management of grade 2 knee osteoarthritis, as classified by the Kellgren-Lawrence grading system. A total of 28 participants, meeting the specified inclusion criteria, were enrolled in the study. These criteria encompassed individuals aged 35-55 years, of either gender, presenting with a pain score exceeding 3 on the Visual Analogue Scale (VAS), and diagnosed with grade 2 knee osteoarthritis. Exclusion criteria were defined to omit participants with a history of malignancy, knee injuries, prior knee surgeries, co-morbidities, rheumatoid arthritis, or other musculoskeletal disorders.

Participants were randomly assigned into two groups utilizing the chit and draw method inherent to the Simple Randomization Technique. Group 1 received Mulligan's MWM in conjunction with conventional physical therapy, while Group 2 was treated with conventional physical therapy alone. The intervention was administered three times per week over a span of one month. Conventional physical therapy constituted the baseline treatment for both groups, integrating exercises to improve knee range of motion (ROM) and muscle strength, as well as electrotherapy modalities such as TENS, ultrasound, and heating pads, applied under standardized conditions.

Data collection was facilitated using the Visual Analogue Scale (VAS) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), enabling a comprehensive assessment of pain, stiffness, and functional limitations associated with knee osteoarthritis. Assessments were conducted at baseline, after two weeks, and at the conclusion of the four-week treatment period.

The study adhered strictly to the ethical guidelines outlined in the Declaration of Helsinki to ensure the rights, safety, and well-being of all participants were protected. Prior to the commencement of the study, ethical approval was obtained from the relevant institutional review board, and informed consent was secured from all participants, ensuring they were fully apprised of the study's nature, objectives, and potential risks.

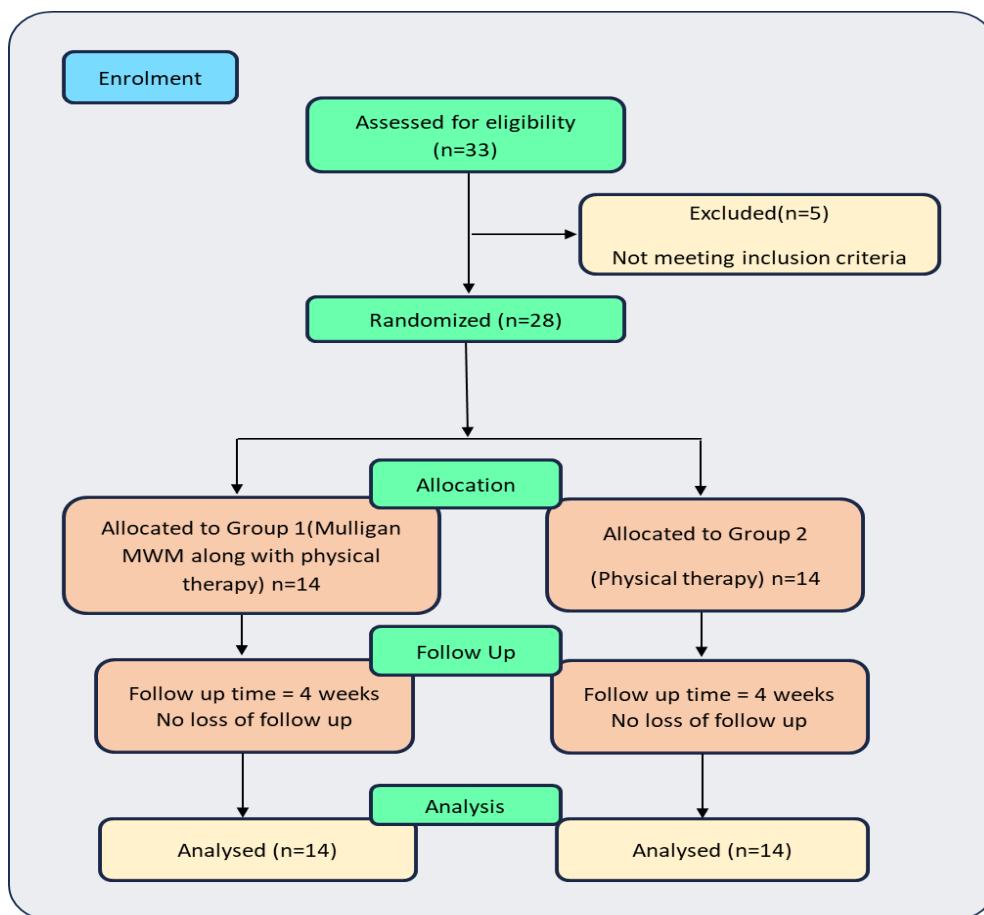


Figure 1 CONSORT Flow Chart

Statistical analysis of the collected data was conducted using the 25th version of the Statistical Package for the Social Sciences (SPSS). To evaluate the effectiveness of the interventions within each group, a Repeated Measures ANOVA was utilized, while comparisons between the two groups were facilitated by the application of One Way ANOVA. This comprehensive approach to data analysis facilitated a robust examination of the therapeutic impact of Mulligan’s MWM when integrated with conventional physical therapy, thereby contributing valuable insights to the body of evidence supporting the management of knee osteoarthritis.

## RESULTS

At the outset of the intervention, the groups compared showed no statistically significant differences in

baseline scores across various measures. Specifically, for the Visual Analogue Scale (VAS), the group receiving Mulligan Mobilization with Movement (MWM) alongside physical therapy had an average score of 6.71 with a standard deviation (SD) of 1.729, while the group undergoing physical therapy alone had a slightly higher average score of 7.14 (SD 1.562), the mean difference being -0.429 (P=0.497) (Table 1). The initial Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) pain scores mirrored this pattern, with the MWM group at a mean of 12.50 (SD 3.345) and the physical therapy group at 13.43 (SD 2.409), resulting in a mean difference of -0.929, which was not significant (P=0.407) (Table 2). This trend continued across the WOMAC stiffness and function scores, with mean differences of -0.357 (P=0.417) and -5.929 (P=0.110), respectively, indicating no significant initial disparities between the two groups (Tables 3 and 4).

The second assessment revealed a shift, with the group receiving MWM plus physical therapy showing significant improvements. Their VAS score decreased to an average of 4.43 (SD 1.399), which was notably lower than the physical therapy group’s average of 5.50 (SD 0.941), reflecting a significant mean difference of -1.071 (P=0.025) (Table 1). A similar significant reduction was noted in the WOMAC pain score for the MWM group, now averaging 6.86 (SD 2.179), compared to the physical therapy group’s average of 9.00 (SD 1.961), with a mean difference of -2.143 (P=0.001) (Table 2). WOMAC stiffness scores further underscored the effectiveness of MWM; the group receiving it reported an average of 3.36 (SD 0.929), in stark contrast to the physical therapy group’s average of 4.71 (SD 1.267), yielding a mean difference of -1.357 (P=0.003) (Table 3). The WOMAC function scores were equally compelling, with the MWM group improving to an average score of 24.43 (SD 7.219), significantly better than the physical therapy group’s 34.79 (SD 6.066), and a mean difference of -10.357 (P<0.001) (Table 4).

Table 1: Between Groups Comparison of Visual Analogue Scale (VAS) score

Assessment	Groups	Means	Standard Deviation	Mean Difference	P-Value
Baseline Assessment	MWMs	6.71	1.729	-0.429	.497
	Physical Therapy Alone	7.14	1.562		
2nd	MWMs	4.43	1.399	-1.071	.025

Assessment	Physical Therapy Alone	5.50	.941		
3rd Assessment	MWMs	2.21	1.051	-1.643	.000
	Physical Therapy Alone	3.86	.663		

Table 2: Between Groups Comparison of WOMAC pain score

Assessment	Groups	Means	Standard Deviation	Mean Difference	P-Value
Baseline Assessment	MWMs	12.50	3.345	-.929	.407
	Physical Therapy Alone	13.43	2.409		
2nd Assessment	MWMs	6.86	2.179	-2.143	.001
	Physical Therapy Alone	9.00	1.961		
3rd Assessment	MWMs	2.79	1.369	-4.071	.000
	Physical Therapy Alone	6.86	2.445		

Table 1: Between Groups Comparison of WOMAC stiffness score

Assessment	Groups	Means	Standard Deviation	Mean Difference	P-Value
Baseline Assessment	MWMs	5.86	1.099	-.357	.417
	Physical Therapy Alone	6.21	1.188		
2nd Assessment	MWMs	3.36	.929	-1.357	.003
	Physical Therapy Alone	4.71	1.267		
3rd Assessment	MWMs	1.14	.864	-2.214	.000
	Physical Therapy Alone	3.36	1.008		

Table 2: Between Groups Comparison of WOMAC physical function score

Assessment	Groups	Means	Standard Deviation	Mean Difference	P-Value
Baseline Assessment	MWMs	47.07	12.640	-5.929	.110
	Physical Therapy Alone	53.00	4.420		
2nd Assessment	MWMs	24.43	7.219	-10.357	.000
	Physical Therapy Alone	34.79	6.066		
3rd Assessment	MWMs	9.79	5.494	-17.786	.000
	Physical Therapy Alone	27.57	6.297		

Table 3: Between Groups Comparison of WOMAC total score

Assessment	Groups	Means	Standard Deviation	Mean Difference	P-Value
Baseline Assessment	MWMs	65.43	15.550	-7.214	.120
	Physical Therapy Alone	72.64	6.332		
2nd Assessment	MWMs	34.64	8.915	-13.851	.000
	Physical Therapy Alone	48.50	7.714		
3rd Assessment	MWMs	13.71	7.141	-24.071	.000
	Physical Therapy Alone	37.79	7.329		

By the third assessment, the advantages of incorporating MWM with physical therapy were most evident. The MWM group's VAS score had further reduced to an average of 2.21 (SD 1.051), compared to the physical therapy group's 3.86 (SD 0.663), achieving a significant mean difference of -1.643 ( $P < 0.001$ ) (Table 1). This trend of significant improvement was consistent across the board, with the WOMAC pain score for the MWM group at a low average of 2.79 (SD 1.369) versus the physical therapy group's 6.86 (SD 2.445), resulting in a significant mean difference of -4.071 ( $P < 0.001$ ) (Table 2). Stiffness scores followed a similar trajectory; the MWM group reported an average of 1.14 (SD 0.864), significantly less than the physical therapy group's average of 3.36 (SD 1.008), with a mean difference of -2.214 ( $P < 0.001$ ) (Table 3). Perhaps most striking was the difference in WOMAC function scores, with the MWM group

reaching an average of 9.79 (SD 5.494) compared to the physical therapy group's 27.57 (SD 6.297), a substantial mean difference of -17.786 ( $P < 0.001$ ) (Table 4). These results underscored the substantial impact of MWM when combined with physical therapy, as reflected by the significant differences in the WOMAC total scores between the groups, with the MWM group averaging 13.71 (SD 7.141) and the physical therapy group 37.79 (SD 7.329), indicating a profound mean difference of -24.071 ( $P < 0.001$ ) by the end of the treatment period (Table 5). The consistency and magnitude of these improvements strongly suggest that the addition of MWM to conventional physical therapy provides a considerable benefit in the treatment of knee osteoarthritis.

## DISCUSSION

The investigation was designed to evaluate the comparative efficacy of Mulligan Mobilization with Movement (MWM) combined with conventional physical therapy against conventional physical therapy alone in managing grade 2 knee osteoarthritis, particularly focusing on alleviating pain, reducing stiffness, and enhancing functional outcomes. Participants ( $n=28$ ) were systematically assigned to one of two treatment groups, with the intervention period spanning one month and assessments conducted bi-weekly.

While both treatment modalities yielded improvements, the incorporation of MWM into conventional physical therapy emerged as a more effective strategy, aligning with prior research indicating a predilection for knee osteoarthritis among older and overweight individuals, particularly women (20). The superior outcomes of the MWM group corroborated with previous findings, where MWM was underscored as a potent method to mitigate discomfort in knee osteoarthritis patients (21). Notably, this study contributed additional empirical support, demonstrating pronounced declines in pain and stiffness alongside marked enhancements in physical function for those receiving the combined treatment approach.

The study, however, is not without its limitations. The relatively brief duration of the intervention and subsequent follow-up imparts constraints on the interpretation of long-term benefits. Additionally, the modest cohort size limits the broad applicability of the findings to the wider knee osteoarthritis population. It is imperative to consider these factors when contextualizing the results, as they may not fully reflect outcomes in varied clinical settings or over extended treatment periods.

Acknowledging these constraints, future research directions should include extended intervention durations to appraise the sustained effects of these therapeutic strategies. Expanding the participant base would enhance the generalizability of the findings, and implementing the study across multiple clinical environments could refine the outcomes further.

In conclusion, the present Randomized Clinical Trial (RCT) substantiated both treatment modalities as efficacious, accessible, and economical non-pharmacological interventions for knee osteoarthritis. Crucially, the combination of Mulligan MWM with conventional physical therapy exhibited enhanced benefits in pain alleviation, stiffness reduction, and functional improvement. These findings suggest that integrating MWM into physical therapy regimens may be advantageous for knee osteoarthritis patients, potentially informing clinical practice and patient care protocols.

## CONCLUSION

In conclusion, this study demonstrates that for individuals with grade 2 knee osteoarthritis, a treatment regimen that combines Mulligan Mobilization with Movement and conventional physical therapy is more effective in reducing pain and stiffness and in improving functional outcomes than conventional physical therapy alone. These findings underscore the potential for integrating MWM into standard care, offering a non-pharmacological, cost-effective approach with significant implications for enhancing patient care and advancing treatment strategies within the scope of human healthcare.

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