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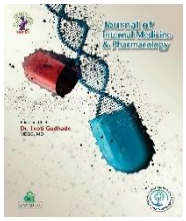

Research Article

Effectiveness of Rhythmic Stabilization (PNF) vs. Conventional Physiotherapy in Knee Osteoarthritis

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ARTICLEINFO

ABSTRACT

Knee osteoarthritis (OA) is a degenerative condition marked by pain, stiffness, reduced range of motion (ROM), and impaired proprioceptive accuracy, negatively impacting quality of life. Proprioceptive Neuromuscular Facilitation (PNF) stretching, particularly rhythmic stabilization, has shown potential for addressing these issues by stimulating mechanoreceptors and improving flexibility and pain management.

This study compared the effectiveness of rhythmic stabilization PNF to conventional physiotherapy in managing Grade 2-3 knee OA. Thirty-six participants aged 40–60 were randomly assigned to Group A (rhythmic stabilization PNF) or Group B (conventional physiotherapy). Outcome measures included the Western Ontario and McMaster Universities Arthritis Index (WOMAC) and Visual Analog Scale (VAS).

Results showed significant improvements in pain reduction, flexibility, and functional mobility in both groups, with Group A achieving superior outcomes. Rhythmic stabilization PNF emerges as an effective therapeutic option for knee OA, offering enhanced patient outcomes and better quality of life.

Keywords: Osteoarthritis; Proprioceptive Neuromuscular Facilitation (PNF); Rhythmic stabilization; Conventional physiotherapy; Knee

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1. Introduction

Osteoarthritis (OA) is a chronic degenerative disorder prevalent in India, characterized by various structural and Osteoarthritis (OA) is a chronic degenerative joint disorder prevalent in India, particularly affecting the knee, with a reported prevalence of 28.7% [1]. It is characterized by structural and biochemical changes in joint tissues, leading to symptoms such as pain, tenderness, stiffness, and reduced flexibility, significantly impacting mobility and quality of life [2].

The pathogenesis of OA involves an imbalance between tissue breakdown and repair processes, resulting in joint degeneration. Impaired proprioceptive accuracy of the knee has been identified as a local factor contributing to the onset and progression of OA, further exacerbating pain and activity limitations [3].

Management strategies for knee OA aim to alleviate symptoms, preserve joint function, and prevent further deterioration. Pharmacological treatments, such as NSAIDs, and non-pharmacological interventions, including physiotherapy and surgical options, are commonly employed. However, pharmacological approaches often entail long-term usage and significant side effects [4].

Physiotherapeutic interventions, particularly Proprioceptive Neuromuscular Facilitation (PNF) techniques such as rhythmic stabilization, offer promising alternatives. These methods have demonstrated effectiveness in improving flexibility, proprioception, and functional mobility with minimal adverse effects [5].

This study evaluates the effectiveness of rhythmic stabilization PNF combined with conventional physiotherapy in managing knee OA. By assessing pain reduction and functional improvement, this research seeks to optimize OA management strategies and enhance patient outcomes.

2. Materials and Methods

A total of 36 participants meeting predefined inclusion criteria were enrolled in this study. Participants were individuals diagnosed with knee osteoarthritis (OA) by certified orthopedic surgeons or physiotherapists. Inclusion criteria included patients aged 40–60 years with Grade 2 or 3 OA based on the Kellgren-Lawrence classification.

Exclusion criteria were rigorously applied to minimize confounding factors and maintain the integrity of the study population. Participants with other knee pathologies (e.g., rheumatoid arthritis or ligament injuries), neurological disorders, post-traumatic or surgical knee conditions, contraindications to exercise (e.g., severe cardiovascular conditions), or those who were uncooperative or unable to follow instructions were excluded.

Before inclusion in the study, detailed information about the procedures, objectives, and potential risks was provided to all participants, and written informed consent was obtained. Ethical approval for the study was secured from the relevant institutional ethics committee to ensure compliance with research standards and participant safety.

2.1 Group A

The participants were randomly assigned to two groups: Group A (n=18) received rhythmic stabilization techniques (PNF), while Group B (n=18) underwent conventional physiotherapy (CPT). Both groups received baseline treatments comprising hot

moist pack (HMP) application and interferential therapy (IFT).

The treatment protocol for Group A included the following procedures:

Hot Moist Pack: Applied to the affected knee in a supine position for 15 minutes to promote muscle relaxation and prepare for subsequent interventions. Rhythmic Stabilization Techniques (PNF): Employed the Hold Relax method involving 2 sets of 5 repetitions. Participants, positioned supine with 90° hip flexion, underwent therapist-guided knee extension until a mild hamstring stretch was achieved. Subsequently, an isometric contraction was induced, followed by relaxation and gentle stretching held for 30 seconds. The protocol was administered once daily, three days a week, over a period of six weeks. Interferential Therapy: Administered using the four-pole vector method for 20 minutes to complement the treatment regimen. The study duration spanned six weeks, during which assessments were conducted at baseline and post-intervention stages to evaluate pain reduction and functional improvement in knee OA patients undergoing the respective treatment modalities.

2.2 Group B

In Group B, patients underwent a treatment regimen aimed at addressing knee osteoarthritis through a combination of therapeutic interventions. The session commenced with patients lying supine, with the affected. Group Bknee slightly flexed, as a hot moist pack was applied around the knee for a duration of 15 minutes. This application of heat therapy aimed to induce muscle relaxation and enhance blood circulation in the affected area, potentially alleviating pain and stiffness associated with osteoarthritis.

Conventional Physiotherapy (CPT) was then administered, comprising a series of exercises targeting the quadriceps, hip, and knee joint. Isometric quadriceps exercises were performed, involving contractions of the quadriceps muscles while in a supine position, contributing to strengthening and stabilizing the knee joint. High sitting knee extension exercises were implemented, focusing on extending the knee joint against resistance to improve muscle strength and function.

Additionally, straight leg raises were conducted, requiring patients to lift one leg off the ground while lying supine, engaging the quadriceps muscles and promoting knee stability. Hip abduction and hip extension exercises were included to enhance overall lower limb strength and stability, contributing to improved functional mobility.

Each exercise was performed for 10 repetitions once daily, five consecutive days a week, over a period of six weeks. This structured exercise regimen aimed to improve muscle strength, joint stability, and functional mobility in patients with knee osteoarthritis, potentially reducing pain and enhancing overall quality of life.

Interferential therapy was also incorporated into the treatment protocol, utilizing the four-pole vector method for a duration of 20 minutes. This electrotherapy modality aimed to alleviate pain and inflammation by delivering electrical stimulation to the affected area, complementing the exercise-based interventions in Group B.

The comprehensive treatment approach implemented in Group B sought to address the multifaceted nature of knee osteoarthritis, targeting both the underlying pathology and associated symptoms to optimize patient outcomes.

3. Outcome measures

Outcome measures utilized in this study included the Western Ontario and McMaster Universities Arthritis Index (WOMAC) and the Visual Analog Scale (VAS). The WOMAC is a validated instrument commonly employed to assess patients with knee osteoarthritis (OA), encompassing evaluations of functional mobility and pain levels. Participants provided subjective ratings ranging from 0 to 4, reflecting their perceived levels of pain and functional limitations. Additionally, the Visual Analog Scale (VAS) served as a subjective measure of acute and chronic pain, allowing participants to indicate their pain intensity by marking a 10-cm line ranging from "no pain" to "worst pain." Both outcome measures were utilized to quantify changes in pain levels and functional status before and after the intervention, providing valuable insights into the efficacy of the treatment protocols administered to the participants with OA knee.

4. Statistical analysis

It was conducted using parametric tests to analyze the data obtained from the study. A total of 36 subjects meeting the inclusion and exclusion criteria were randomly allocated into two groups: Group A (receiving Proprioceptive Neuromuscular Facilitation - PNF) and Group B (receiving Conventional Physiotherapy - CPT). The outcome measures included the Visual Analog Scale (VAS) and the Western Ontario and McMaster Universities Arthritis Index (WOMAC).

Both groups received their respective interventions along with baseline protocols. To assess the effectiveness of the interventions, paired t-tests were employed to compare the outcomes before and after treatment within each group. Additionally, independent t-tests were utilized to compare the outcomes between the two groups.

Statistical analysis was performed using GraphPad Instat version. These parametric tests were chosen due to their suitability for comparing means between groups and detecting changes within groups over time. The significance level was set at $p < 0.05$ to determine statistical significance.

5. Results and Discussion

The findings of this study are detailed in Tables 1, 2, and 3, which provide a comprehensive overview of the outcomes observed across the two intervention groups. Table 1 summarizes the demographic profiles of participants in Group A (PNF) and Group B (Conventional Physiotherapy, CPT). The average age of participants in Group A was 55.2 years (±3.8 SD), while Group B had a slightly higher average age of 58.5 years (±3.5 SD). Both groups had a majority of female participants, with 78.4% females and 21.6% males in Group A and 68.3% females and 31.7% males in Group B.

Table 2 outlines the Visual Analog Scale (VAS) scores for pain levels before and after treatment. In Group A, the average pre-treatment VAS score was 7.4 (±0.9 SD), which dropped significantly to 3.1 (±0.4 SD) post-treatment ($p < 0.0001$). Similarly, Group B experienced a reduction in VAS scores from 8.0 (±1.3 SD) pre-treatment to 6.7 (±0.5 SD) post-treatment ($p < 0.0001$).

Table 3 presents the Western Ontario and McMaster Universities Arthritis Index (WOMAC) scores, reflecting participants' pain levels and functional mobility. Group A showed a significant reduction in the mean WOMAC score, from 81.2 (±4.7 SD) pre-

treatment to 52.8 (±5.1 SD) post-treatment ($p < 0.0001$). In contrast, Group B demonstrated a decrease from 83.9 (±3.2 SD) to 72.5 (±4.6 SD) post-treatment ($p < 0.0001$).

The results clearly highlight notable improvements in both pain reduction and functional mobility in participants from both groups. However, Group A (PNF) achieved better outcomes compared to Group B (CPT), demonstrating the superior efficacy of rhythmic stabilization techniques in managing knee OA. These findings suggest that incorporating PNF techniques into physiotherapy programs can enhance treatment effectiveness for knee osteoarthritis.

Discussion

The statistical analysis of pre- and post-treatment data revealed substantial improvements in outcomes for both intervention groups, with Group A (Proprioceptive Neuromuscular Facilitation, PNF) demonstrating significantly better results than Group B (Conventional Physiotherapy, CPT). Pain reduction, measured via the Visual Analog Scale (VAS), showed a greater mean improvement in Group A (3.6 ± 1.2) compared to Group B (1.3 ± 0.8). Similarly, functional mobility, assessed using the Western Ontario and McMaster Universities Arthritis Index (WOMAC), reflected a mean improvement of 28.4 ± 11.2 in Group A, substantially surpassing the 11.4 ± 6.5 observed in Group B.

Knee osteoarthritis (OA), a chronic degenerative joint condition, is a leading cause of disability globally, significantly impacting mobility, daily activities, and quality of life. Hallmark symptoms such as joint pain, stiffness, and reduced range of motion contribute to muscle weakness and joint instability, exacerbating functional decline. These challenges underline the need for effective therapeutic interventions to manage OA symptoms and enhance functional independence.

This study aimed to compare the efficacy of rhythmic stabilization PNF with CPT in addressing pain, improving hamstring flexibility, and enhancing functional mobility in patients with OA knee. The results indicate that the addition of rhythmic stabilization PNF to baseline treatments, such as interferential therapy (IFT) and hot moist pack (HMP), provides superior outcomes. Participants in Group A experienced notable improvements in pain reduction, flexibility, and mobility, highlighting the potential of PNF techniques in addressing the multifaceted challenges of OA knee.

Although CPT also demonstrated some benefits in pain management and functional improvement, its effectiveness was less pronounced compared to PNF. These findings emphasize the value of integrating rhythmic stabilization PNF into OA treatment protocols. By targeting pain relief, enhancing muscle flexibility, and promoting better functional mobility, PNF techniques can significantly alleviate the burden of OA knee, improving the quality of life for affected individuals.

Future research should focus on larger clinical trials and longitudinal studies to further validate these findings and refine the application of PNF in managing knee OA and other musculoskeletal conditions. This will ensure evidence-based optimization of therapeutic strategies to address the growing burden of OA and enhance patient outcomes.

6. Conclusion

In conclusion, our study demonstrates the effectiveness of both Proprioceptive Neuromuscular Facilitation

(PNF) stretching and Conventional Physiotherapy (CPT) in reducing pain levels, improving hamstring flexibility, and enhancing functional mobility among patients with osteoarthritis (OA) knee. However, the group receiving PNF stretching, in conjunction with the baseline protocol incorporating Interferential therapy and Hot moist pack, exhibited notably superior outcomes compared to the CPT group.

Specifically, patients undergoing PNF stretching experienced significantly greater reductions in pain levels, increased flexibility of the muscles, and improved functional mobility compared to those receiving CPT. These findings underscore the efficacy of incorporating rhythmic stabilization PNF techniques into the treatment protocol for OA knee.

In summary, our study supports the application of PNF stretching alongside baseline interventions for patients with OA knee, as it yields superior outcomes in pain reduction, increased muscle flexibility, and enhanced functional independence. This highlights the potential of PNF as a valuable therapeutic approach in managing symptoms and improving the quality of life for individuals affected by OA knee. Further research and clinical trials are warranted to explore the long-term effects and optimal implementation of PNF in the management of OA knee and related musculoskeletal conditions.

Conflict of Interest

The authors declare no conflict of interest.

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Table 1: Participant Demographics

Characteristic	Group A	Group B
Gender Female (%)	78.4	68.3
Gender Male (%)	21.6	31.7
Age Mean	55.2	58.5
Age SD	3.8	3.5

Table 2: Pre and Post Treatment Statistics (VAS)

Statistical Measure (VAS)	Group A Pre-Test	Group A Post-Test	Group B Pre-Test	Group B Post-Test	Difference (PNF)	Difference (CPT)
Mean	7.4	3.1	8.0	6.7	3.6	1.3
SD	0.9	0.4	1.3	0.5	1.2	0.8
Minimum	6.5	2.5	6.2	6.1	1.2	0.2
Maximum	8.9	3.8	9.2	7.5	5.4	2.5
Lower 95% CI	6.9	2.8	7.5	6.4	-	-
Upper 95% CI	7.9	3.4	8.5	7.0	-	-
t-value	-	-	-	-	20.315	5.785
p-value	-	-	-	-	<0.0001	<0.001

Table 3: Pre and Post Treatment Statistics (WOMAC)

Statistical Measure (WOMAC)	Group A Pre-Test	Group A Post-Test	Group B Pre-Test	Group B Post-Test	Difference (PNF)	Difference (CPT)
Mean	81.2	52.8	83.9	72.5	28.4	11.4
SD	4.7	5.1	3.2	4.6	11.2	6.5
Minimum	72.0	42.0	76.0	63.0	6.0	3.0
Maximum	89.0	61.0	90.0	81.0	42.5	23.0
Lower 95% CI	79.0	50.2	82.3	70.2	-	-
Upper 95% CI	83.4	55.4	85.5	74.8	-	-
t-value	-	-	-	-	25.896	6.894