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Original Article

Comparative Effects of Wearing Knee Support Brace and Kinesiotaping on Pain, Physical Activity Level and Kinesiophobia in Patients with Knee Osteoarthritis

Arooj Iftikhar[1]*, Zain-ul-Abbas[2], Saima Jabbar[3], Zaaira Jaan[4], M Soban Afzal[5], Mahnoor Liaqat[1]

[1]The University of Lahore.
[2]Sehat Medical Complex The University of Lahore
[3]Jinnah Hospital Lahore.
[4]Federal Institute of Health Sciences Lahore.
[5]The University of Lahore, Sargodha Campus.
Corresponding Author: Arooj Iftikhar, MS Scholar; Email: aroojiftikhar874@gmail.com

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ABSTRACT

Background: Osteoarthritis (OA), primarily affecting knees, hips, and hands, is the most prevalent form of arthritis, with knee OA being a significant cause of disability in older individuals. It poses a substantial burden on personal health and healthcare systems, characterized by symptoms like joint pain, restricted motion, and muscle weakness.

Objective: This study aimed to compare the effectiveness of knee support braces and kinesiotaping in managing symptoms of knee OA, focusing on pain reduction, physical activity enhancement, and kinesiophobia mitigation.

Methods: Conducted at the University of Lahore Teaching Hospital from December 2022 to July 2023, this randomized controlled trial enrolled individuals aged 45-60 years with grade II-III medial compartment knee OA. Participants were purposively sampled and randomly allocated into two groups: the knee brace group and the kinesiotaping group. Data collection involved the Visual Analogue Scale (VAS) for pain, the International Physical Activity Questionnaire Short-Form (IPAQ-SF) for physical activity level, and the Tampa Scale of Kinesiophobia (TSK) for measuring kinesiophobia. Interventions included a three-month rehabilitation program with either knee braces or kinesiotaping, supplemented with a home exercise program. Statistical analysis was performed using SPSS version 25, employing parametric tests like independent sample t-tests and repeated measures ANOVA.

Results: The study comprised 96 participants, with a mean age distribution across groups ranging from 45 to 60 years. At baseline, pain scores were comparable between groups. However, significant reductions in pain scores were noted in the kinesiotaping group at the 4th (mean difference = 0.39, p = 0.001), 8th (mean difference = 0.39, p = 0.001), and 12th weeks (mean difference = 0.71, p = 0.000). Physical activity levels, as per IPAQ-SF, also showed significant improvements in the kinesiotaping group at the 4th, 8th, and 12th weeks. Kinesiophobia levels, measured by TSK, decreased significantly in the kinesiotaping group over the study period.

Conclusion: Kinesiotaping was found to be more effective than knee braces in reducing pain, enhancing physical activity levels, and decreasing kinesiophobia in patients with knee OA. These findings suggest that kinesiotaping could be a preferred non-surgical intervention in the management of knee OA symptoms.

Keywords: Osteoarthritis, Knee Support Braces, Kinesiotaping, Pain Management, Physical Activity, Kinesiophobia, Randomized Controlled Trial.

INTRODUCTION

Osteoarthritis (OA), predominantly impacting the knees, hips, and hands, stands as the most common form of arthritis. Notably, knee OA emerges as a primary contributor to functional impairment and disability among older individuals, thereby imposing substantial burdens on both personal health and healthcare systems (1). Characterized by articular cartilage degradation, osteophyte formation at bone edges, subchondral bone sclerosis, and sometimes cyst formation in advanced stages, OA's pathophysiology is complex (2). Key modifiable risk factors identified in literature include obesity, comorbidities, occupational elements, levels of physical activity, biomechanical factors, and dietary exposures (3). Varying in intensity, knee OA-induced joint pain can be mild or

severe and may fluctuate between constant and intermittent episodes. This pain often restricts range of motion and is accompanied by symptoms like muscle weakness and audible joint sounds. The resultant functional limitations significantly impact daily activities such as walking, stair climbing, and maintaining an upright posture, ultimately diminishing psychological well-being and life quality (4).

Globally, osteoarthritis ranks as the tenth leading cause of disability, with the knee being the most commonly affected joint. The burden of knee OA, measured in years lived with disability, surged by 30.8% from 2007 to 2017. With an aging and increasingly obese population, the prevalence of knee OA is anticipated to escalate. A retrospective cohort study indicated that narratively diagnosed knee OA had a positive predictive value of 94.0%, while codified knee OA stood at 96.0%. Furthermore, from 2008 to 2019, the incidence rate of knee OA climbed from 9.98 to 13.8 per 1,000 person-years, with comorbidities also influencing the risk of severe knee OA diagnosis (5).

In managing knee OA symptoms, international guidelines from authorities such as the National Institute for Health and Care Excellence (NICE)(6), the Osteoarthritis Research Society International (OARSI)(7), the American College of Rheumatology (ACR)(8), the Ottawa Panel, and the European League against Rheumatism (EULAR)(9) predominantly advocate for exercise, patient education, and weight management as first-line treatments. They caution against surgery, especially arthroscopic knee surgery, due to its limited effectiveness, increased likelihood of knee replacement, and potential risks, emphasizing non-surgical interventions and lifestyle modifications as preferable management strategies (10).

Among non-surgical options, knee braces have been widely recognized for offering support. However, alternative methods like neoprene sleeves, compression stockings, and kinesiotaping (KT) are gaining traction, showing promise in providing stability and alleviating pain in various knee conditions, including acute and chronic injuries, and postoperative scenarios (11). Recent evidence indicates KT's emerging role as a standard treatment for pain relief and functional enhancement in knee OA patients (12).

This study delves into the comparative effects of knee support braces and kinesiotaping on knee OA. It aims to furnish clinicians and researchers with empirical evidence to integrate these treatments into therapeutic protocols effectively. Knee braces are known to enhance mechanical stability, redistribute joint load, and improve mobility, while kinesiotaping is believed to bolster neuromuscular control, modulate pain perception, and enhance functional performance. These non-invasive, cost-effective interventions not only provide pain relief and augment joint functionality but also potentially delay the need for surgical interventions. The study's significance lies in its potential to refine patient care and treatment strategies for knee osteoarthritis, offering a comprehensive view of two prevalent non-surgical treatment modalities.

MATERIAL AND METHODS

The research, a randomized controlled trial, was conducted in the Outpatient Department of Physical Therapy at the University of Lahore Teaching Hospital, Lahore. Spanning nine months from December 2022 to July 2023, this study aimed to assess the comparative effects of knee support braces and kinesiotaping on patients with knee osteoarthritis. To determine the sample size, the Visual Analogue Scale (VAS) for pain was used as the primary outcome measure, resulting in a requirement of 48 participants per group. Anticipating a 20% dropout rate, this number was increased to 57 per group (13). Purposive sampling technique was employed for participant selection.

Individuals aged between 45 to 60 years, diagnosed with medial compartment knee osteoarthritis (OA) of grade II to III severity as per the Kellgren-Lawrence Grading Scale, were eligible for inclusion. Participants needed the capability to complete a three-month rehabilitation program (14). Exclusion criteria encompassed a history of knee joint surgery, grade IV knee OA, significant ligament instability, more than 20° flexion contracture, inability to walk, and contraindications to wearing a knee brace such as skin allergy, peripheral vascular disease, or lower limb edema (13). The study employed two primary tools: Kinesiotape and Knee Support Brace. Ethical considerations were meticulously addressed. The study adhered to the ethical guidelines set by the University of Lahore's ethical committee. Prior approval was obtained, ensuring the protection of participant rights. Written informed consent was secured, and participant confidentiality was maintained. The study informed participants of potential adverse effects and their right to withdraw at any time. Data security was ensured through lock and password-protected storage.

For data collection, eligible participants were randomly allocated to either the knee brace group or the kinesiotaping group using a simple randomization method and sealed envelopes to ensure blinding. This single-blind trial kept assessors unaware of demographic and clinical data, as well as group allocation. Data collection occurred at baseline, and then at the fourth, eighth, and twelfth weeks. Tools used for assessment included the Visual Analogue Scale (VAS) for pain intensity, the International Physical Activity Questionnaire Short-Form (IPAQ-SF) for physical activity level, and the Tampa Scale of Kinesiophobia (TSK) for measuring kinesiophobia.

Pain was defined according to the International Association for the Study of Pain (IASP) as an unpleasant sensory and emotional experience associated with actual or potential tissue damage (15). The VAS was used for pain measurement, categorizing pain levels as none, mild, moderate, or severe, with specific cut points (16). Physical activity, defined as any skeletal muscle movement that increases energy expenditure above the resting metabolic rate (17), was assessed using the IPAQ-SF. Kinesiophobia, or the fear of movement, was evaluated using the Tampa Scale of Kinesiophobia (TSK), a 17-item questionnaire with demonstrated reliability and validity (20, 21).

Interventions included educating participants about knee osteoarthritis and providing a home exercise program. Participants were advised against corticosteroid injections or NSAIDs, with paracetamol permitted for pain relief. Group A (Knee Brace Group) wore knee braces during daily activities for at least three months and participated in thrice-weekly exercise sessions as per the American College of Sports Medicine (ACSM) guidelines. These sessions included stretching, strengthening exercises, cycling, and walking, with progression every six sessions (22, 23). Group B (Kinesiotaping Group) received kinesiotaping alongside similar exercises to alleviate chronic knee effusion and improve thigh muscle function, with tapes applied once weekly for twelve sessions and 24-hour breaks between applications (24). Both groups engaged in a 12-week fitness program, comprising stretching and strengthening exercises, and cycling, with progressive increments in exercise intensity and duration.

Data analysis was conducted using SPSS version 25. Quantitative data such as age, VAS, IPAQ, and TSK scores were presented as mean ± SD, while qualitative data like gender and symptomatic side were expressed in frequency and percentage. The normality of data was confirmed using the Kolmogorov-Smirnov test as $n > 50$. Parametric tests, independent sample t-tests, and repeated measures ANOVA were utilized for between-group and within-group comparisons. A p-value of 0.05 was set for statistical significance.

RESULTS

The study's demographic profile (Table 1) revealed a diverse age distribution among the participants. Those aged 45-50 years formed the largest group, accounting for 46.9% of the total, followed by the 51-55 age group (34.4%), and the 56-60 age group (18.8%). Regarding the duration of osteoarthritis (OA), the majority (51%) had been experiencing symptoms for 1-2 years. This was followed by 24% with a 3-4 year duration, 13.5% with over 5 years, and 11.5% with less than one year. In terms of severity based on the KLG Scale, 53.1% were classified as grade 3, 26% as grade 2, and 20.8% as grade 4. Gender distribution showed a higher prevalence of OA among males (62.5%) compared to females (37.5%).

The Independent Sample t-test results (Table 2) for Pain Score (VAS) highlighted significant changes over time. At baseline, the mean difference in pain scores was minimal (-0.02) with no statistical significance (t=0.20, p=0.840). However, there was a marked increase in the mean difference at the 4th week (0.39, p=0.001), which persisted into the 8th week (0.39, p=0.001), and became even more pronounced by the 12th week (0.71, p=0.000). Physical Activity Level, as measured by the IPAQ-SF, also showed significant alterations. Initially, the baseline difference was not significant (t=3.29, p=0.074, mean difference=-0.19), but by the 4th week, a significant reduction was noted (mean difference=-0.50, p=0.000), which further decreased at the 8th week (mean difference=-1.21, p=0.000) and was maintained at the 12th week (mean difference=-0.71, p=0.000). Kinesiophobia, as assessed by the TAMPA Score, similarly exhibited significant changes. Starting from a baseline mean difference of 0.25 (p=0.062), there was a considerable increase at the 4th week (mean difference=0.96, p=0.000), which continued to rise at the 8th week (mean difference=1.33, p=0.000) and peaked at the 12th week (mean difference=2.02, p=0.000).

Multivariate test results (Table 3) for Pain, Physical Activity Level (IPAQSF), and Kinesiophobia (TAMPA) were significant across all tests. Pain exhibited significant values in both Pillai's Trace (F=477.02, p=0.000) and Wilks' Lambda (F=477.02, p=0.000). The IPAQSF scores also showed significant multivariate effects as indicated by Pillai's Trace (F=388.67, p=0.000) and Wilks' Lambda (F=388.67, p=0.000). Similarly, significant results were observed for TAMPA, with Pillai's Trace (F=101.43, p=0.000) and Wilks' Lambda (F=101.43, p=0.000) indicating strong multivariate effects.

Table 1 Concise Demographic Data

Category	Subcategory	Frequency	Percent (%)
Age in Years			
	45-50	45	46.9
	51-55	33	34.4
	56-60	18	18.8
Duration of OA			

Category	Subcategory	Frequency	Percent (%)
	Less than one year	11	11.5
	1-2 years	49	51.0
	3-4 years	23	24.0
	5 or more years	13	13.5
KLG Scale			
	2	25	26.0
	3	51	53.1
	4	20	20.8
Gender			
	Male	60	62.5
	Female	36	37.5

Table 2 Concise Independent Sample t-test Results

Variables	Time Point	t-value	Significance (2-tailed)	Mean Difference
Pain Score (VAS)				
	Baseline	0.20	0.840	-0.02
	4th week	3.58	0.001	0.39
	8th week	3.58	0.001	0.39
	12th week	6.74	0.000	0.71
Physical Activity Level (IPAQ-SF)				
	Baseline	3.29	0.074	-0.19
	4th week	6.38	0.000	-0.50
	8th week	12.55	0.000	-1.21
	12th week	10.18	0.000	-0.71
Kinesiophobia (TAMPA Score)				
	Baseline	1.96	0.062	0.25
	4th week	7.54	0.000	0.96
	8th week	8.29	0.000	1.33
	12th week	13.64	0.000	2.02

Table 3 Concise Multivariate Test Results

Effect	Multivariate Test	F Value	Significance
Pain	Pillai's Trace	477.02	0.000
	Wilks' Lambda	477.02	0.000
IPAQSF	Pillai's Trace	388.67	0.000
	Wilks' Lambda	388.67	0.000
TAMPA	Pillai's Trace	101.43	0.000
	Wilks' Lambda	101.43	0.000

Table 4 Concise Repeated Measure ANOVA Results

Variable	Test Component	F Value	Significance
Pain	Within-Subjects Effects	573.34	0.000
	Within-Subjects Contrasts	851.43	0.000
	Between-Subjects Effects	2637.44	0.000
Physical Activity Level	Within-Subjects Effects	346.02	0.000
	Within-Subjects Contrasts	712.40	0.000

Variable	Test Component	F Value	Significance
	Between-Subjects Effects	1511.21	0.000
Kinesiophobia	Within-Subjects Effects	250.72	0.000
	Within-Subjects Contrasts	309.25	0.000
	Between-Subjects Effects	1712.96	0.000

The Repeated Measure ANOVA results (Table 4) for Pain, Physical Activity Level, and Kinesiophobia indicated significant effects across all test components. For Pain, significant within-subjects effects (F=573.34, p=0.000), within-subjects contrasts (F=851.43, p=0.000), and between-subjects effects (F=2637.44, p=0.000) were observed. Physical Activity Level also showed significant within-subjects effects (F=346.02, p=0.000), within-subjects contrasts (F=712.40, p=0.000), and between-subjects effects (F=1511.21, p=0.000). Kinesiophobia demonstrated similar patterns with significant within-subjects effects (F=250.72, p=0.000), within-subjects contrasts (F=309.25, p=0.000), and between-subjects effects (F=1712.96, p=0.000), underscoring the robustness of the study's findings across these measures.

DISCUSSION

The study explored the comparative efficacy of kinesiotaping and knee brace interventions in alleviating pain, enhancing physical activity, and reducing kinesiophobia in individuals with knee osteoarthritis. The findings revealed that while both treatments were beneficial, kinesiotaping demonstrated a notably higher effectiveness in pain relief, suggesting a stronger analgesic effect than knee braces. This observation aligns with the research conducted by Lu et al. (2018) and Priore et al. (2020), which also highlighted the pain-reducing capabilities of kinesiotaping in similar patient populations (29, 30). Conversely, studies by Abolhasani et al. (2019) and Liu et al. (2020) did not observe such significant distinctions in pain levels between kinesiotaping and control groups, indicating the potential variability of kinesiotaping's efficacy across different studies and patient demographics (31, 32).

In terms of physical activity, the study found that participants in the kinesiotaping group exhibited higher levels of activity compared to those wearing knee braces. This result corroborates the findings of Günaydin and Bayrakci Tunay (2022) and Wu et al. (2022), who reported improvements in physical activity and function following kinesiotaping (33, 34). However, this stands in contrast to the work of Wageck et al. (2016) and Castrogiovanni et al. (2016), where no significant changes were noted in physical activity levels post-kinesiotaping in knee osteoarthritis patients (35, 36). These conflicting outcomes might be attributed to variations in study designs, the duration of interventions, and the methodologies employed for measuring physical activity.

Additionally, the study indicated that kinesiotaping was more effective in reducing kinesiophobia over time compared to knee brace intervention. This aligns with the findings of Kavak et al. (2018), who also reported a reduction in kinesiophobia using kinesiotaping (37). Conversely, Gholami et al. (2020) found no significant benefit of kinesiotaping on kinesiophobia or functional performance in patients with knee disorders, underscoring the inconsistency of results across different studies (38).

The study, while insightful, was not without limitations. The sample size was limited, which could potentially affect the generalizability of the findings. Moreover, the duration of the study was not sufficiently long to ascertain the long-term effects of the interventions. The absence of a control group or a placebo group also limits the strength of the conclusions that can be drawn. Furthermore, the study's participants varied in terms of the severity of knee osteoarthritis, activity levels, and treatment history, which could introduce heterogeneity into the results.

To address these limitations and enhance the robustness of future research, it is recommended to conduct larger-scale studies with a more diverse and representative sample. A longer follow-up period would allow for a better understanding of the long-term benefits of these interventions. Including a control group receiving either no intervention or a placebo would provide a stronger basis for comparison. Conducting multicenter studies across various healthcare settings would enhance the external validity of the findings and offer a more comprehensive understanding of the effectiveness of kinesiotaping and knee brace interventions in the treatment of knee osteoarthritis.

CONCLUSION

The study conclusively demonstrates that both knee support braces and kinesiotaping are effective interventions for managing symptoms of knee osteoarthritis. However, kinesiotaping showed superior results in terms of pain reduction, enhanced physical activity levels, and decreased kinesiophobia compared to knee braces. These findings have significant clinical implications, suggesting that kinesiotaping could be a more advantageous treatment modality in knee OA management. This evidence supports the integration of kinesiotaping into treatment protocols for knee OA, offering a non-invasive, cost-effective alternative that not only alleviates pain but also improves functional outcomes. The study underscores the need for a tailored approach in OA management,

highlighting the potential of kinesiotaping to address specific patient needs, thereby enhancing overall patient care and quality of life.

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