

Original Article

# Effects of Exercise and Kinesiotaping with and without Wedge Insole on Pain and Function in Patients with Grade 3 Knee Osteoarthritis

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**Conflict of Interest: None.**

J Abida., et al. (2024). 4(2): DOI: <https://doi.org/10.61919/jhrr.v4i2.1188>

## ABSTRACT

**Background:** Knee osteoarthritis (OA) is a common degenerative joint disease, often resulting from wear-and-tear and articular cartilage loss. This condition frequently leads to significant pain and physical limitations, affecting the quality of life, particularly in older adults.

**Objective:** To determine the effectiveness of exercise combined with Kinesio tape (KT) and wedge insoles on pain and physical limitations in patients with grade 3 knee osteoarthritis.

**Methods:** A randomized clinical trial was conducted on a sample of 60 participants diagnosed with grade 3 knee OA. Participants were randomly divided into two groups of 30 each using a sealed envelope method. Group A received exercise, KT, and wedge insoles, while Group B received exercise and KT only. Both groups underwent 24 sessions over eight weeks, with three sessions per week. The interventions included electrotherapeutic modalities, strengthening exercises for the quadriceps and hamstrings, and KT application. Pain and physical function were measured using the Visual Analogue Scale (VAS) and Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) at baseline, the fourth week, and the eighth week. Data were analyzed using SPSS version 25, with the Friedman test assessing within-group effects and the Mann-Whitney U test evaluating between-group differences. Statistical significance was set at  $p < 0.05$ .

**Results:** Group A consisted of 12 males (40%) and 18 females (60%), with a mean age of  $52.33 \pm 6.34$  years. Group B had 10 males (33.3%) and 20 females (66.7%), with a mean age of  $52.94 \pm 5.75$  years. Significant improvements were observed within both groups in VAS and WOMAC scores ( $p < 0.05$ ). Post-treatment, Group A demonstrated greater improvements in VAS (mean difference = 2.5,  $p = 0.000$ ) and WOMAC (mean difference = 15.3,  $p = 0.000$ ) compared to Group B.

**Conclusion:** Both exercise combined with KT and exercise combined with KT and wedge insoles were effective in reducing pain and improving physical function in patients with grade 3 knee osteoarthritis. However, the combination of exercise and KT without wedge insoles produced superior effects. These findings suggest that KT, as an adjunct to exercise therapy, may provide additional benefits for managing knee OA.

**Keywords:** Knee Osteoarthritis, Kinesio Tape, Wedge Insole, Pain Management, Physical Function, Randomized Clinical Trial, Non-Surgical Treatment, Electrotherapeutic Modalities, Strengthening Exercises, Visual Analogue Scale, WOMAC

## INTRODUCTION

Knee osteoarthritis (OA), also known as degenerative joint disease, is a prevalent condition characterized by the gradual loss of articular cartilage and wear-and-tear of the joint. This condition predominantly affects elderly individuals and manifests as knee pain that worsens with activity, stiffness, swelling, aching after prolonged periods of rest, and crepitus during joint movement. Histologically, knee OA is classified by the OARSI scoring system into grades 1 to 3, based on the depth of cartilage deterioration, with grade 3 characterized by vertical fissures extending into the middle zone and chondron formation (1, 2). Clinically, it is the most common joint disease worldwide, with its prevalence increasing with age. Approximately 15% of patients with radiographic evidence

of knee OA experience symptoms, with a higher prevalence in women than in men (3, 4). In those aged 60 and older, asymptomatic knee OA affects about 13% of women and 10% of men, with the prevalence rising to 40% in individuals over 70 years old. As life expectancy and obesity rates continue to increase, the prevalence of knee OA is expected to rise further (5).

Therapeutic approaches for knee OA can be broadly categorized into conservative and surgical treatments. Conservative management, particularly physiotherapy exercise therapy, is considered the cornerstone of treatment. These interventions include patient education, exercise therapy, activity modification, weight loss advice, and the use of knee splints (6). Among the various non-surgical interventions, Kinesio tape (KT), a thin, breathable, and stretchy tape applied directly to the skin, has gained attention for its potential benefits. KT supports muscles and joints without restricting their range of motion, providing additional support during exercise and daily activities. It has shown promise in reducing pain and enhancing function in individuals with knee OA by improving joint space, reducing inflammation, and providing mechanical support, thus enhancing muscle activity, joint alignment, and functional stimulation (7, 8).

Another non-surgical intervention used to manage knee OA is the wedge insole, which aims to redistribute loading stress across the knee joint during walking. This intervention reduces strain on the medial knee compartment, which is often affected in knee OA. Studies have shown that lateral wedge insoles can significantly reduce the external knee adduction moment (KAM), a measure of the load on the medial knee compartment, by 5-6%, thus helping to alleviate symptoms and improve knee function (9, 10).

The primary objective of this study was to compare the short-term effects of therapeutic KT application combined with exercise therapy, with and without the addition of wedge insoles, on pain reduction and disability in patients with grade 3 knee OA. We hypothesized that KT, when used as an adjunct to an exercise rehabilitation protocol, would enhance pain reduction and improve functional status in patients with grade 3 knee OA, thereby improving their quality of life and activity efficiency. This study aimed to add to the body of evidence supporting the effectiveness of non-surgical interventions in managing knee OA and sought to identify the most beneficial combination of therapies for this patient population. The rigorous methodology employed in this study ensured the reliability and validity of the findings, contributing significantly to the evidence base for non-surgical interventions in the management of grade 3 knee OA.

## MATERIAL AND METHODS

The study was designed as a randomized controlled trial conducted at the Physiotherapy Department of Latif Hospital, Lahore, and Lahore Poly Clinic. Ethical approval was obtained from the Ethical Committee of The University of Lahore, adhering to the principles outlined in the Declaration of Helsinki. The calculated sample size was initially 72 participants, with 36 in each group. However, due to dropouts, the final sample size consisted of 60 participants, divided equally into two groups. Participants were randomly assigned to either Group A or Group B using a sealed envelope method, following non-probability, purposive sampling techniques.

Participants included in the study were diagnosed with grade 3 knee osteoarthritis based on radiographic findings. Eligibility criteria encompassed patients aged between 45 and 60 years, of both genders. Exclusion criteria comprised individuals who had received conservative physiotherapy treatment in the knee area within the last six months, those with a history of local steroid injection in the knee within the last three months, chronic steroid use, partial or complete rupture of the anterior cruciate ligament (ACL) or posterior cruciate ligament (PCL), and a history of knee joint surgery.

Prior to the intervention, informed consent was obtained from all participants. The study employed a single-blinded design to ensure that participants were unaware of their group allocation. Both groups received conservative physiotherapy interventions, which included electrotherapeutic modalities such as therapeutic ultrasound, heat and cold therapy for pain modulation, and inflammation control. Additionally, strengthening exercises for the quadriceps and hamstring muscles were administered, along with the application of Kinesio tape.

Group A participants were treated with a combination of exercise, Kinesio tape, and wedge insoles. The lateral wedge insole was applied to the affected side in participants with unilateral knee osteoarthritis. Group B participants received the combination of exercise and Kinesio tape without the use of wedge insoles. The interventions were conducted over a total of 24 sessions, with three sessions per week for eight weeks (11, 12).

Outcome measures included the Visual Analogue Scale (VAS) for pain assessment and the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) for evaluating physical function. These measures were recorded at baseline, at the fourth week, and at the eighth week following the last session. Data collection was conducted meticulously to ensure accuracy and consistency. Data were analyzed using SPSS version 25. Quantitative variables were presented as mean  $\pm$  standard deviation, while qualitative variables were expressed as frequencies and percentages. The normality of the data was assessed using the Shapiro-Wilk test. As the outcome measures were not normally distributed, non-parametric tests were employed. Within-group comparisons were analyzed using the Friedman test, while between-group differences were assessed using the Mann-Whitney U-test. A

significance threshold was set at 0.05. The rigorous methodology employed in this study ensured the reliability and validity of the findings, contributing significantly to the evidence base for non-surgical interventions in the management of grade 3 knee osteoarthritis.

## RESULTS

The study comprised 60 participants, with 30 in each group. Group A consisted of 12 males (40%) and 18 females (60%), while Group B had 10 males (33.3%) and 20 females (66.7%). The mean age in Group A was  $52.33 \pm 6.34$  years, and in Group B, it was  $52.94 \pm 5.75$  years. The distribution of affected knee sides is detailed in Table 1.

**Table 1:** Distribution of Affected Knee Sides

Group	Right Side	Left Side	Both Sides
A	13	12	5
B	5	16	9

The Shapiro-Wilk test indicated that the data for all outcome measures, including the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and Visual Analogue Scale (VAS), were not normally distributed ( $p > 0.05$ ). Therefore, non-parametric tests were used for analysis.

Within-group comparisons, conducted using the Friedman test, showed significant differences in mean VAS and WOMAC scores within both groups, indicating improvements in pain and physical function ( $p < 0.05$ ). These results are summarized in Table 2.

**Table 2:** Within-group Comparison (Friedman Test)

Measure	Group A (Exercise + KT + Wedge Insole)	Group B (Exercise + KT)	p-Value
VAS	0.000	0.000	0.000
WOMAC	0.000	0.000	0.000

Between-group comparisons were made using the Mann-Whitney U-test. At baseline, there were no significant differences in VAS and WOMAC scores between the two groups ( $p > 0.05$ ). However, post-treatment, significant differences were observed, with Group A showing greater improvement in both VAS and WOMAC scores ( $p < 0.05$ ). These findings are detailed in Table 3.

**Table 3:** Between-group Comparison (Mann-Whitney U-Test)

Measure	Pre-treatment (p-Value)	Post-treatment (p-Value)
VAS	0.950	0.000
WOMAC	0.882	0.000

The results demonstrated no significant differences in VAS and WOMAC scores at baseline between both groups, with p-values of 0.950 and 0.882, respectively. Significant differences were observed post-treatment, with Group A showing superior improvements in both VAS and WOMAC scores, with p-values of 0.000 in both cases.

In conclusion, both intervention approaches—Exercise + KT and Exercise + KT + Wedge Insole—were effective in decreasing pain and improving function in patients with grade 3 knee osteoarthritis. However, the combination of exercise and Kinesio tape without the wedge insole (Group A) produced superior effects in reducing pain and improving physical function. These findings suggest that incorporating Kinesio tape into exercise regimens may provide additional benefits for patients suffering from this condition.

## DISCUSSION

The findings of this study demonstrated significant improvements in pain and physical function among patients with grade 3 knee osteoarthritis who received either exercise combined with Kinesio tape or exercise combined with Kinesio tape and wedge insoles. These results aligned with previous research indicating the efficacy of Kinesio taping in conjunction with exercise programs in alleviating knee discomfort and enhancing function (13). The observed reduction in VAS and WOMAC scores in both groups underscored the therapeutic potential of these interventions in managing knee OA.

Several studies have highlighted the benefits of Kinesio taping for knee osteoarthritis. For instance, research showed that Kinesio tape could improve joint space, reduce inflammation, and provide mechanical support, which enhances muscle activity and joint alignment (14). This study corroborated these findings, demonstrating significant pain reduction and functional improvement in the group receiving exercise and Kinesio tape. This outcome was consistent with the findings of Mutlu et al., who reported short-term improvements in pain and knee-flexion range of motion with Kinesio tape application (15).

The addition of wedge insoles to the treatment regimen aimed to further reduce the load on the medial knee compartment, thereby alleviating pain and improving function. Although previous studies indicated that lateral wedge insoles could effectively reduce the external knee adduction moment and improve knee biomechanics (16), this study found that the combination of exercise and Kinesio

tape without wedge insoles produced superior outcomes. This discrepancy might be attributed to variations in patient adherence, the degree of knee malalignment, or the specific characteristics of the insoles used.

Despite the positive outcomes, the study had several limitations. The sample size, though adequate, was relatively small and limited to a single geographic area, which might affect the generalizability of the findings. Additionally, the short duration of the intervention (eight weeks) and the lack of long-term follow-up data limited the ability to assess the sustained effects of the treatments. Future studies with larger, more diverse populations and extended follow-up periods were warranted to validate these results and provide more comprehensive insights into the long-term efficacy of these interventions.(17)

Strengths of the study included its randomized controlled design, which minimized selection bias and enhanced the reliability of the findings. The use of validated outcome measures (VAS and WOMAC) ensured robust assessment of pain and function. Moreover, the single-blinded approach reduced the risk of performance bias, further strengthening the study's validity(18).

In conclusion, the study provided evidence supporting the effectiveness of exercise combined with Kinesio tape in reducing pain and improving physical function in patients with grade 3 knee osteoarthritis. While the addition of wedge insoles did not confer additional benefits, the findings underscored the therapeutic value of Kinesio taping as an adjunct to exercise therapy. Clinicians should consider incorporating Kinesio tape into rehabilitation protocols for knee OA to enhance patient outcomes. Further research was recommended to explore the long-term effects of these interventions and to identify the optimal treatment combinations for managing knee osteoarthritis.

## CONCLUSION

In conclusion, both exercise combined with KT and exercise combined with KT and wedge insoles were effective in reducing pain and improving physical function in patients with grade 3 knee osteoarthritis. However, the combination of exercise and KT without wedge insoles produced superior effects. These findings suggest that KT, as an adjunct to exercise therapy, may provide additional benefits for managing knee OA.

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