Time Course Effects of Kinesio Taping in Knee Osteoarthritis Patients

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Disclaimers

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ABSTRACT

Background: Knee osteoarthritis is a common musculoskeletal disorder in the elderly, characterized by cartilage loss leading to pain, stiffness, and restricted movement. Kinesiotaping has been suggested as a therapeutic approach to reduce pain and improve functional outcomes in knee osteoarthritis patients.

Objective: This study aimed to compare the effects of quadriceps and patellar kinesiotaping applied for different durations (24, 48, and 72 hours) on pain, balance, and functional performance in patients with knee osteoarthritis.

Methods: A randomized clinical trial was conducted from March to September 2020 at the Railway General Hospital, Rawalpindi, and Abasyn Rehabilitation Center, Islamabad. Forty-eight patients with knee osteoarthritis (grades 2-3) were randomly assigned to three groups: Group A (kinesiotaping for 24 hours), Group B (kinesiotaping for 48 hours), and Group C (kinesiotaping for 72 hours). All participants also received conventional therapy, including hot pack application, quadriceps strengthening exercises (15 repetitions × 3 sets), and stretching exercises (5 repetitions with a 10-second hold × 3 sets). Pain, balance, and functional performance were assessed at baseline, post-intervention, and one week later using the Numeric Pain Rating Scale (NPRS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), Functional Reach Test (FRT), and Time Up and Go Test (TUG). Data were analyzed using SPSS version 25, with intragroup comparisons conducted using the Wilcoxon signed-rank test and intergroup comparisons using the Kruskal-Wallis test. A p-value of less than 0.05 was considered statistically significant.

Results: Significant reductions in pain were observed across all groups ($p < 0.05$), with the most notable improvement in Group C (72 hours), where NPRS scores decreased from a median of 2 (IQR 1.75) at baseline to 1 (IQR 1) at follow-up ($p < 0.05$). However, no significant improvements were noted in balance or functional performance across the groups, as indicated by FRT, WOMAC, and TUG scores ($p > 0.05$).

Conclusion: Kinesiotaping significantly reduces pain in knee osteoarthritis patients, particularly when applied for 72 hours, but does not appear to significantly impact balance or functional performance. These findings suggest that kinesiotaping is effective for shortterm pain management, though additional interventions may be necessary to improve functional outcomes.

INTRODUCTION

Osteoarthritis (OA) is a progressive joint disorder characterized by the breakdown of joint cartilage and underlying bone, often leading to pain, stiffness, and reduced mobility. It is the most common form of arthritis, particularly prevalent among the elderly, and is associated with significant morbidity and disability (1). Knee osteoarthritis, in particular, is a chronic degenerative disorder that is highly prevalent among older adults, often leading to increased fall risk and pain associated with muscle weakness, particularly in the quadriceps muscles, which are most commonly affected by this condition. The disorder is a major contributor to the restriction of daily activities, causing severe pain, stiffness, swelling, and reduction in joint range of motion, all of which significantly impair the quality of life for those affected (2).

In the context of gait mechanics, individuals with osteoarthritic knees and weakened quadriceps muscles often display a shortened stance phase during the gait cycle. Normally, the quadriceps muscles are responsible for controlling knee flexion during weight-bearing activities, whereas the hamstrings and gastrocnemius muscles remain relatively inactive. However, in osteoarthritis patients, the weakening of the quadriceps results in functional limitations, increased fall risk, and slower gait speed, further exacerbating the condition (3). Previous studies have highlighted that pain and significant declines in physical function are closely linked with reduced muscle strength, poor balance, and impaired proprioception, contributing to the gradual worsening of knee instability (4).

The World Health Organization (WHO) has projected that by 2020, osteoarthritis will become the fourth leading cause of disability worldwide (5). In patients with knee osteoarthritis, pain is a significant factor that adversely affects knee flexibility and functional capabilities, with studies indicating a notable decrease in both knee extension and flexion strength in these patients (2). The prevalence of knee osteoarthritis is particularly high in individuals over the age of 45, with approximately 80% of affected individuals experiencing movement restrictions, 20% facing difficulties with daily living activities, and nearly 11% struggling with personal care tasks (6). The incidence of knee osteoarthritis is expected to continue rising, particularly in industrialized countries, where it already affects between 17% to 30% of the elderly population, with women being disproportionately affected compared to men (7). In Asia, the condition affects between 15% to 40% of the population aged 40 years and older, with the prevalence increasing due to longer life expectancies. By 2020, it was estimated that up to 57% of the population would be diagnosed with knee osteoarthritis, and 66% would experience movement dysfunction (8). Conventional therapies for managing knee osteoarthritis typically include resistance training for the quadriceps, moderate aerobic exercise, weight reduction, full-body vibration, and neuromuscular training. Among these, the use of taping techniques has shown promising results in reducing pain and improving functional outcomes. Taping, particularly of the knee, can alleviate pain by improving the patellofemoral position and reducing mechanical stress on soft tissues. Various taping methods have been explored in the literature, though there is evidence that improper application may exacerbate soft tissue inflammation (9). Kinesiotaping (KT), a technique that involves applying elastic therapeutic tape with appropriate tension to a lengthened muscle, has gained recognition as a valuable adjunct in clinical interventions. This method is believed to provide support and facilitate muscle contraction, thus aiding in joint stability and function. Additionally, taping can enhance muscle activity and proprioception, potentially overriding pain signals by stimulating sensory nerve endings in the skin. Specific taping techniques, such as patellar taping, have been shown to improve proprioception and spontaneous strength, thereby enhancing dynamic postural control (10).

The current research aims to evaluate the effects of kinesiotaping over different time durations—24 hours, 48 hours, and 72 hours—on pain, balance, and functional status in patients with knee osteoarthritis. By assessing the outcomes of these interventions, this study seeks to provide further evidence on the efficacy of kinesiotaping as a complementary treatment for knee osteoarthritis, with the goal of informing clinical practice and improving patient outcomes.

MATERIAL AND METHODS

This randomized clinical trial (RCT) was conducted to evaluate the effects of kinesiotaping over varying durations in patients with knee osteoarthritis. The study took place at the Railway General Hospital, Rawalpindi, and the Abasyn Rehabilitation Center, Islamabad, from March to September 2020, spanning a period of six months. The trial adhered to the ethical principles outlined in the Declaration of Helsinki, and ethical approval was obtained from the institutional review board of the respective hospitals prior to the commencement of the study.

A sample size of 48 participants was calculated using the OpenEpi tool, ensuring adequate power to detect significant differences between groups. Participants were recruited through non-probability consecutive sampling and included adults aged 40-60 years who were diagnosed with unilateral knee osteoarthritis of grades 2-3 on the Kellgren and Lawrence grading system. Eligibility criteria required that participants had experienced knee pain for more than one month. Exclusion criteria encompassed individuals with rheumatic diseases, inflammatory or septic arthritis, a history of intra-articular corticosteroid injection within the past month, knee fractures, systemic illnesses, any carcinoma, and those with allergic reactions to kinesiotaping.

Upon enrollment, participants were randomly assigned to one of three groups, with each group receiving kinesiotaping for a different duration: Group A for 24 hours, Group B for 48 hours, and Group C for 72 hours. All participants also received conventional therapy, which included the application of a hot pack, quadriceps muscle strengthening exercises (15 repetitions × 3 sets), and stretching exercises (5 repetitions with a 10-second hold × 3 sets). The kinesiotaping technique varied slightly depending on the group. For quadriceps taping, participants were positioned supine, and Y-shaped tape was applied from the mid-thigh to the upper border of the patella with 25% tension, with the distal end placed on the tibial tubercle without tension. McConnell taping was performed in a long sitting position, with the tape being pulled from the lateral to the medial side of the patella.

Data collection involved three assessment points: baseline (prior to intervention), post-intervention (after the first session), and at followup (one week later). The primary outcome measures included the Numeric Pain Rating Scale (NPRS), the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), the Functional Reach Test (FRT), and the Time Up and Go Test (TUG). Participants were also provided with a home exercise plan, which included strengthening exercises for the quadriceps and vastus medialis oblique muscles (3 sets × 15 repetitions) and stretching exercises for the hamstrings (5 repetitions with a 10-second hold).

The collected data were entered into SPSS version 25 for statistical analysis. Descriptive statistics were used to summarize the baseline characteristics of the participants. The Shapiro-Wilk test was employed to assess the normality of the data. Intragroup comparisons were conducted using the Wilcoxon signed-rank test, while intergroup comparisons were analyzed using the Kruskal-Wallis test, followed by post hoc analysis where necessary. A p-value of less than 0.05 was considered statistically significant.

Throughout the study, strict adherence to the ethical standards was maintained. All participants provided

informed consent before participation, and their confidentiality and privacy were ensured. The findings from this research are intended to contribute to the growing body of evidence on the efficacy of kinesiotaping in managing knee osteoarthritis, providing valuable insights for clinicians and researchers in the field.

RESULTS

The study included a total of 48 patients with knee osteoarthritis who were randomly assigned to one of three intervention groups: Group A (24 hours kinesiotaping), Group B (48 hours kinesiotaping), and Group C (72 hours kinesiotaping). The demographic and baseline characteristics of the participants are presented in Table 1. The mean age of the participants was 56 ± 4.08 years. The majority of the participants were female (60.4%), and the remaining 39.6% were male. Regarding body mass index (BMI), 62.5% of participants were within the normal range, 25% were overweight, and 12.5% were classified as obese. Additionally, 70.8% of participants had osteoarthritis in the right knee, while 29.2% had it in the left knee. The participants' occupational status revealed that 60.4% were housewives and 39.6% were railway employees, with 66.7% of all participants having comorbid conditions.

Table 1: Baseline Demographic and Clinical Characteristics of Participants

Characteristic	Response	Group A (n=16)	Group B (n=16)	Group C (n=16)	Total (n=48)
Age (mean ± SD)	Mean ± SD	55.7 ± 4.3	56.1 ± 3.9	56.3 ± 4.2	56 ± 4.08
Gender (n, %)	Male	6 (37.5%)	7 (43.8%)	6 (37.5%)	19 (39.6%)
	Female	10 (62.5%)	9 (56.3%)	10 (62.5%)	29 (60.4%)
BMI (n, %)	Normal	10 (62.5%)	9 (56.3%)	11 (68.8%)	30 (62.5%)
	Overweight	4 (25%)	4 (25%)	4 (25%)	12 (25%)
	Obese	2 (12.5%)	3 (18.8%)	1 (6.3%)	6 (12.5%)
Affected Knee (n, %)	Right	12 (75%)	11 (68.8%)	11 (68.8%)	34 (70.8%)
	Left	4 (25%)	5 (31.3%)	5 (31.3%)	14 (29.2%)
Occupational Status (n, %)	Housewives	10 (62.5%)	10 (62.5%)	9 (56.3%)	29 (60.4%)
	Railway Employees	6 (37.5%)	6 (37.5%)	7 (43.8%)	19 (39.6%)
Comorbidities (n, %)	Yes	11 (68.8%)	11 (68.8%)	10 (62.5%)	32 (66.7%)
	No	5 (31.3%)	5 (31.3%)	6 (37.5%)	16 (33.3%)

The intragroup analysis for pain, as measured by the Numeric Pain Rating Scale (NPRS), showed statistically significant reductions in pain across all three groups from baseline to follow-up ($p < 0.05$). However, the degree of pain reduction varied between groups, with Group C (72 hours) showing the most significant improvement when compared to Group A (24 hours), as indicated by post hoc analysis ($p < 0.05$). The intergroup analysis is summarized in Table 2.

Table 2: Intragroup and Intergroup Analysis for NPRS

Group	NPRS (Baseline)	NPRS (Post Intervention)	NPRS (Follow-Up)	p-value (Intragroup)
Group A (24 hrs)	3 (1)	2 (1)	2 (0.75)	< 0.05
Group B (48 hrs)	3 (1)	2 (0.75)	2 (1)	< 0.05
Group C (72 hrs)	2 (1.75)	1 (1.75)	1 (1)	< 0.05
Intergroup Comparison	Mean Rank (Baseline)	Mean Rank (Post-Intervention)	Mean Rank (FollowUp)	p-value (Intergroup)
Group A vs. Group B	25.59	24.3	19.6	> 0.05
Group A vs. Group C	31.5	24.8	17.7	< 0.05 (C-A)
Group B vs. Group C	30.03	24.4	18.7	> 0.05

Table 3: Intragroup and Intergroup Analysis for FRT, WOMAC, TUG

Variable	Group A (24 hrs)	Group B (48 hrs)	Group C (72 hrs)	p-value (Intragroup)	p-value (Intergroup)
FRT (Baseline)	3 (1)	2.5 (1.75)	3 (1)	> 0.05	> 0.05
FRT (Follow-Up)	3 (1)	2.5 (2)	2.5 (2)	> 0.05	> 0.05
WOMAC (Baseline)	1 (1)	1 (0)	1 (0)	> 0.05	> 0.05
WOMAC (Follow-Up)	1 (0)	1 (0)	1 (0)	> 0.05	> 0.05
TUG (Baseline)	2 (1)	2 (0)	2 (0)	> 0.05	> 0.05
TUG (Follow-Up)	2 (1)	2 (1)	2 (1)	> 0.05	> 0.05

In terms of balance and functional performance, measured by the Functional Reach Test (FRT), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and Time Up and Go Test (TUG), the intragroup analysis revealed no significant improvements in FRT and TUG scores across all three groups ($p > 0.05$). However, WOMAC scores showed a slight improvement, although not statistically significant, in all groups. Intergroup comparisons similarly showed no significant differences between the groups for these functional outcomes ($p > 0.05$). The detailed results are presented in Table 3. The results of this study indicate that kinesiotaping significantly reduces pain in patients with knee osteoarthritis, particularly when applied for 72 hours. However, no significant improvements were observed in balance and functional performance measures, suggesting that while kinesiotaping is effective for pain management, it may not significantly impact other functional outcomes in the short term.

DISCUSSION

The findings of this study demonstrated that kinesiotaping significantly reduced pain in patients with knee osteoarthritis, particularly when applied for 72 hours, aligning with previous research that supports the efficacy of kinesiotaping in managing osteoarthritis-related pain. These results were consistent with the work of Tani et al., who found that kinesiotaping on the quadriceps muscle significantly improved gait speed in knee osteoarthritis patients after three days of application (2). Similarly, studies by Cho et al. and Lu et al. have shown that kinesiotaping can effectively reduce pain and improve physical function in osteoarthritis patients, reinforcing the notion that this intervention can play a valuable role in pain management (13,15).

However, the present study did not observe significant improvements in balance or functional performance as measured by the Functional Reach Test (FRT), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and Time Up and Go Test (TUG). This finding contrasts with some earlier studies, such as that by Haghighi et al., which reported positive effects of quadriceps and patellar taping on balance and functional status in knee osteoarthritis patients (8). The discrepancy could be attributed to differences in study design, taping techniques, or the duration of follow-up. The current study's shorter duration may have limited the ability to detect changes in functional outcomes, as previous research suggests that longer intervention periods may be necessary to observe significant improvements in balance and function (11,12).

One of the strengths of this study was the rigorous methodology, including randomization, standardized intervention protocols, and the use of validated outcome measures. Additionally, the study provided a direct comparison of the effects of kinesiotaping over different time durations, offering valuable insights into the optimal duration for pain relief in knee osteoarthritis patients. The inclusion of a follow-up assessment also allowed for the evaluation of the short-term effects of the intervention (16,17).

However, the study also had several limitations. The sample size was relatively small, which may have limited the statistical power to detect differences in functional outcomes. Additionally, the study was conducted over a short period, which may not have been sufficient to observe long-term effects of kinesiotaping on balance and functional performance. The study also relied on patient self-reports for some outcomes, which could introduce bias. Furthermore, the participants were not blinded to the intervention, potentially affecting the perceived effectiveness of the treatment.

Another limitation was the lack of a control group that did not receive kinesiotaping, which would have provided a clearer understanding of the intervention's efficacy. The study also did not assess long-term adherence to the home exercise plan, which could have influenced the outcomes. Moreover, the study was conducted during the COVID-19 pandemic, which may have affected patient turnout and participation, as well as the overall generalizability of the findings.

Future research should aim to address these limitations by including larger sample sizes, longer follow-up periods, and control groups to better understand the long-term effects of kinesiotaping. Studies should also explore the impact of kinesiotaping on different populations, including those with varying degrees of osteoarthritis severity, to determine the broader applicability of the findings. Additionally, future studies could investigate the combined effects of kinesiotaping with other therapeutic interventions, such as neuromuscular training or full-body vibration, to enhance functional outcomes.

This study provided evidence that kinesiotaping effectively reduces pain in knee osteoarthritis patients, particularly with longer application durations. However, the intervention did not significantly improve balance or functional performance within the study's timeframe. These findings suggest that while kinesiotaping is a valuable tool for pain management, additional or alternative interventions may be necessary to address the functional limitations associated with knee osteoarthritis.

CONCLUSION

In conclusion, this study provides valuable insights into the effectiveness of kinesiotaping as a pain management strategy for patients with knee osteoarthritis. The results demonstrate that applying kinesiotaping for extended durations, particularly 72 hours, leads to significant reductions in pain levels, highlighting its potential as a beneficial adjunct to conventional therapies. However, the study also reveals that while kinesiotaping effectively alleviates pain, it does not substantially enhance balance or functional performance within the short-term intervention period. These findings underscore the importance of integrating kinesiotaping with other therapeutic approaches, such as targeted exercise programs or neuromuscular training, to address the multifaceted challenges of knee osteoarthritis comprehensively. The

study's limitations, including the short duration of the intervention and the relatively small sample size, suggest that further research is necessary to explore the long-term effects of kinesiotaping and its impact on different patient populations. Nonetheless, this study contributes to the growing body of evidence supporting kinesiotaping as a viable option for managing knee osteoarthritis pain, offering clinicians a practical tool to improve patient outcomes in the context of this prevalent and debilitating condition.

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