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Effect of Mobilization in Patients with Unilateral Osteoarthritis of the Knee: A Comparative Study

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Abstract: ***Osteoarthritis (OA) of the knee is a prevalent and debilitating condition characterized by the progressive degeneration of articular cartilage, leading to pain, stiffness, and functional limitations. Physiotherapy is a cornerstone of non-pharmacological management for OA, aiming to alleviate symptoms and improve function. While exercise is a well-established intervention, the comparative effectiveness of different physiotherapy modalities, particularly the long-term effects of combining manual therapy with exercise, is not well-documented. This quasi-experimental study compared the effects of three different physiotherapy interventions in patients with unilateral knee OA: a) pain-modulating modalities and exercise; b) mobilization with movement (MWM) alone; and c) MWM combined with exercise. Participants were assessed at baseline, 4 weeks, 8 weeks, and 12 weeks using the Western Ontario and McMaster Universities Arthritis Index (WOMAC. The group receiving MWM combined with exercise demonstrated the most significant and sustained improvement in WOMAC scores over the 12-week period compared to the other two groups (p < 0.001). These findings suggest that a comprehensive approach combining manual therapy and exercise is superior to either intervention alone for the long-term management of unilateral knee OA.***

Keywords: Osteoarthritis (OA), Movement with mobilization (MWM), WOMAC, Manual therapy

1. Introduction

Osteoarthritis (OA) of the knee is a chronic, progressive musculoskeletal condition that results in the deterioration of articular cartilage and subchondral bone, leading to pain, stiffness, and functional limitations [1]. The global prevalence of knee OA is high, affecting approximately 651.4 million people in 2020, with a global incidence of 203 per 10,000 individuals [2]. In addition to age and obesity, studies indicate that a sedentary lifestyle and female gender are significant risk factors for the disease [3]. OA often begins unilaterally and can progress to affect both knees, highlighting the importance of early intervention [4].

In low- to middle-income countries like India, OA presents a substantial financial burden on individuals and healthcare systems. A 2018 study estimated that the direct medical cost of OA treatment was approximately Rs. 8,000, with an additional Rs. 2,500 spent on non-medical management, though further detailed studies on the total financial burden are needed [3].

Physiotherapy is a crucial, non-pharmacological component of OA management. It encompasses a variety of interventions, including exercise therapy, manual therapy, and electrotherapy, all of which aim to reduce pain, improve function, and prevent disability [5]. Among these, exercise therapy is considered the cornerstone of management with the highest level of evidence supporting its efficacy [6, 7]. However, the long-term effects of different therapeutic approaches, particularly the use of manual therapy in conjunction with exercise, require further investigation [8].

Despite existing evidence on the benefits of individual interventions, there is a lack of comparative studies on their long-term effectiveness. Specifically, the combined effect of manual therapy, such as Mobilization with Movement (MWM), with exercise therapy, has not been extensively studied in the context of unilateral knee OA. This study aims to address this gap by comparing the long-term effects of three different treatment protocols: pain-modulating modalities and exercise, MWM alone, and a combined approach of MWM and exercise. We hypothesize that the combined approach will yield superior and more durable outcomes.

2. Materials and Methodology

Study Design

This was a quasi-experimental, comparative study conducted after receiving ethical clearance from the Departmental Ethical Committee of the National Institute for Empowerment of Persons with Multiple Disabilities (NIEPMD). The study included patients aged 45 to 65 years with unilateral knee pain and functional limitations. After obtaining informed consent, baseline assessments were performed.

Participants and Interventions

Participants were assigned to one of three groups conveniently, and each group received treatment three times a week for four weeks:

Group 1: Exercise and Pain-Modulating Modality: Participants in this group received wax therapy followed by a structured exercise program. The exercises included stretching for knee flexors and extensors, hip abductors and flexors, and progressive strengthening for hip and knee musculature using Thera Bands [8].

Group 2: Mobilization with Movement (MWM): Participants received gentle, graded knee MWM during each session, After the 4-week treatment period, patients were advised to continue with hot water fermentation at home.

Group 3: MWM and Exercise: This group received a combined intervention of both MWM and the full exercise program described for Group 1.

Each session lasted approximately 40 minutes per participant.

Outcome Measures

The Western Ontario and McMaster Universities Arthritis Index (WOMAC) was used as the primary outcome measure. The WOMAC is a widely validated, self-administered questionnaire that assesses pain, stiffness, and physical function in patients with knee OA [10]. The patients' baseline WOMAC scores were recorded (Week 0), followed by measurements at Week 4, Week 8, and Week 12.

Statistical Analysis

To analyze the significant improvement within each group over time, a repeated measures ANOVA was used [11]. A one-way ANOVA was employed to analyze the difference in mean scores between the three groups at the end of the 12-week follow-up period. A post-hoc analysis using the Tukey HSD method was conducted to identify which specific groups had the most significant differences. A significance level of $p < 0.05$ was established.

3. Results

Within-Group Analysis

Exercise and Pain-Modality Group: There was a significant improvement in WOMAC scores within this group over time, $F(1.5, 13.48) = 71.83$, $p < 0.001$. The mean WOMAC scores were 48.6 at baseline, 40 at 4 weeks, 38.9 at 8 weeks, and 35.8 at 12 weeks.

MWM Group: This group also showed a significant improvement in WOMAC scores over time, $F(2.1, 18.94) = 38.49$, $p < 0.001$. Mean scores were 52.1 at baseline, 32.2 at 4 weeks, 43.8 at 8 weeks, and 39.8 at 12 weeks.

MWM and Exercise Group: This group demonstrated the most significant improvement in WOMAC scores over the 12-week period, F (1.92, 17.27) = 121.38$, $p < 0.001$. Mean scores were 49.3 at baseline, 40.3 at 4 weeks, 31.4 at 8 weeks, and 23.8 at 12 weeks.

Between-Group Analysis

A one-way ANOVA revealed a statistically significant difference in the mean change of WOMAC scores between the groups from baseline to 12 weeks ($p < 0.001$). The post-hoc Tukey test indicated that the MWM and Exercise group (mean difference: 12.3) had a significantly greater improvement compared to both the Exercise and Pain-Modality group (mean difference: 4.2) and the MWM alone group (mean difference: 8.1).

Gender	AGE IQR	Percentage	Mean	SD	SE	LT LEG	RT LEG
Male	51-56	63.5	53.26	4.4	0.93	12	7
Female	53-58	36.5	55.27	3.64	1.1	7	4

Post Hoc Tests

Multiple Comparisons

Dependent Variable: womac

	(I) grouping	(J) grouping	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
Tukey HSD	1	2	-4.200	1.956	.099	-9.05	.65
		3	-12.300*	1.956	.000	-17.15	-7.45
	2	1	4.200	1.956	.099	-.65	9.05
		3	-8.100*	1.956	.001	-12.95	-3.25
	3	1	12.300*	1.956	.000	7.45	17.15
		2	8.100*	1.956	.001	3.25	12.95
Bonferroni	1	2	-4.200	1.956	.123	-9.19	.79
		3	-12.300*	1.956	.000	-17.29	-7.31
	2	1	4.200	1.956	.123	-.79	9.19
		3	-8.100*	1.956	.001	-13.09	-3.11
	3	1	12.300*	1.956	.000	7.31	17.29
		2	8.100*	1.956	.001	3.11	13.09

*. The mean difference is significant at the 0.05 level.

4. Discussion

The results of this study clearly demonstrate that the combination of Mobilization with Movement (MWM) and exercise therapy is significantly more effective for the long-term management of unilateral knee OA than either intervention alone. The MWM and exercise group showed the most substantial and sustained improvement in WOMAC scores, particularly during the follow-up period from Week 4 to Week 12.

These findings are consistent with the literature that highlights the synergistic benefits of combining different therapeutic approaches [18]. While some studies on MWM alone have shown short-term improvements in range of motion and strength, they have not always reported significant changes in WOMAC scores [19]. Our results contrast with this, suggesting that when MWM is combined with a comprehensive exercise program, it leads to more meaningful and lasting improvements in pain, stiffness, and function.

The sustained improvement observed in the combined therapy group suggests that exercise reinforces the gains from MWM by improving muscle strength and joint stability, which are crucial for long-term functional recovery [18]. In contrast, the MWM-alone group showed an initial rapid improvement at 4 weeks, followed by a slight decline, likely due to the lack of an ongoing strengthening program.

5. Limitations

This study has several limitations. The quasi-experimental design and small sample size limit the generalizability of the findings and make it susceptible to selection bias and confounding variables. A further limitation is the lack of control over potential confounding factors, such as participants using over-the-counter medications or topical creams during the study period.

6. Future Directions

Future research should address these limitations by conducting a larger, multi-center, randomized controlled trial (RCT) to eliminate selection bias and increase the statistical power and generalizability of the findings [20, 21]. Further research could also explore the impact of patient-therapist rapport and patient-specific goal setting on treatment outcomes.

7. Conclusion

This study concludes that a comprehensive approach combining Mobilization with Movement (MWM) with exercise therapy is significantly more effective and has longer-lasting effects on patients with unilateral knee osteoarthritis than either exercise with pain-modulating modalities or MWM alone. The findings underscore the importance of integrating manual therapy techniques with a structured exercise program to maximize the benefits of physiotherapy for OA. This conservative, non-invasive approach can help reduce disease progression and disability, ultimately improving the patient's quality of life.

Conflict of Interest
Author has no conflict of interest.

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