Journal of Neonatal Surgery
ISSN(Online): 2226-0439
Vol. 14, Issue 2s (2025)
https://www.jneonatalsurg.com

OPEN ACCESS

Evaluating the Benefits of Proprioceptive Neuromuscular Facilitation and Mat Pilates in Knee Osteoarthritis: A Comparative Study

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Cite this paper as: Shatakshi Deshpande, Dr Renuka Pal, Dr Usman khan, Dr. Jafar Khan, Dr. Deepak Lohar, Dr. Farukh Mohammad Pinjara, Dr Adil Raza Ansari, Dr. Sourabh Soni, Dr. Prashant Ramawat, Dr. Hasnen Sheikh, (2025) Evaluating the Benefits of Proprioceptive Neuromuscular Facilitation and Mat Pilates in Knee Osteoarthritis: A Comparative Study. *Journal of Neonatal Surgery*, 14 (2s), 694-698.

ABSTRACT

Background: Knee osteoarthritis (KOA) is a progressive and degenerative joint condition that significantly impacts the mobility, independence, and overall quality of life of affected individuals. Characterized by joint pain, stiffness, and functional impairment, KOA is especially prevalent in older adults and poses a growing public health concern due to aging populations and sedentary lifestyles. As surgical options are often reserved for advanced cases, conservative physiotherapeutic approaches play a crucial role in early-stage management. Exercise-based interventions, particularly those targeting neuromuscular control and joint stabilization, are increasingly recognized for their ability to alleviate symptoms and restore functional capacity without the adverse effects of long-term medication use.

Objective: This study aimed to compare the therapeutic efficacy of Proprioceptive Neuromuscular Facilitation (PNF) and Mat Pilates in reducing pain and enhancing functional performance in individuals with knee osteoarthritis.

Methods:A total of 40 participants clinically diagnosed with Grade 2 or 3 KOA were enrolled and divided equally into two intervention groups. Group A received PNF exercises in combination with standard physiotherapy, while Group B underwent Mat Pilates exercises alongside physiotherapy. Both groups completed three sessions per week for four consecutive weeks. Pain and physical function were evaluated using the Visual Analog Scale (VAS) and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) before and after the intervention.

Results: Statistical analysis revealed significant improvements in both groups across pain and function parameters ($p < 0.001$). However, the Mat Pilates group demonstrated a more substantial reduction in pain (mean change: -2.35 vs. -1.50; $p = 0.028$) and greater functional improvement (mean change in WOMAC: -7.45 vs. -1.75; $p = 0.001$) compared to the PNF group.

Conclusion: Both interventions were effective in managing KOA symptoms, but Mat Pilates yielded more favorable outcomes in terms of pain relief and functional enhancement. Its focus on core strengthening, postural control, and coordinated movement likely contributed to its superior performance. Mat Pilates may therefore be considered a more effective and consistent physiotherapeutic option in the conservative treatment of knee osteoarthritis.

Keywords: *Knee Osteoarthritis, Mat Pilates, Proprioceptive Neuromuscular Facilitation, Physiotherapy, Pain Management, Functional Improvement, WOMAC, VAS*

1. INTRODUCTION

Knee osteoarthritis (KOA) is a widespread degenerative joint condition that significantly impacts the elderly and middle-aged populations. As one of the most common causes of chronic disability, KOA is characterized by persistent joint pain, stiffness, swelling, and decreased range of motion, often culminating in reduced independence and diminished quality of life. The disease pathology involves the gradual breakdown of articular cartilage, formation of osteophytes, subchondral bone sclerosis, and synovial inflammation—all contributing to progressive joint degeneration and impaired biomechanics.

Conservative management remains the cornerstone of KOA treatment, especially in early to moderate stages of the disease. Among non-pharmacological options, physiotherapy plays a pivotal role in restoring function and alleviating symptoms. Interventions that emphasize neuromuscular re-education, proprioception, strength enhancement, and joint stability have gained clinical traction for their ability to target the underlying functional impairments associated with KOA.

Two such physiotherapeutic techniques—**Proprioceptive Neuromuscular Facilitation (PNF)** and **Mat Pilates**—are increasingly being incorporated into rehabilitation protocols for individuals with knee osteoarthritis. PNF is a technique based on specific movement patterns that are spiral and diagonal in nature, simulating functional motions and enhancing motor coordination. It has been shown to improve muscle activation, proprioceptive acuity, and joint stabilization, especially beneficial in cases where neuromuscular control is compromised. Mat Pilates, on the other hand, focuses on core strengthening, postural alignment, flexibility, and controlled movement. By targeting the trunk and hip musculature, Pilates helps redistribute mechanical stress away from the knee joint and enhances overall movement efficiency.

Despite their growing use, there is a lack of robust comparative studies that evaluate the relative efficacy of PNF and Mat Pilates in the rehabilitation of KOA. Most available literature addresses these interventions in isolation, without direct comparison across key clinical outcomes such as pain reduction, joint function, and proprioceptive improvement. This study, therefore, aims to bridge that gap by systematically assessing and contrasting the therapeutic effects of PNF and Mat Pilates in individuals with knee osteoarthritis. The findings are intended to provide evidence-based insights for clinicians in selecting and tailoring optimal rehabilitation strategies for patients with KOA.

2. METHODOLOGY:

Study Design: Quantitative, randomized comparative study.

Sample: 40 patients clinically diagnosed with Grade 2 or 3 KOA based on Kellgren and Lawrence criteria, aged 40–70 years.

Groups:

Group A: 20 patients underwent PNF exercises plus standard physiotherapy.

Group B: 20 patients underwent Mat Pilates exercises plus standard physiotherapy.

Inclusion Criteria:

Adults aged 40–70 years.

Clinically diagnosed KOA with VAS ≥ 4.

Grade 2 or 3 KOA.

Exclusion Criteria:

Recent surgery or trauma.

Severe systemic conditions.

Concurrent rehabilitation programs.

Duration: 4 weeks, with three 60-minute sessions per week.

Outcome Measures:

VAS (Visual Analog Scale) – to assess pain.

WOMAC Index – to assess pain, stiffness, and physical function.

Statistical Analysis: Paired and independent t-tests using SPSS; significance set at $p < 0.05$.

3. RESULTS:

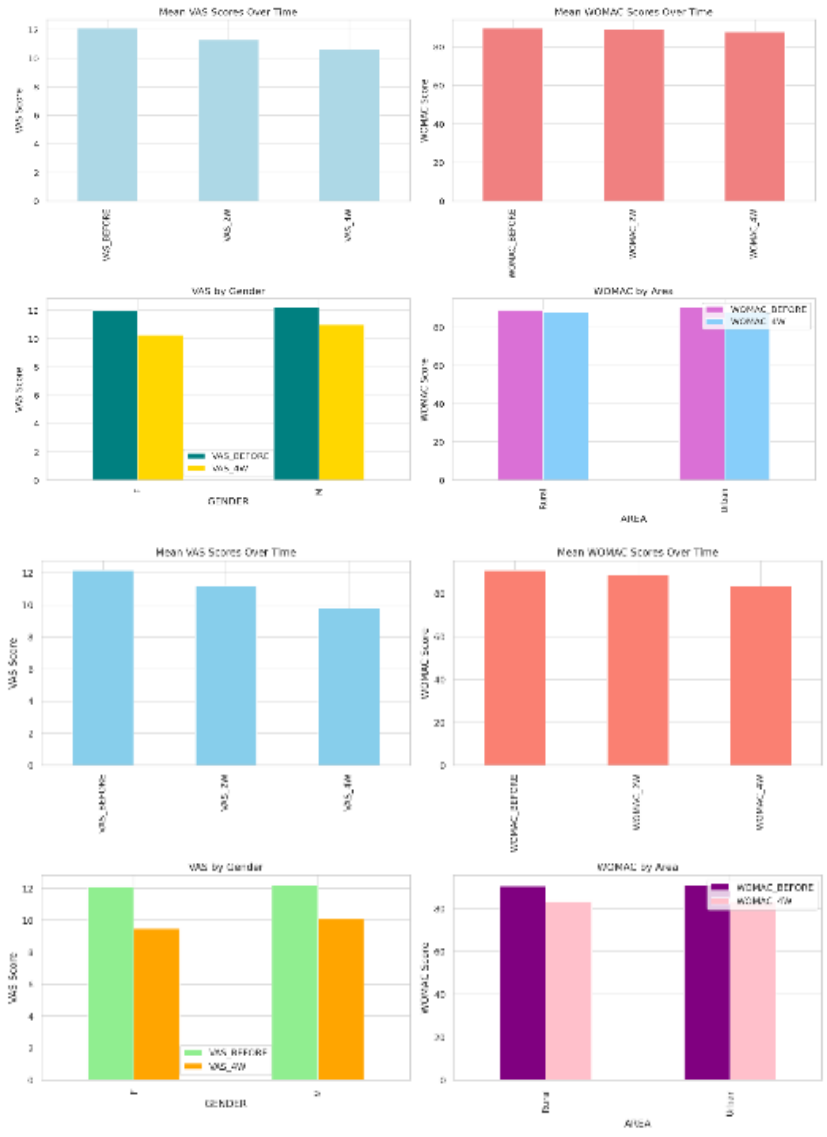
Table 1: Pre- and Post-Intervention Scores Within Groups

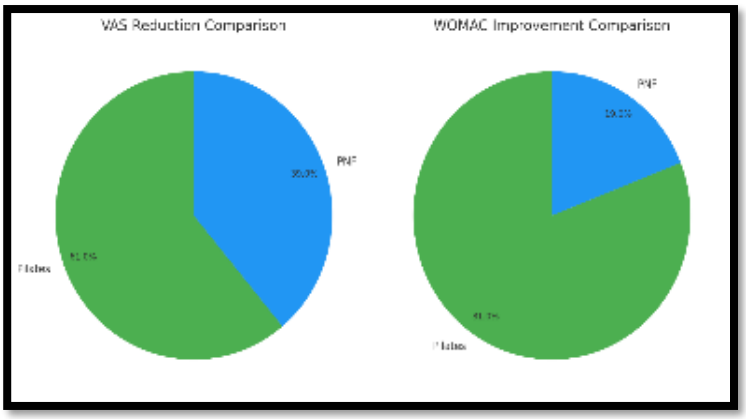
Group	VAS Before	VAS After	Change	WOMAC Before	WOMAC After	Change
PNF	12.10	10.60	-1.50	89.65	87.90	-1.75
Pilates	12.15	9.80	-2.35	90.75	83.30	-7.45

Table 2: Between-Group Comparison at 4 Weeks

Outcome	t-Statistic	p-Value	Interpretation
VAS	-2.30	0.028	Significant
WOMAC	-3.56	0.001	Highly Significant

Both interventions significantly reduced pain and improved function, but Mat Pilates demonstrated statistically superior improvements.





4. DISCUSSION:

This study compared the effectiveness of **Mat Pilates and Proprioceptive Neuromuscular Facilitation (PNF)** in reducing pain and improving function in individuals with knee osteoarthritis over a four-week intervention. Both groups showed statistically significant improvements in **VAS and WOMAC scores**, affirming the value of exercise-based rehabilitation. However, the **Pilates group achieved greater improvements**, with more pronounced reductions in pain and disability.

The superior outcomes in the Pilates group may be linked to its focus on **core stability, postural alignment, and controlled, low-impact movements**, which enhance proprioception and reduce joint stress. In contrast, while PNF was effective in improving dynamic stability and flexibility, its effect on pain and function was comparatively modest.

The statistical analysis confirmed significant between-group differences (VAS: $p = 0.028$, WOMAC: $p = 0.001$), with Pilates providing more consistent and reliable results, as shown by lower mean absolute deviation values.

These findings suggest that Pilates may offer broader functional benefits than PNF, especially due to its holistic and adaptable nature. Clinically, this supports the use of Pilates in conservative KOA management, particularly for improving neuromuscular control and reducing symptoms.

5. LIMITATIONS

include a small sample size, short intervention duration, and a single-center population. Future studies should explore **larger samples, long-term outcomes, and potential benefits of combining Pilates and PNF** to optimize rehabilitation protocols.

6. CONCLUSION:

This study demonstrated that both **Mat Pilates and Proprioceptive Neuromuscular Facilitation (PNF)** are effective in managing pain and functional limitations in individuals with **knee osteoarthritis (KOA)**. However, **Pilates produced significantly greater improvements**, as evidenced by larger reductions in VAS and WOMAC scores and lower post-intervention variability.

The **superior outcomes in the Pilates group** may be attributed to its focus on **core strength, postural control, and neuromuscular coordination**. While PNF remains a beneficial technique—particularly for enhancing flexibility and dynamic stability—its effects were comparatively modest.

These findings support the use of **Mat Pilates as a preferred rehabilitation approach** for KOA. Future research with **larger sample sizes and extended follow-up periods** is needed to confirm long-term benefits and explore the combined use of both techniques.

7. LIMITATIONS:

Small sample size.

Short duration (4 weeks).

Lack of long-term follow-up.

Single-center study.

8. RECOMMENDATIONS:

Larger, multi-center trials.

Long-term follow-up to assess sustained effects.

Exploration of combined interventions..

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