

COMPARATIVE EFFECTS OF CALCANEAL LOW-DYE TAPING, PLANTAR FASCIA STRETCHING AND SHAM TAPING ON ACUTE PLANTAR HEEL PAIN AND FUNCTIONAL ACTIVITY LEVEL IN FOOTBALL PLAYERS

Original Research

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ABSTRACT

Background: Heel pain is a prevalent issue among athletes, particularly affecting those involved in football, with approximately 11-15% of these individuals seeking professional care for their discomfort. This study focuses on the acute management of plantar heel pain, a common condition in this demographic.

Objective: To compare the effects of calcaneal Low-dye Taping, plantar fascia stretching, and sham taping on acute plantar heel pain and functional activity levels in football players.

Methods: This randomized controlled trial was registered with identifier NCT05736809 and conducted at the Pakistan Sports Board Lahore. The study comprised 21 football players aged 20-45, divided into three groups. Participants underwent treatments over three weeks, with two sessions per week, using the Numeric Pain Rating Scale and Foot and Ankle Disability Index for assessment.

Results: The application of Low-dye taping resulted in a significant improvement in heel pain, with a mean difference in pain scores of 4.14 ($p=0.003$) as determined by the Paired t-test. This significant result underscores the effectiveness of Low-dye taping in reducing acute heel pain among football players.

Conclusion: While all tested interventions provided relief, calcaneal Low-dye taping was notably more effective in improving functional activity levels in football players suffering from acute plantar heel pain.

Keywords: Achilles Tendon, Calcaneal Taping, Football, Heel Pain, Plantar Fasciitis, Plantar Heel Pain, Randomized Controlled Trial.

INTRODUCTION

Plantar heel pain is a common complaint in foot and ankle clinics, affecting approximately 11–15% of patients seeking professional care for foot ailments. Plantar fasciitis, also known as Runner's heel, Painful heel syndrome, and Calcaneal Periostitis, impacts around one in ten individuals at some point in their lives (1, 2). This condition is predominantly found in middle-aged obese women and young male athletes. The plantar fascia, a critical connective tissue, maintains the arch of the foot and extends into five digital bands that insert into the base of the periosteum of each toe and the metatarsal heads (3). Originating from the medial tubercle of the calcaneus, it is intimately involved with the mechanics of walking, notably through the 'windlass effect' during the weight-bearing phase of the gait cycle, which allows for the storage and conversion of energy (5, 6, 7).

Despite its prevalence, the exact pathogenesis of plantar fasciitis remains poorly understood. Traditionally, it is thought to result from repetitive microtrauma at the insertion point on the calcaneus, leading to degenerative rather than inflammatory changes in the tissue, hence the term fasciosis might be more appropriate (8, 9). This degeneration is exacerbated by the daily transition from a plantarflexed to a dorsiflexed foot position, particularly noticeable when first walking in the morning (10). Over time, histological changes such as the atrophy of the plantar fat pad and the formation of heel spurs occur, although these spurs do not necessarily align with the direction of plantar fascia traction (11, 12). Symptoms typically intensify with the first steps in the morning or at the beginning of activity, easing as the person warms up.

This study aims to assess the comparative effects of calcaneal Low-Dye taping, plantar fascia stretching, and sham taping on the acute management of plantar heel pain and functional activity among football players. It specifically explores the changes in foot pressure distribution during gait following the application of Low-Dye taping, which is hypothesized to provide an anti-pronation effect, thereby alleviating symptoms and improving function. The objective is to rationalize treatment approaches based on their effectiveness in modifying the biomechanical and symptomatic aspects of plantar fasciitis, thereby guiding clinical interventions for this prevalent condition.

METHODS

This randomized controlled trial was registered under the identifier NCT05736809 and conducted at the Pakistan Sports Board in Lahore over a period of 10 months following the approval of the synopsis. The study's ethical approval was obtained from the Research & Ethics Committee of Riphah College of Rehabilitation and Allied Health Sciences, Riphah International University Lahore, with the reference number REC/RCR & AHS/22/0424 dated January 25, 2022. A total of 21 participants were selected using purposive sampling and divided equally into three groups. The inclusion criteria allowed for individuals aged 20 to 45 years of both genders, experiencing pain upon the first steps in the morning and pain located at the plantar surface of the mid-foot, consistent with plantar fasciitis. Exclusion criteria included patients who had undergone surgery or received treatment for any lower leg or foot fracture within the previous six months.

Data collection involved the use of the Numeric Pain Rating Scale (NPRS), a validated tool for assessing pain levels from 0 ("no pain") to 10 ("very severe pain"), specifically during the first steps taken in the morning (6). Additionally, the Foot and Ankle Disability Index (FADI) was used to evaluate functional limitations associated with daily and sports-related activities (14). All participants initially received a baseline treatment consisting of Rest, Ice, Compression, and Elevation (RICE), along with a nonsteroidal anti-inflammatory drug (NSAID) due to tenderness at the anterior medial head. The intervention protocols were as follows: Group 1 underwent calcaneal Low-Dye taping with four tapes at the calcaneal-Achilles tendon on the day of the injury, followed by subsequent taping sessions twice weekly for three weeks (15). Group 2 engaged in plantar fascia stretching exercises, performing 10 repetitions of a 10-second hold, three times daily, for three consecutive weeks (16). Group 3 received sham taping to explore the psychological impact of non-therapeutic intervention using the same schedule as the other groups.

Data analysis included the Shapiro-Wilk test to determine the normality of the data; a p-value greater than 0.05 indicated that parametric tests were suitable. For between-group comparisons, one-way analysis of variance (ANOVA) was employed to detect any significant differences in NPRS and FADI scores among the groups. Within each group, paired sample t-tests were utilized to evaluate changes in

scores over the treatment period. The methodology ensured that all participants were treated under consistent conditions with standardized assessments, providing a robust basis for evaluating the effects of each intervention on plantar fasciitis symptoms and functional outcomes.

RESULTS

In this randomized controlled trial, 21 football players participated, divided into three groups of seven each. The average ages of groups A, B, and C were 27.57 ± 4.79 , 29.29 ± 3.63 , and 26.86 ± 3.89 years respectively, demonstrating a middle-aged cohort engaged in active sports. The body mass index (BMI) recorded for these groups were 22.10 ± 1.42 , 20.92 ± 2.44 , and 22.57 ± 1.34 , indicating a generally healthy weight range among the participants. The primary outcome measured was pain, assessed using the Numeric Pain Rating Scale (NPRS). Before the interventions, the mean pain scores were 1.71 ± 5.38 for group A, 5.00 ± 1.41 for group B, and 5.57 ± 0.78 for group C. After the interventions, significant improvements in pain scores were noted with group A reporting a mean of 1.57 ± 0.78 , group B 3.86 ± 0.90 , and group C 4.57 ± 0.53 . The reduction in pain scores indicates the effectiveness of the treatments, with group A showing the most significant improvement.

Table 1: Descriptive statistics for demographics variables of athletes

Group Names	N	Minimum	Maximum	Mean	Std. Deviation	
Age in years	Group A	7	22	36	27.57	± 4.79
	Group B	7	23	34	29.29	± 3.63
	Group C	7	21	33	26.86	± 3.89
Weight in KGs	Group A	7	60	72	66.00	± 4.43
	Group B	7	58	75	65.57	± 6.02
	Group C	7	60	75	67.85	± 4.63
Height in meters	Group A	7	1.68	1.82	1.72	± 0.54
	Group B	7	1.72	1.82	1.77	± 0.03
	Group C	7	1.67	1.80	1.73	± 0.04
BMI	Group A	7	20.50	24.90	22.10	± 1.42
	Group B	7	18.30	25.40	20.92	± 2.44
	Group C	7	20.40	23.90	22.57	± 1.34

Functional disability was assessed using the Foot and Ankle Disability Index (FADI), where group A demonstrated remarkable improvement from a pre-intervention score of 53.23 ± 10.96 to 87.00 ± 7.23 post-intervention. Groups B and C also showed improvements in their scores from 46.71 ± 17.74 and 57.14 ± 19.91 pre-intervention to 59.14 ± 19.48 and 71.14 ± 24.18 post-intervention, respectively. These results underline the positive impact of the interventions on enhancing functional abilities related to the foot and ankle among football players.

Table 2: Between-Group Comparison of NPRS and FADI Scores Pre- and Post-Intervention

Assessment	Time	Group A (Mean ± SD)	Group B (Mean ± SD)	Group C (Mean ± SD)	P-value
NPRS	Pre-intervention	1.71 ± 5.38	5.00 ± 1.41	5.57 ± 0.78	0.60
	Post-intervention	1.57 ± 0.78	3.86 ± 0.90	4.57 ± 0.53	0.00
FADI	Pre-intervention	53.23 ± 10.96	46.71 ± 17.74	57.14 ± 19.91	0.59
	Post-intervention	87.00 ± 7.23	59.14 ± 19.48	71.14 ± 24.18	0.01

In-depth within-group analyses revealed that group A experienced a substantial reduction in pain, with a mean difference of -4.14 and a statistically significant p-value of 0.00, suggesting highly effective intervention for this group. Group B and C also showed improvements in pain management, albeit less pronounced than group A. In terms of functional ability, as measured by FADI, group A's mean difference was -33.71, indicating a significant enhancement in function compared to groups B and C, which reported mean differences of -12.42 and -14.00 respectively. The statistical analyses conducted, including the Shapiro-Wilk test for data normality and one-way analysis of variance (ANOVA) for between-group comparisons, validated the application of parametric tests due to p-values greater than 0.05. This statistical significance across the findings confirms the efficacy of the interventions, particularly the superior results noted in group A, which involved specific taping techniques.

Table 3: Within-Group Analysis of NPRS Pre- and Post-Intervention

	Study Groups					
	Group A		Group B		Group C	
pre-intervention	5.71±1.38		5.00±1.41		5.57±0.78	
post-intervention	1.57±0.78		3.86±0.90		4.57±0.53	
Within Group Change	Mean Difference	P value	Mean Difference	P Value	Mean Difference	P value
Pre-intervention						
post-intervention	4.14	0.00	1.14	0.00	1.00	0.00

Table 4: Within-Group Analysis of FADI Scores Pre- and Post-Intervention

	Study Groups					
	Group A		Group B		Group C	
pre-intervention	53.29±10.96		46.71±17.77		57.14±19.91	
post-intervention	87.00±7.23		59.14±19.48		71.14±24.18	
Within Group Change	Mean Difference	P value	Mean Difference	P Value	Mean Difference	P value
Pre-intervention						
post-intervention	-33.71	0.00	-12.42	0.00	-14.00	0.00

The interventions assessed in this study significantly reduced pain and improved functional abilities in football players suffering from plantar fasciitis, with calcaneal Low-Dye taping emerging as the most effective treatment method. These results provide a strong basis for recommending specific therapeutic approaches in the management of plantar heel pain in athletic populations.

DISCUSSION

This study investigated the efficacy of three-week interventions for acute heel pain in football players due to plantar fasciitis, involving a comparative analysis of low-dye calcaneal taping, sham taping, and plantar fascia stretching. With 21 participants divided into three groups, the research was underpinned by both experimental and comparative methodologies, enabling a robust examination of the treatments' immediate and short-term effects. The findings indicated that all treatment groups experienced a reduction in heel pain, supporting previous research that highlights the benefits of various interventions for plantar fasciitis. Notably, the study by S Pinrattana and R Kanlayana (2022) corroborated the immediate effectiveness of kinesiotaping, which surpassed the outcomes of the other two interventions by facilitating the healing process and reducing tissue inflammation. This aligns with the theory that heel pain in plantar fasciitis is often linked to tissue inflammation, where interventions like kinesiotaping can provide rapid relief by stimulating mechanoreceptors, enhancing lymphatic drainage, and supporting the foot's arch (17).

In our study, the Low-dye Taping group reported statistically significant improvements in both static and dynamic pain relief. This was similar to findings by Tsai et al. (2020), who noted that rehabilitative taping not only stabilizes joints and muscles without restricting the range of motion but also aids the body's healing processes by targeting different receptors of the somatosensory system (19). Further supporting the efficacy of taping, P. Harradine's study in 2020 used a finite element foot model to demonstrate that taping could effectively offload the plantar fascia under both taped and untaped running conditions, although the differences between Low-Dye taping and non-taping were not significantly vast (20). Additionally, Sharma N et al. (2020) found that physiotherapy interventions combining calcaneal and low-dye taping with ultrasound and passive stretching offered more significant improvements compared to treatments without taping. This suggests that taping might play a critical role in reducing rearfoot pronation and thus decreasing medial loading, which is hypothesized as a pivotal mechanism for alleviating symptoms of plantar fasciitis (15, 21).

Despite the positive outcomes, the study faced limitations such as the small sample size and the exclusion of left foot-dominant athletes, which could skew the generalizability of the results. Furthermore, confounding variables such as the type of footwear and socks worn during the treatment were not controlled, which might influence the effectiveness of the Low-Dye Taping's efficacy. Future studies should consider these factors and include a more diverse participant pool to extend the applicability of the findings. While the three-week treatment duration for acute plantar fasciitis showed promising results across all interventions, the superior efficacy of kinesiotaping, particularly for immediate pain relief, suggests that it should be considered a viable treatment option. Nonetheless, both calcaneal and low-dye taping remain beneficial and should be included as part of a comprehensive therapeutic approach to managing plantar fasciitis in athletes. Further research with a broader scope and a more controlled environment is recommended to validate these findings and optimize treatment protocols.

CONCLUSION

This study concludes that while sham taping, plantar fascia stretching, and low-dye taping all provide beneficial outcomes for managing acute plantar heel pain, calcaneal low-dye taping emerges as the superior method, particularly in enhancing the functional activity levels of football players. These findings underscore the importance of selecting appropriate therapeutic interventions that not only alleviate pain but also improve overall foot function, thereby supporting athletes in maintaining performance and reducing recovery time. This comparative analysis highlights calcaneal low-dye taping as a pivotal treatment for plantar fasciitis, advocating its use in clinical practices for more effective management of foot-related ailments in sports settings.

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