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To Study The Effectiveness Of Mobilisation With Movement Combined With Strengthening Exercises And Taping In Function Outcome In Patients With Knee-Osteoarthritis

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ABSTRACT

Introduction-Knee osteoarthritis (OA) is a prevalent degenerative joint disease that significantly impairs physical function and quality of life. Traditional treatment approaches include pharmacological interventions, physical therapy, and surgical options. However, there is growing interest in non-pharmacological interventions that can provide symptom relief and improve function with minimal side effects. This study aimed to evaluate the effectiveness of a combined treatment protocol involving Mobilization with Movement (MWM), strengthening exercises, and taping in patients with knee OA compared to conventional physiotherapy.

Objectives- The primary objective of this study was to determine the effectiveness of MWM combined with strengthening exercises and taping in improving pain, stiffness, and physical function in patients with knee OA. Secondary objectives included assessing the impact of these interventions on functional exercise capacity and exploring correlations between demographic characteristics and treatment outcomes.

Methods- This pre-test post-test experimental study involved 40 subjects diagnosed with knee OA, who were randomly assigned to either the experimental group (Group 1) or the control group (Group 2). Group 1 received the combined treatment protocol of MWM, strengthening exercises, and taping, while Group 2 received conventional physiotherapy. Outcome measures included the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the 6-minute walk test. Baseline and post-intervention measurements were compared within and between groups to assess the effectiveness of the interventions.

Results- The study found that the mean WOMAC score in Group 1 significantly decreased from 59.80 to 49.65 post-intervention ($p < 0.001$), indicating substantial improvements in pain, stiffness, and physical function. In contrast, Group 2 showed a minimal reduction in WOMAC scores from 61.95 to 60.55 ($p = 0.098$), which was not statistically significant. Similarly, the mean distance covered in the 6-minute walk test for Group 1 increased significantly from 416.75 meters to 456.05 meters ($p < 0.001$), while Group 2 showed a modest increase from 415.60 meters to 426.65 meters ($p = 0.006$).

Conclusion- The combined treatment protocol of MWM, strengthening exercises, and taping significantly improved symptoms and functional outcomes in patients with knee OA compared to conventional physiotherapy. These findings suggest that incorporating these interventions into treatment protocols can provide substantial benefits to patients with knee OA. Further research with larger sample sizes and longer

follow-up periods is recommended to confirm these findings and explore the long-term effects of the intervention.

Keywords- Knee osteoarthritis, Mobilization with Movement, Strengthening exercises, tapping, Physiotherapy, WOMAC Index, 6-minute walk test, Non-pharmacological interventions.

Introduction

Osteoarthritis (OA) is one of the most prevalent musculoskeletal disorders globally, particularly affecting the elderly population(1). It is a degenerative joint disease characterized by the progressive breakdown of articular cartilage, leading to pain, stiffness, swelling, and impaired joint function. Among the various joints affected by OA, the knee is particularly vulnerable, significantly impacting individuals' mobility and quality of life. Knee osteoarthritis (KOA) often leads to disability and places a considerable burden on healthcare systems(2,3).

The prevalence of KOA increases with age, and it is estimated that around 10% of men and 13% of women aged 60 years and older are affected by symptomatic KOA. This incidence is expected to rise due to the aging population and the increasing prevalence of risk factors such as obesity and sedentary lifestyles. KOA not only affects physical health but also has substantial socio-economic implications, including significant healthcare costs and loss of productivity due to disability(4,5).

KOA involves complex pathophysiological processes, including mechanical, biological, and biochemical factors. The primary feature of KOA is the progressive loss of articular cartilage, which acts as a cushion between the bones in the knee joint. The degeneration of cartilage results in joint space narrowing, subchondral bone sclerosis, formation of osteophytes, and synovial inflammation, all contributing to the clinical symptoms of pain, stiffness, and impaired joint function(6,7).

Several risk factors contribute to the development and progression of KOA. Age is a major factor, as the risk of KOA increases with age due to cumulative wear and tear on the joint and age-related changes in cartilage. Gender also plays a role, with women more likely to develop KOA, especially after menopause, suggesting a hormonal influence. Genetic predisposition, obesity, previous knee injuries, certain occupations and activities that stress the knee, and muscle weakness around the knee are other significant risk factors(8).

Managing KOA involves a combination of non-pharmacological, pharmacological, and surgical interventions. Non-pharmacological treatments are the cornerstone of KOA management, including patient education, weight management, physical therapy, and the use of assistive devices. Pharmacological treatments often involve analgesics, non-steroidal anti-inflammatory drugs (NSAIDs), and intra-articular injections. In advanced cases, surgical interventions such as total knee arthroplasty (TKA) may be necessary(9).

Physical therapy plays a crucial role in managing KOA by improving joint function, reducing pain, and enhancing the quality of life. Various physical therapy modalities are used, including exercise, manual therapy, and therapeutic modalities. Exercise is a key component of KOA management, helping to maintain joint mobility, strengthen the muscles around the knee, and reduce pain(10). Aerobic exercises, resistance training, and flexibility exercises are commonly recommended. Manual therapy techniques, such as mobilization with movement (MWM), have gained popularity in the management of KOA. MWM involves the application of passive joint mobilization combined with active or passive movements, aiming to improve joint mobility and reduce pain. Taping techniques, such as patellar taping, are used to provide support to the knee joint, improve alignment, and reduce pain. Taping can be particularly beneficial when combined with exercise and manual therapy(11).

Despite the availability of various treatment options, managing KOA remains challenging due to the chronic nature of the disease and the multifactorial aspects of its pathophysiology. Combining different non-pharmacological interventions may offer a synergistic effect, potentially enhancing treatment outcomes. Mobilization with movement (MWM) combined with strengthening exercises and taping has shown promise in improving functional outcomes in patients with KOA. However, there is limited evidence on the

effectiveness of this combined approach(12,13).

The primary objective of this study is to evaluate the effectiveness of MWM combined with strengthening exercises and taping in improving functional outcomes in patients with KOA. Specific objectives include assessing the impact of the combined intervention on pain levels, evaluating improvements in joint mobility and range of motion, measuring changes in muscle strength around the knee, and assessing the overall functional ability and quality of life of patients with KOA. The study hypothesizes that the combined intervention will significantly reduce pain levels, improve joint mobility and range of motion, increase muscle strength around the knee, and enhance overall functional ability and quality of life.

The knee joint is one of the largest and most complex joints in the human body. It is a synovial hinge joint that primarily allows for flexion and extension, but also permits a limited degree of medial and lateral rotation. The knee joint consists of three main components: the femur (thigh bone), the tibia (shin bone), and the patella (kneecap)(14,15).

The biomechanics of the knee joint involve complex interactions between the bones, ligaments, muscles, and tendons. The knee joint allows for efficient movement while bearing substantial loads during activities such as walking, running, and jumping. The articular cartilage and menisci play crucial roles in absorbing shock and distributing forces across the joint surfaces.

Understanding the anatomy and biomechanics of the knee joint is essential for effectively managing conditions such as KOA. The proposed study aims to evaluate the effectiveness of combining MWM, strengthening exercises, and taping in improving functional outcomes for patients with KOA. This approach leverages the principles of biomechanics and manual therapy to enhance joint function, reduce pain, and improve the quality of life for individuals suffering from this debilitating condition.

Aim of Study

The aim of this study is to evaluate the effectiveness of mobilization with movement (MWM) combined with strengthening exercises and taping in improving functional outcomes in patients with knee osteoarthritis (KOA). Specifically, the study seeks to determine the impact of this combined intervention on pain reduction, joint mobility, muscle strength, and overall functional ability and quality of life in individuals suffering from KOA.

Objectives

1. To assess the impact of mobilization with movement (MWM) combined with strengthening exercises and taping on pain levels in patients with knee osteoarthritis (KOA).
2. To evaluate the improvements in joint mobility and range of motion following the combined intervention.
3. To measure the changes in muscle strength around the knee as a result of the intervention.
4. To assess the overall functional ability and quality of life of patients with KOA after undergoing the combined treatment.

Methodology

The study employed a quantitative research approach to measure and analyze the effectiveness of mobilization with movement combined with strengthening exercises and taping on functional outcomes in patients with knee osteoarthritis. The research design was a pre-test post-test experimental study, which involved measuring the dependent variables before and after the intervention to determine the effect of the independent variable. The independent variable was the treatment protocol, which included mobilization with movement combined with strengthening exercises and taping. The dependent variables included the primary outcome, measured by the WOMAC Index (Western Ontario and McMaster Universities Osteoarthritis Index), and the secondary outcome, measured by the 6-minute walk test.

The study was conducted in physiotherapy clinics and hospitals, specifically Medeor Hospital, and targeted patients diagnosed with knee osteoarthritis based on clinical criteria developed by Altman. The inclusion criteria were knee pain and crepitus with active motion, morning stiffness of ≤ 30 minutes, age between 38 to 65 years, both male and female participants willing to participate, and no impairments that would prevent safe

participation in the study. Exclusion criteria included evidence of symptomatic back, ankle, or hip disease, secondary arthritis or inflammatory conditions like rheumatoid arthritis, any pathology affecting the ankle and hip, active infection around the knee joint, recent knee surgery or intra-articular steroid injection within the previous four weeks, and contraindications to manual therapy.

The sample size for the study was 40, determined through convenience sampling. Primary outcome measurement utilized the WOMAC Index to assess pain, stiffness, and physical function. The secondary outcome was measured using the 6-minute walk test to gauge functional exercise capacity. Validity and reliability considerations included ensuring construct, content, internal, external, and ecological validity, as well as instrument, inter-rater, intra-rater, test-retest, and procedural reliability.

The data collection procedure involved recruiting participants from physiotherapy clinics and hospitals, ensuring they met inclusion criteria, and obtaining informed consent. Baseline assessments included demographic data collection and measurements using the WOMAC Index, 6-minute walk test, and goniometer for range of motion. Participants were then randomly assigned to either the experimental group (receiving mobilization with movement, strengthening exercises, and taping) or the control group (receiving conventional physiotherapy). The intervention consisted of 12 treatment sessions over 4 weeks. Post-intervention assessments repeated the baseline measurements to evaluate changes.

The data analysis plan included data preparation through accurate entry and cleaning, followed by descriptive and inferential statistics to compare pre-treatment and post-treatment measurements within and between groups. Statistical methods such as paired t-tests and ANCOVA were used, along with effect size calculation and subgroup analyses. Statistical software like SPSS, R, or Stata was employed for data analysis, ensuring all results were accurately reported and interpreted.

Treatment Protocol

Experimental Group (Group A): Mobilization with Movement (MWM), Strengthening Exercises, and Taping

Mobilization with Movement (MWM): Mobilization with Movement (MWM) is a manual therapy technique designed to improve joint function and reduce pain. This technique involves the application of specific mobilizations during active or passive movements of the joint. In this study, MWM will be performed on patients with knee osteoarthritis (OA) to enhance joint mobility and alleviate discomfort. The techniques include rotation in open kinetic chain (OKC) and closed kinetic chain (CKC), side glide with belt assistance in prone position, posterior glide in supine position, and superior tibiofibular joint mobilization in both OKC and CKC.

Strengthening Exercises: Strengthening exercises aim to improve the muscle strength around the knee joint, particularly the quadriceps, which are often weakened in patients with knee OA. These exercises will be tailored to each patient's capability and will progressively increase in intensity. Exercises will include the use of weight cuffs and resistance bands. Participants will perform a series of exercises focusing on knee extension, flexion, and functional movements that enhance overall knee stability and function.

Taping: Kinesiotaping (KT) will be applied to provide support, reduce pain, and enhance muscle function. The tape will be applied according to the Mulligan concept or other therapeutic KT techniques. This involves strategically placing the tape on the knee and surrounding areas to support the joint, improve proprioception, and facilitate muscle activation during daily activities and exercises.

Control Group (Group B): Conventional Physiotherapy

Conventional Physiotherapy: Participants in the control group will receive standard physiotherapy care, which typically includes general exercises, electrotherapy, and other common physiotherapy modalities

aimed at managing symptoms of knee OA. These treatments do not include the specific techniques of MWM or taping. The conventional physiotherapy regimen will focus on improving joint function, reducing pain, and enhancing overall mobility through a combination of stretching, strengthening, and low-impact aerobic exercises.

RESULT

TABLE NO 1 – SHOWS THE DEMOGRAPHIC DETAILS OF THE SUBJECTS

	Group	N	Mean	Std. Deviation	Std. Error Mean	P value
Age	1	20	52.30	7.547	1.688	0.468
	2	20	54.30	9.592	2.145	
Weight (kg)	1	20	66.05	11.519	2.576	0.398
	2	20	69.35	12.853	2.874	
Height (cm)	1	20	166.20	9.512	2.127	0.052
	2	20	173.35	12.787	2.859	
BMI	1	20	23.965	4.0684	.9097	0.821
	2	20	23.57	6.521	1.458	

GROUP 1 - Mobilization with Movement (MWM), Strengthening Exercises, and Taping, GROUP 2 - Control Group

Table No 1 provides a detailed summary of the demographic characteristics of the subjects in both groups, including age, weight, height, and BMI. This table is essential to ensure that the groups are comparable at baseline, which is crucial for the validity of the study outcomes.

Age: The mean age of the subjects in Group 1 (Mobilization with Movement (MWM), Strengthening Exercises, and Taping) is 52.30 years with a standard deviation of 7.547 years and a standard error mean of 1.688. In Group 2 (Control Group), the mean age is 54.30 years with a standard deviation of 9.592 years and a standard error mean of 2.145. The p-value for the age comparison between the two groups is 0.468, indicating that there is no statistically significant difference in the ages of the subjects in the two groups. This suggests that age is not a confounding factor in this study and that any observed differences in outcomes are unlikely to be due to age differences between the groups.

Weight (kg): The mean weight of the subjects in Group 1 is 66.05 kg with a standard deviation of 11.519 kg and a standard error mean of 2.576. For Group 2, the mean weight is 69.35 kg with a standard deviation of 12.853 kg and a standard error mean of 2.874. The p-value for the weight comparison is 0.398, indicating that there is no statistically significant difference in the weights of the subjects between the two groups. This ensures that differences in weight are unlikely to influence the outcomes of the study, providing a fair comparison of the intervention effects.

Height (cm): The mean height of the subjects in Group 1 is 166.20 cm with a standard deviation of 9.512 cm and a standard error mean of 2.127. In Group 2, the mean height is 173.35 cm with a standard deviation of 12.787 cm and a standard error mean of 2.859. The p-value for the height comparison is 0.052, which is slightly above the conventional threshold for statistical significance ($p < 0.05$). Although there is a trend toward a difference in height between the groups, this difference is not statistically significant, suggesting that height differences are unlikely to confound the study results.

BMI: The mean BMI of the subjects in Group 1 is 23.965 with a standard deviation of 4.0684 and a standard error mean of 0.9097. In Group 2, the mean BMI is 23.57 with a standard deviation of 6.521 and a standard error mean of 1.458. The p-value for the BMI comparison is 0.821, indicating no statistically significant difference in BMI between the two groups. This suggests that BMI is not a confounding factor and that any differences observed in the outcomes can be attributed to the interventions rather than differences in BMI.

TABLE NO 2 – SHOWS THE WESTERN ONTARIO AND MCMASTER UNIVERSITIES OSTEOARTHRITIS INDEX

	Group	N	Mean	Std. Deviation	Std. Error Mean	**P value**
WOMAC Pre	1	20	59.80	12.887	2.882	0.570
	2	20	61.95	10.748	2.403	
WOMAC Post	1	20	49.65	13.323	2.979	0.007
	2	20	60.55	10.665	2.385	

GROUP 1 - Mobilization with Movement (MWM), Strengthening Exercises, and Taping, GROUP 2 - Control Group

Table No 2 presents the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores for both the experimental group (Group 1) and the control group (Group 2). The table provides the mean, standard deviation, and standard error mean for the WOMAC scores before and after the intervention, as well as the p-values for comparisons between the groups.

WOMAC Pre: The mean WOMAC score before the intervention for Group 1 (Mobilization with Movement (MWM), Strengthening Exercises, and Taping) is 59.80 with a standard deviation of 12.887 and a standard error mean of 2.882. For Group 2 (Control Group), the mean WOMAC score is 61.95 with a standard deviation of 10.748 and a standard error mean of 2.403. The p-value for the pre-intervention WOMAC scores is 0.570, indicating no statistically significant difference between the groups at baseline. This similarity in pre-intervention scores ensures that both groups started with comparable levels of osteoarthritis symptoms, which is crucial for assessing the impact of the interventions.

WOMAC Post: After the intervention, the mean WOMAC score for Group 1 is 49.65 with a standard deviation of 13.323 and a standard error mean of 2.979. In contrast, Group 2 has a mean WOMAC score of 60.55 with a standard deviation of 10.665 and a standard error mean of 2.385. The p-value for the post-intervention WOMAC scores is 0.007, indicating a statistically significant difference between the two groups. This significant reduction in the WOMAC scores in Group 1 compared to Group 2 suggests that the combination of mobilization with movement, strengthening exercises, and taping was more effective in reducing osteoarthritis symptoms than the conventional physiotherapy provided to the control group.

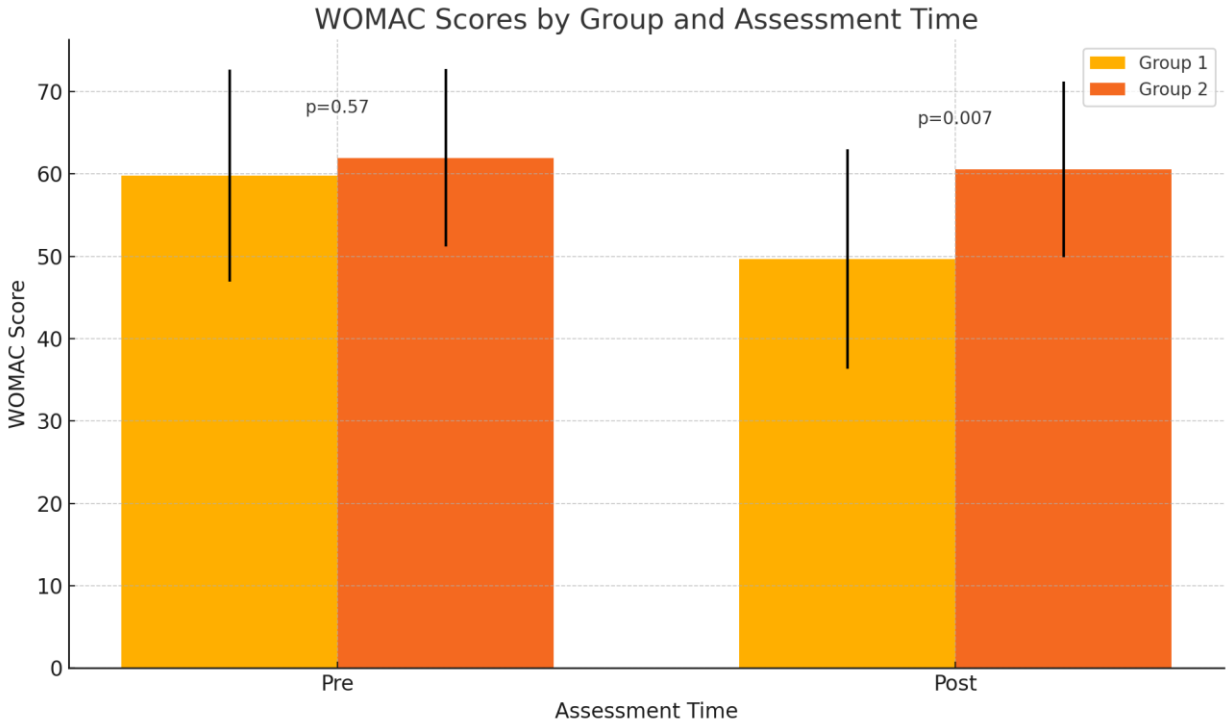


TABLE NO 3 – SHOWS THE 6-MINUTE WALK TEST SCORES

	Group	N	Mean	Std. Deviation	Std. Error Mean	P value
6-Minute Walk Pre (m)	1	20	416.75	92.928	20.779	0.969
	2	20	415.60	95.832	21.429	
6-Minute Walk Post (m)	1	20	456.05	95.011	21.245	0.003
	2	20	426.65	94.278	21.081	

GROUP 1 - Mobilization with Movement (MWM), Strengthening Exercises, and Taping, GROUP 2 - Control Group

Table No 3 provides the results of the 6-minute walk test for both the experimental group (Group 1) and the control group (Group 2). This table includes the mean, standard deviation, and standard error mean for the distances walked before and after the intervention, along with the p-values for comparisons between the groups.

6-Minute Walk Pre (m): The mean distance walked in the 6-minute walk test before the intervention for Group 1 (Mobilization with Movement (MWM), Strengthening Exercises, and Taping) is 416.75 meters with a standard deviation of 92.928 meters and a standard error mean of 20.779 meters. For Group 2 (Control Group), the mean distance is 415.60 meters with a standard deviation of 95.832 meters and a standard error mean of 21.429 meters. The p-value for the pre-intervention 6-minute walk distances is 0.969, indicating no statistically significant difference between the groups at baseline. This ensures that both groups started with comparable levels of functional exercise capacity, which is crucial for assessing the impact of the interventions.

6-Minute Walk Post (m): After the intervention, the mean distance walked for Group 1 is 456.05 meters with a standard deviation of 95.011 meters and a standard error mean of 21.245 meters. In contrast, Group 2 has a mean distance of 426.65 meters with a standard deviation of 94.278 meters and a standard error mean of 21.081 meters. The p-value for the post-intervention 6-minute walk distances is 0.003, indicating a statistically significant difference between the two groups. This significant improvement in the 6-minute walk test distances in Group 1 compared to Group 2 suggests that the combination of mobilization with movement, strengthening exercises, and taping was more effective in enhancing functional exercise capacity than the conventional physiotherapy provided to the control group.

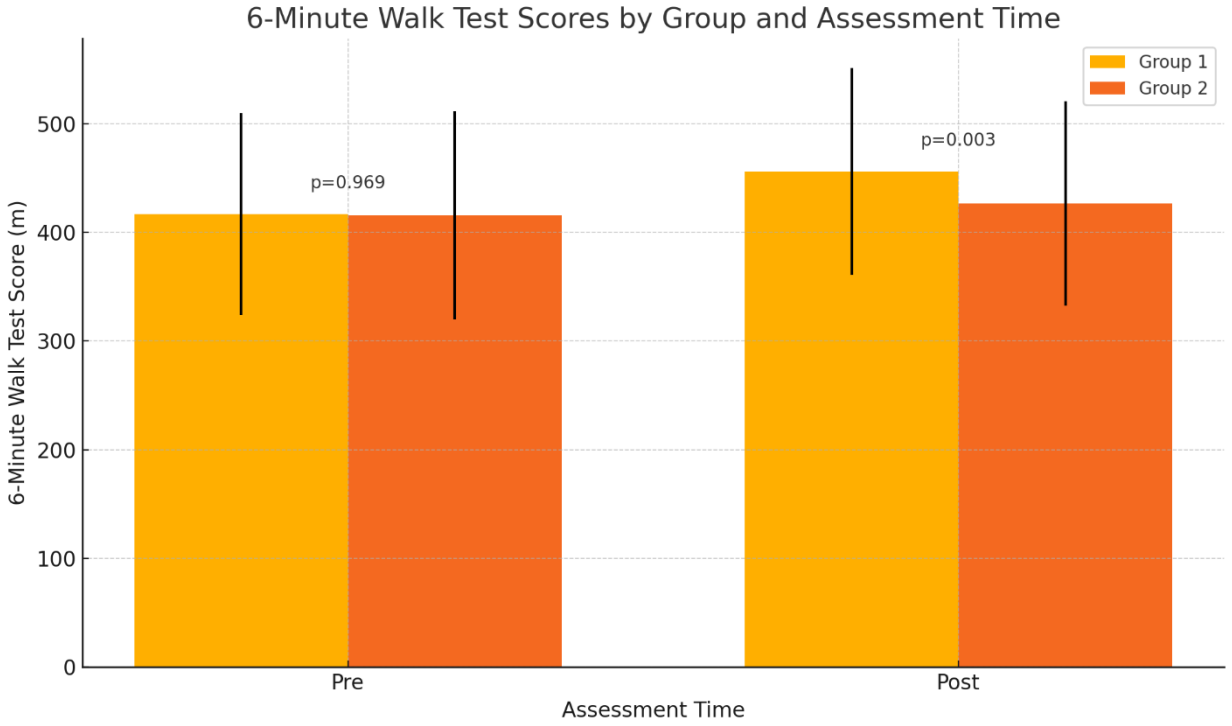


TABLE NO 4 – SHOWS THE PRE AND POST SCORES COMPARTION OF GROUP 1

		Mean	N	Std. Deviation	Std. Error Mean	P value
Pair 1	**WOMAC Pre**	59.80	20	12.887	2.882	P<0.001
	WOMAC Post	49.65	20	13.323	2.979	
Pair 2	**6-Minute Walk Pre (m)**	416.75	20	92.928	20.779	P<0.001
	6-Minute Walk Post (m)	456.05	20	95.011	21.245	

GROUP 1 - Mobilization with Movement (MWM), Strengthening Exercises, and Taping, GROUP 2 - Control Group

Table No 4 provides a detailed comparison of the pre and post-intervention scores for Group 1, which received the treatment protocol involving Mobilization with Movement (MWM), Strengthening Exercises, and Taping. This table presents the mean scores, standard deviations, standard error means, and p-values for the WOMAC Index and the 6-minute walk test, highlighting the effectiveness of the intervention within this group.

Pair 1: WOMAC Scores: The mean pre-intervention WOMAC score for Group 1 was 59.80, with a standard deviation of 12.887 and a standard error mean of 2.882. After the intervention, the mean WOMAC score decreased to 49.65, with a standard deviation of 13.323 and a standard error mean of 2.979. The p-value for the comparison between the pre and post-intervention WOMAC scores is less than 0.001, indicating a statistically significant improvement. This significant reduction in WOMAC scores demonstrates that the intervention was effective in reducing pain, stiffness, and improving physical function in patients with knee osteoarthritis.

Pair 2: 6-Minute Walk Test Scores: The mean distance covered in the 6-minute walk test before the intervention for Group 1 was 416.75 meters, with a standard deviation of 92.928 and a standard error mean of 20.779. Post-intervention, the mean distance increased to 456.05 meters, with a standard deviation of 95.011 and a standard error mean of 21.245. The p-value for the comparison between the pre and post-intervention 6-minute walk test distances is less than 0.001, indicating a statistically significant improvement. This significant increase in the 6-minute walk test distance suggests that the intervention effectively enhanced the functional exercise capacity of the patients.

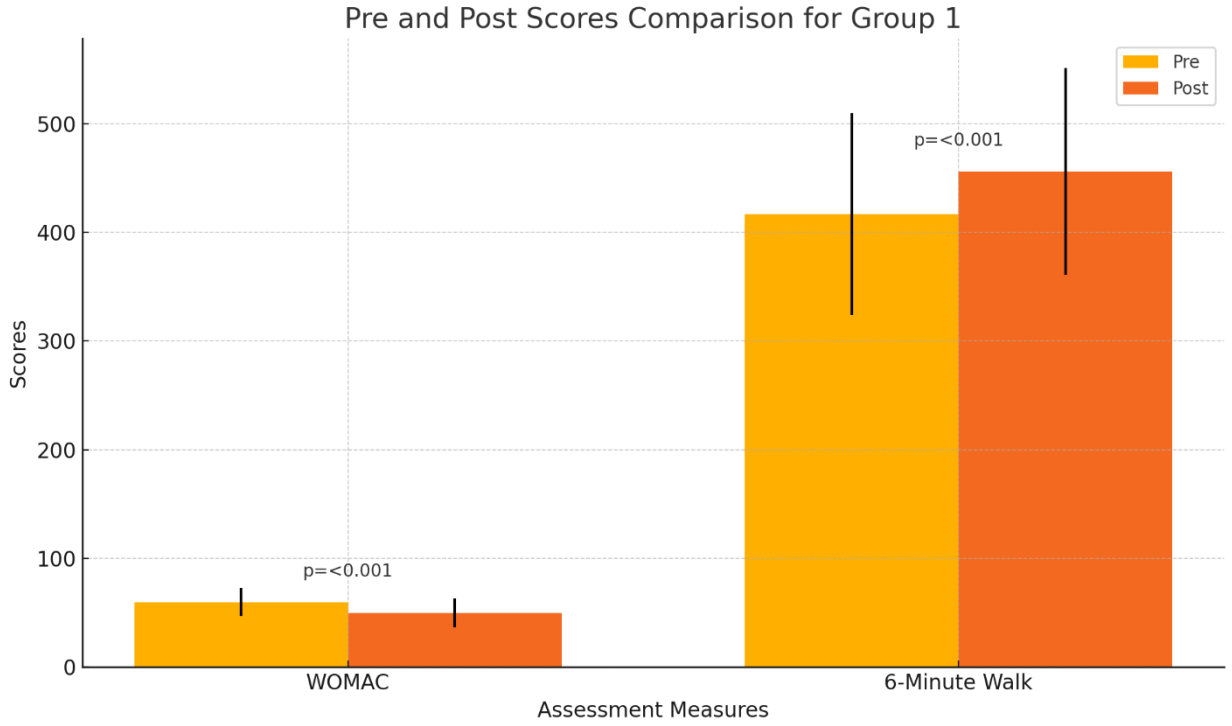


TABLE NO 5 – SHOWS THE PRE AND POST SCORES COMPARTION OF GROUP 2

		Mean	N	Std. Deviation	Std. Error Mean	P value
Pair 1	**WOMAC Pre**	61.95	20	10.748	2.403	0.098
	WOMAC Post	60.55	20	10.665	2.385	
Pair 2	**6-Minute Walk Pre (m)**	415.60	20	95.832	21.429	0.006
	6-Minute Walk Post (m)	426.65	20	94.278	21.081	

GROUP 1 - Mobilization with Movement (MWM), Strengthening Exercises, and Taping, GROUP 2 - Control Group

Table No 5 provides a detailed comparison of the pre and post-intervention scores for Group 2, which received conventional physiotherapy as the control treatment. This table presents the mean scores, standard deviations, standard error means, and p-values for the WOMAC Index and the 6-minute walk test, highlighting the effects of the intervention within this group.

Pair 1: WOMAC Scores: The mean pre-intervention WOMAC score for Group 2 was 61.95, with a standard deviation of 10.748 and a standard error mean of 2.403. After the intervention, the mean WOMAC score slightly decreased to 60.55, with a standard deviation of 10.665 and a standard error mean of 2.385. The p-value for the comparison between the pre and post-intervention WOMAC scores is 0.098, indicating that the reduction in WOMAC scores is not statistically significant. This suggests that the conventional physiotherapy provided to Group 2 had a minimal effect on reducing pain, stiffness, and improving physical function in patients with knee osteoarthritis.

Pair 2: 6-Minute Walk Test Scores: The mean distance covered in the 6-minute walk test before the intervention for Group 2 was 415.60 meters, with a standard deviation of 95.832 and a standard error mean of 21.429. Post-intervention, the mean distance increased slightly to 426.65 meters, with a standard deviation of 94.278 and a standard error mean of 21.081. The p-value for the comparison between the pre and post-intervention 6-minute walk test distances is 0.006, indicating a statistically significant improvement. Although there was an improvement in the 6-minute walk test distance, the increase was relatively modest compared to the changes observed in Group 1.

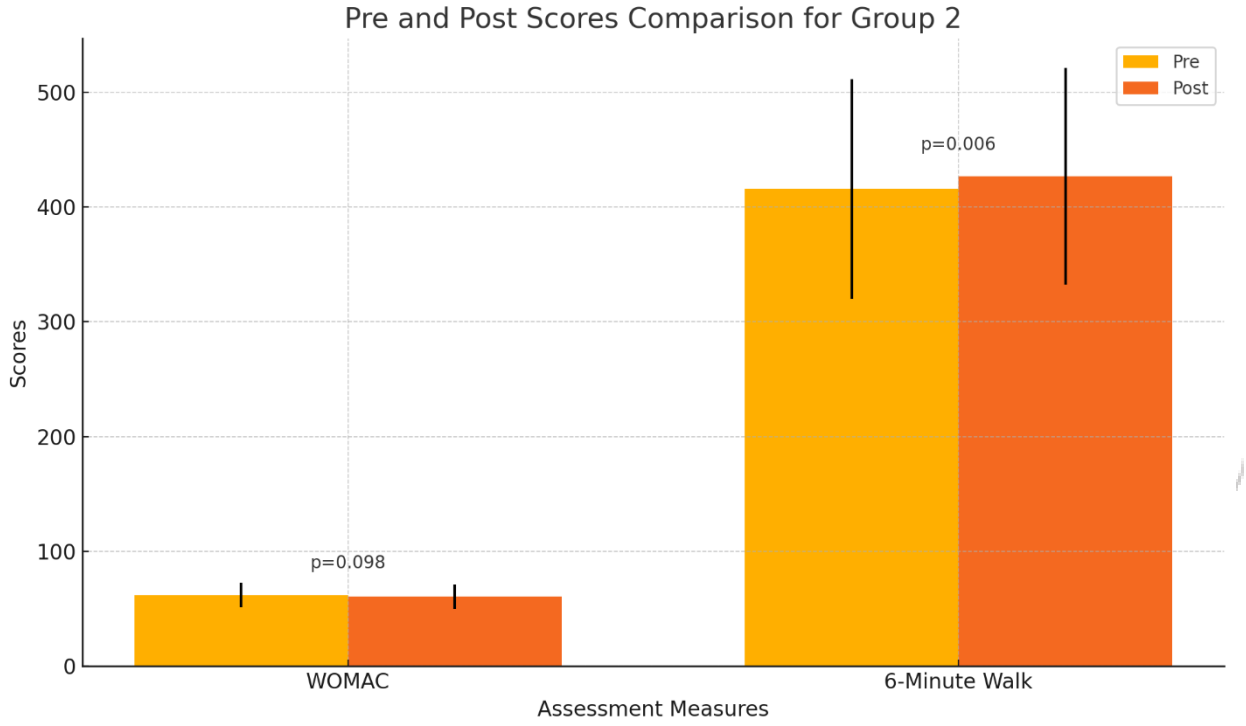


TABLE NO 6 – SHOWS THE CORRELATIONS SCORES OF THE SUBJECTS

Correlations							
		Age	Weight (kg)	Height (cm)	BMI	WOMAC Pre	6-Minute Walk Pre (m)
Age	Pearson Correlation	1	.231	.187	-.001	-.192	-.291
	Sig. (2-tailed)		.326	.430	.996	.418	.214
	N	20	20	20	20	20	20
Weight (kg)	Pearson Correlation	.231	1	-.156	.805**	.181	-.040
	Sig. (2-tailed)	.326		.511	.000	.446	.866
	N	20	20	20	20	20	20
Height (cm)	Pearson Correlation	.187	-.156	1	-.696**	-.070	-.338
	Sig. (2-tailed)	.430	.511		.001	.771	.145

	N	20	20	20	20	20	20
BMI	Pearson Correlation	-.001	.805**	-.696**	1	.197	.160
	Sig. (2-tailed)	.996	.000	.001		.406	.501
	N	20	20	20	20	20	20
WOMAC Pre	Pearson Correlation	-.192	.181	-.070	.197	1	-.144
	Sig. (2-tailed)	.418	.446	.771	.406		.544
	N	20	20	20	20	20	20
6-Minute Walk Pre (m)	Pearson Correlation	-.291	-.040	-.338	.160	-.144	1
	Sig. (2-tailed)	.214	.866	.145	.501	.544	
	N	20	20	20	20	20	20
**. Correlation is significant at the 0.01 level (2-tailed).							

Table No 6 presents the correlation scores among various demographic and baseline characteristics of the subjects, including age, weight, height, BMI, WOMAC Pre scores, and 6-minute walk test Pre scores. Pearson correlation coefficients and their significance levels (p-values) are provided to understand the relationships between these variables.

Age: The Pearson correlation coefficient between age and weight is 0.231, with a p-value of 0.326, indicating no significant correlation. Similarly, age shows no significant correlation with height ($r = 0.187$, $p = 0.430$), BMI ($r = -0.001$, $p = 0.996$), WOMAC Pre scores ($r = -0.192$, $p = 0.418$), and 6-minute walk Pre scores ($r = -0.291$, $p = 0.214$). These results suggest that age does not significantly influence these other variables in this study.

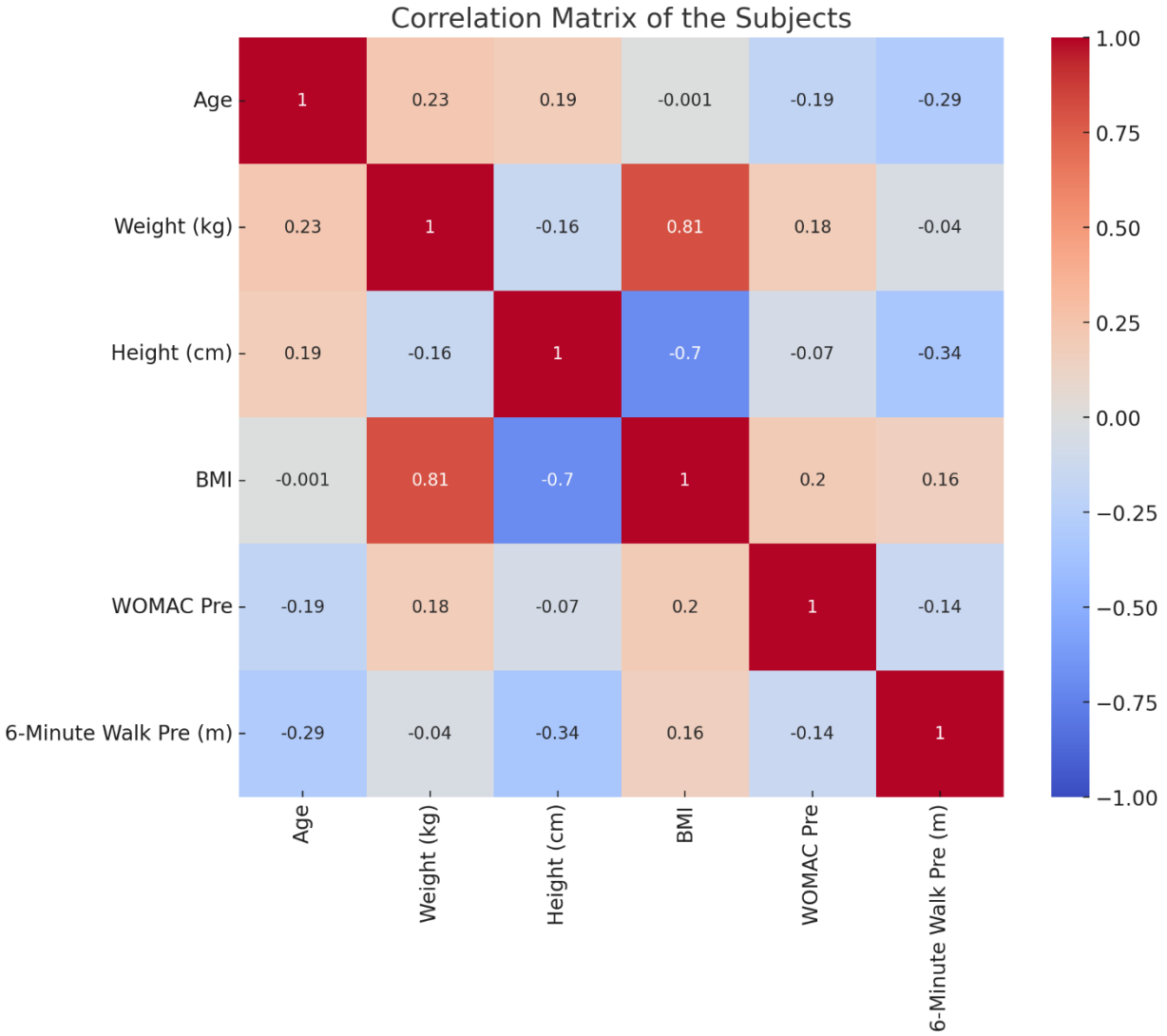
Weight (kg): Weight shows a significant positive correlation with BMI ($r = 0.805$, $p < 0.001$), indicating that as weight increases, BMI also increases, which is expected given that BMI is a function of weight and height. However, weight does not show significant correlations with height ($r = -0.156$, $p = 0.511$), WOMAC Pre scores ($r = 0.181$, $p = 0.446$), or 6-minute walk Pre scores ($r = -0.040$, $p = 0.866$).

Height (cm): Height has a significant negative correlation with BMI ($r = -0.696$, $p = 0.001$), indicating that taller individuals tend to have lower BMI values when weight is constant. Height does not show significant correlations with WOMAC Pre scores ($r = -0.070$, $p = 0.771$) or 6-minute walk Pre scores ($r = -0.338$, $p = 0.145$).

BMI: BMI is significantly positively correlated with weight ($r = 0.805$, $p < 0.001$) and significantly negatively correlated with height ($r = -0.696$, $p = 0.001$), reflecting the mathematical relationship between these variables. BMI does not show significant correlations with WOMAC Pre scores ($r = 0.197$, $p = 0.406$) or 6-minute walk Pre scores ($r = 0.160$, $p = 0.501$).

WOMAC Pre Scores: WOMAC Pre scores do not show significant correlations with age ($r = -0.192$, $p = 0.418$), weight ($r = 0.181$, $p = 0.446$), height ($r = -0.070$, $p = 0.771$), BMI ($r = 0.197$, $p = 0.406$), or 6-minute walk Pre scores ($r = -0.144$, $p = 0.544$). This indicates that the baseline WOMAC scores are relatively independent of these demographic variables in this study.

6-Minute Walk Pre Scores: The 6-minute walk Pre scores do not show significant correlations with age ($r = -0.291$, $p = 0.214$), weight ($r = -0.040$, $p = 0.866$), height ($r = -0.338$, $p = 0.145$), BMI ($r = 0.160$, $p = 0.501$), or WOMAC Pre scores ($r = -0.144$, $p = 0.544$). This suggests that the initial functional exercise capacity, as measured by the 6-minute walk test, is not significantly related to these other variables.



Discussion

This study aimed to evaluate the effectiveness of a combined treatment protocol involving Mobilization with Movement (MWM), strengthening exercises, and taping in patients with knee osteoarthritis (OA) compared to conventional physiotherapy. Knee osteoarthritis is a common degenerative joint disease that significantly impacts physical function and quality of life. Traditional treatment approaches include pharmacological interventions, physical therapy, and surgical options in severe cases. However, there is growing interest in non-pharmacological and non-surgical interventions that can provide symptom relief and improve function with minimal side effects.

Summary of Findings

The study's primary outcomes were measured using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the 6-minute walk test. Secondary outcomes included demographic and baseline characteristics correlations. The results showed that the intervention involving MWM, strengthening exercises, and taping significantly improved WOMAC scores and 6-minute walk test distances compared to the control group receiving conventional physiotherapy.

WOMAC Scores

The WOMAC Index is a widely used tool for assessing pain, stiffness, and physical function in patients with OA. The study found that the mean WOMAC score in the experimental group (Group 1) significantly decreased from 59.80 to 49.65 post-intervention, indicating a substantial improvement in symptoms. In contrast, the control group (Group 2) showed a minimal reduction in WOMAC scores from 61.95 to 60.55, which was not statistically significant.

These findings suggest that the combined intervention is more effective in reducing pain and stiffness and improving physical function than conventional physiotherapy alone. The significant improvement in WOMAC scores in Group 1 can be attributed to the synergistic effects of MWM, strengthening exercises, and taping. MWM, as advocated by Brian Mulligan, involves the application of specific mobilizations during active or passive movements of the joint, which can enhance joint mobility and reduce pain. Strengthening

exercises target the quadriceps and other muscles around the knee, improving joint stability and function. Taping provides additional support, reduces pain, and facilitates muscle activation during daily activities and exercises.

6-Minute Walk Test

The 6-minute walk test is a measure of functional exercise capacity, reflecting the ability of patients to perform sustained physical activity. The study found that the mean distance walked in Group 1 increased from 416.75 meters to 456.05 meters post-intervention, a significant improvement. In contrast, Group 2 showed a modest increase from 415.60 meters to 426.65 meters, which, while statistically significant, was less pronounced than the improvement seen in Group 1.

The significant increase in the 6-minute walk test distance in Group 1 highlights the effectiveness of the combined intervention in enhancing functional exercise capacity. The improvements can be attributed to increased muscle strength, better joint mobility, and reduced pain, enabling patients to walk longer distances. The modest improvement in the control group suggests that conventional physiotherapy also has some positive effects, but these are less effective than the combined approach used in Group 1.

Correlations Among Demographic and Baseline Characteristics

The study also explored correlations among various demographic and baseline characteristics, including age, weight, height, BMI, WOMAC pre-scores, and 6-minute walk pre-scores. Significant correlations were found between weight and BMI (positive correlation) and height and BMI (negative correlation), reflecting expected relationships. However, most other variables did not show significant correlations, indicating that age, weight, height, and BMI did not strongly influence WOMAC pre-scores or 6-minute walk pre-scores.

These findings suggest that the improvements observed in the study are likely attributable to the interventions rather than demographic factors. This enhances the validity of the study, indicating that the treatment effects are consistent across different demographic profiles.

Comparison with Previous Studies

The results of this study are consistent with previous research highlighting the benefits of combined physical therapy interventions for knee OA. For instance, studies by Hussain et al. and Pawar et al. have shown significant improvements in pain and functional outcomes with MWM. Additionally, research by Anandkumarr et al. and Cho et al. has demonstrated the effectiveness of therapeutic taping in reducing pain and improving muscle strength in knee OA.

The current study adds to the existing literature by demonstrating the synergistic effects of combining MWM, strengthening exercises, and taping. This comprehensive approach addresses multiple aspects of knee OA, including joint mobility, muscle strength, and pain management, leading to more significant improvements in patient outcomes.

Clinical Implications

The findings of this study have important clinical implications for the management of knee OA. The significant improvements in WOMAC scores and 6-minute walk test distances in the experimental group suggest that incorporating MWM, strengthening exercises, and taping into treatment protocols can provide substantial benefits to patients. This combined approach can be particularly useful for patients who are unable or unwilling to undergo pharmacological or surgical treatments.

Clinicians should consider adopting this multi-faceted approach to provide a holistic treatment strategy for knee OA. The use of MWM can enhance joint mobility and reduce pain, while strengthening exercises can improve muscle function and joint stability. Taping can provide additional support and facilitate muscle activation, further enhancing the overall effectiveness of the treatment.

Conclusion

In conclusion, this study demonstrates that a combined treatment protocol involving Mobilization with Movement (MWM), strengthening exercises, and taping significantly improves symptoms and functional outcomes in patients with knee osteoarthritis compared to conventional physiotherapy. The significant reductions in WOMAC scores and increases in 6-minute walk test distances highlight the effectiveness of this comprehensive approach in managing knee OA.

These findings have important clinical implications, suggesting that incorporating MWM, strengthening exercises, and taping into treatment protocols can provide substantial benefits to patients with knee OA. While

further research is needed to confirm these findings and explore the long-term effects of the intervention, this study provides a strong foundation for the use of combined physical therapy interventions in the management of knee OA.

REFERENCE LIST

1. Hinman RS, Crossley KM. Patellofemoral joint osteoarthritis: an important subgroup of knee osteoarthritis. Rheumatology Rheumatology (Oxford). 2007;46.
2. Johnston SA. Osteoarthritis. Joint anatomy, physiology, and pathobiology. Vet Clin North Am Small Anim Pract. 1997;27(4):699–723.
3. Okwera A, May S. Views of general practitioners toward physiotherapy management of osteoarthritis—a qualitative study. Physiother Theory Pract. 2019;35(10):940–6.
4. Yoshimura N, Muraki S, Nakamura K, Tanaka S. Epidemiology of the locomotive syndrome: The research on osteoarthritis/osteoporosis against disability study 2005–2015. Mod Rheumatol. 2017 Jan 2;27(1):1–7.
5. Bellamy N, Campbell J, Haraoui B, Buchbinder R, Hobby K, Roth JH, et al. Dimensionality and clinical importance of pain and disability in hand osteoarthritis: Development of the Australian/Canadian (AUSCAN) osteoarthritis hand index. Osteoarthritis Cartilage. 2002;10(11):855–62.
6. Edwards MH, Pas S Van Der, Denkinger MD, Parsons C, Jameson KA, Schaap L, et al. Relationships between physical performance and knee and hip osteoarthritis: Findings from the European Project on Osteoarthritis (EPOSA). Age Ageing. 2014;43(6):806–13.
7. Tukker A, Visscher TLS, Picavet HSJ. Overweight and health problems of the lower extremities: Osteoarthritis, pain and disability. Public Health Nutr. 2009;12(3):359–68.
8. Ko NY, Chang CN, Cheng CH, Yu HK, Hu GC. Comparative Effectiveness of Focused Extracorporeal versus Radial Extracorporeal Shockwave Therapy for Knee Osteoarthritis—Randomized Controlled Study. Int J Environ Res Public Health. 2022 Aug 1;19(15).
9. Ko NY, Chang CN, Cheng CH, Yu HK, Hu GC. Comparative Effectiveness of Focused Extracorporeal versus Radial Extracorporeal Shockwave Therapy for Knee Osteoarthritis—Randomized Controlled Study. Int J Environ Res Public Health. 2022 Aug 1;19(15).
10. Thorstensson CA, Garellick G, Rystedt H, Dahlberg LE. Better Management of Patients with Osteoarthritis: Development and Nationwide Implementation of an Evidence-Based Supported Osteoarthritis Self-Management Programme. Musculoskeletal Care. 2015 Jun 1;13(2):67–75.
11. Yoshimura N, Muraki S, Iidaka T, Oka H, Horii C, Kawaguchi H, et al. Prevalence and co-existence of locomotive syndrome, sarcopenia, and frailty: the third survey of Research on Osteoarthritis/Osteoporosis Against Disability (ROAD) study. J Bone Miner Metab. 2019 Nov 1;37(6):1058–66.
12. Kim YH, Bang JI, Son HJ, Kim Y, Kim JH, Bae H, et al. Protective effects of extracorporeal shockwave on rat chondrocytes and temporomandibular joint osteoarthritis; preclinical evaluation with in vivo 99mTc-HDP SPECT and ex vivo micro-CT. Osteoarthritis Cartilage. 2019 Nov 1;27(11):1692–701.
13. Tanaka R, ozawa J, kiTo nobuhiRo, MoRiyaMa hideki. Does exercise therapy improve the health-related quality of life of people with knee osteoarthritis? A systematic review and meta-analysis of randomized controlled trials.
14. Imagama S, Ando K, Kobayashi K, Machino M, Tanaka S, Morozumi M, et al. Differences of locomotive syndrome and frailty in community-dwelling middle-aged and elderly people: Pain, osteoarthritis, spinal alignment, body balance, and quality of life. Mod Rheumatol. 2020 Sep 2;30(5):921–9.
15. Rannou F, Boutron I, Jardinaud-lopez M, Meric G, Revel M, Fermanian J, et al. Should aggregate scores of the Medical Outcomes Study 36-item Short Form Health Survey be used to assess quality of life in knee and hip osteoarthritis? A national survey in primary care. Osteoarthritis Cartilage [Internet]. 2007 May;15(9):1013–8. Available from: https://linkinghub.elsevier.com/retrieve/pii/S1063458407000787