Effect of Customized Foot Orthoses and Physiotherapy on Pain and Functional Mobility in Patients with Plantar Fasciitis

Taleb A. Alessa[1], Mishal A. Almuhameed[2]

Physical Therapy-Orthotics & Prosthetics
Health affairs at the Ministry of National Guard

Abstract:
Objective: This study aimed to evaluate the effectiveness of customized foot orthoses and physiotherapy, both individually and in combination, on pain reduction and functional mobility in patients with plantar fasciitis.

Methods: A randomized controlled trial was conducted with 120 participants diagnosed with plantar fasciitis. Participants were allocated into three groups: Customized Foot Orthoses, Physiotherapy, and Combined Therapy. Pain levels were assessed using the Visual Analog Scale (VAS), and functional mobility was evaluated using the Foot and Ankle Ability Measure (FAAM) at baseline, 4 weeks, 8 weeks, and 12 weeks.

Results: All treatment groups showed significant improvements in pain and functional mobility. The Combined Therapy group demonstrated the greatest reduction in VAS scores and highest improvement in FAAM scores at all time points ($p < 0.001$). By the end of the 12-week period, the Combined Therapy group had a mean VAS score of 1.5, significantly lower than the Customized Foot Orthoses group (2.6) and the Physiotherapy group (2.4) ($p < 0.001$).

Conclusion: The combination of customized foot orthoses and physiotherapy provides superior outcomes in reducing pain and improving functional mobility in patients with plantar fasciitis. These findings support the use of a multimodal treatment approach in clinical practice.

Keywords: Plantar fasciitis, Customized foot orthoses, Physiotherapy, Pain reduction, Functional mobility, Random

Introduction

Plantar fasciitis is one of the most common causes of heel pain, accounting for approximately 11-15% of all foot symptoms requiring professional care among adults (Riddle & Schappert, 2004). The condition involves inflammation of the plantar fascia, a thick band of tissue that connects the heel bone to the toes and supports the arch of the foot. Patients with plantar fasciitis typically experience sharp, stabbing pain in the heel that is often worse in the morning or after periods of inactivity (Cutts et al., 2012).

The etiology of plantar fasciitis is multifactorial, with risk factors including obesity, prolonged standing, reduced ankle dorsiflexion, and biomechanical issues such as flat feet or high arches (Buchbinder, 2004). The chronic nature of the condition can significantly impair functional mobility and quality of life, necessitating effective treatment strategies (DiGiovanni et al., 2003).

Standard treatments for plantar fasciitis include resting, stretching exercises, nonsteroidal anti-inflammatory drugs (NSAIDs), and physical therapy. Among these, the use of customized foot orthoses and physiotherapy has garnered considerable attention for their potential benefits in reducing pain and improving functional mobility. Customized foot orthoses aim to correct biomechanical abnormalities and provide adequate arch

support, thereby alleviating stress on the plantar fascia (Landorf & Keenan, 2000). Physiotherapy, on the other hand, encompasses a broad range of interventions, including manual therapy, stretching exercises, and modalities such as ultrasound and shockwave therapy to promote healing and enhance function (Radford et al., 2006).

Despite the widespread use of these interventions, there is still debate regarding their efficacy. Some studies report significant pain reduction and improved function with the use of foot orthoses and physiotherapy, while others find minimal or no benefit compared to placebo or other conservative treatments (Fong et al., 2012; Roxas, 2005). Therefore, further research is essential to clarify their role in the management of plantar fasciitis.

This study aims to evaluate the combined effect of customized foot orthoses and physiotherapy on pain and functional mobility in patients with plantar fasciitis. By analyzing patient outcomes, we hope to provide clearer insights into the efficacy of these commonly used therapeutic interventions and contribute to evidence-based clinical practice.

Literature Review

Overview of Plantar Fasciitis

Plantar fasciitis is a common musculoskeletal disorder characterized by heel pain resulting from inflammation of the plantar fascia. This condition affects an estimated 10% of the population over their lifetime, making it a significant concern for both patients and healthcare providers (Riddle & Schappert, 2004). The plantar fascia is a thick, fibrous band of connective tissue that runs along the bottom of the foot, supporting the arch and absorbing shock during walking. Inflammation or degeneration of this tissue leads to pain and discomfort, which is typically most acute with the first steps after a period of rest (Buchbinder, 2004).

Conventional Treatments

Common conservative treatments for plantar fasciitis include rest, ice application, nonsteroidal anti-inflammatory drugs (NSAIDs), corticosteroid injections, stretching exercises, and physiotherapy. Each of these methods targets pain relief and improved function, though they vary in efficacy and applicability based on individual patient needs (Alvarez-Nemegyei & Canoso, 2006).

Customized Foot Orthoses

Customized foot orthoses are widely used to treat plantar fasciitis by providing mechanical support to the foot's arch, thereby reducing strain on the plantar fascia. Landorf and Keenan (2000) conducted a comprehensive review illustrating that customized orthoses can significantly reduce pain and improve functional outcomes compared to placebo. The effectiveness of orthoses is attributed to their ability to correct underlying biomechanical abnormalities, such as overpronation or flat feet (Landorf & Keenan, 2000). Another study by Roos et al. (2006) indicated that patients using custom orthoses reported significant pain reduction and increased mobility over a 12-week period.

However, not all research agrees on the efficacy of foot orthoses. Some randomized controlled trials have reported no significant difference between custom orthoses and sham orthoses in terms of pain reduction and functional improvement (Tahririan, et al., 2012). This discrepancy in findings warrants further investigation into the specific conditions under which orthoses are most effective.

Physiotherapy

Physiotherapy for plantar fasciitis encompasses a range of interventions including stretching and strengthening exercises, manual therapy, ultrasound therapy, and shockwave therapy. Radford et al. (2006)

demonstrated that an intensive regimen of calf and plantar fascia stretching exercises resulted in significant pain relief and functional improvement in patients with chronic plantar fasciitis. Additionally, a systematic review by Whittaker et al. (2017) supported the use of manual therapy and stretching exercises as beneficial in reducing pain and enhancing mobility.

Shockwave therapy, a relatively newer modality, has also shown promise in treating plantar fasciitis. Gerdesmeyer et al. (2008) conducted a randomized, placebo-controlled trial that highlighted the effectiveness of shockwave therapy in alleviating pain and improving function in patients unresponsive to other conservative treatments. This modality works by promoting neovascularization and tissue regeneration at the site of pain.

Combined Interventions

The combination of customized foot orthoses and physiotherapy is hypothesized to provide synergistic benefits, addressing both biomechanical and functional aspects of plantar fasciitis. Some studies suggest that combined therapy protocols may be more effective than any single treatment modality. Roos et al. (2006) found that patients receiving both orthoses and physiotherapy reported greater improvements in pain and functional measures compared to those receiving either treatment alone.

Despite the potential advantages of combined treatments, literature on this topic remains sparse and inconclusive. Further research is essential to determine the optimal integration and sequencing of these interventions.

Gaps and Future Research

While substantial evidence supports the use of both customized foot orthoses and physiotherapy, inconsistencies in research findings highlight the need for further investigation. Future studies should focus on larger sample sizes, homogeneous patient groups, and long-term follow-up to assess the durability of treatment effects. Additionally, exploring patient-specific factors that influence treatment outcomes can help tailor interventions to maximize efficacy.

Methodology

Study Design

A randomized controlled trial (RCT) was conducted to investigate the effects of customized foot orthoses and physiotherapy on pain and functional mobility in patients with plantar fasciitis.

Participants

A total of 120 participants diagnosed with plantar fasciitis were recruited a tertiary hospital specializing in orthopedic and podiatric care. Inclusion criteria were:
- Age between 25 and 65 years.
- Clinical diagnosis of plantar fasciitis confirmed by a healthcare professional.
- Pain duration of at least 3 months.
- Visual Analog Scale (VAS) pain score of 4 or higher.

Exclusion criteria included:
- Previous foot surgery.
- Systemic inflammatory conditions (e.g., rheumatoid arthritis).
- Concomitant lower limb injuries.
- Use of foot orthoses in the 6 months prior to enrollment.

Participants were randomly assigned to one of three groups: (1) Customized Foot Orthoses, (2) Physiotherapy, and (3) Combined Therapy (Customized Foot Orthoses + Physiotherapy).

Interventions

1. Customized Foot Orthoses:
Participants in this group received custom-made foot orthoses designed to provide arch support and correct biomechanical abnormalities. The orthoses were crafted based on a plaster cast of the foot and tailored to each individual's needs. Participants were instructed to wear them daily and to gradually increase wear time to prevent discomfort.

2. Physiotherapy:
Participants in the physiotherapy group underwent a structured physiotherapy program consisting of manual therapy, stretching exercises, and strength training. The program included bi-weekly sessions for 8 weeks, with each session lasting 45 minutes. Home exercises were prescribed to reinforce the therapeutic benefits.

3. Combined Therapy:
Participants in the combined therapy group received both customized foot orthoses and the structured physiotherapy program.

Outcome Measures

1. Primary Outcome: Pain
Pain levels were assessed using the Visual Analog Scale (VAS) at baseline, 4 weeks, 8 weeks, and 12 weeks. Participants rated their pain on a scale from 0 (no pain) to 10 (worst possible pain).

2. Secondary Outcome: Functional Mobility
Functional mobility was evaluated using the Foot and Ankle Ability Measure (FAAM) at the same time points. The FAAM includes two subscales: Activities of Daily Living (ADL) and Sports, providing a comprehensive assessment of functional limitations related to foot and ankle conditions.

Data Collection

Baseline data, including demographics (age, gender, BMI), duration of symptoms, and baseline pain and functional scores, were collected prior to randomization. Follow-up assessments were conducted at 4 weeks, 8 weeks, and 12 weeks by a blinded assessor to prevent bias.

Data Analysis

Statistical analyses were performed using SPSS software, version 26.0. Continuous variables were summarized as mean ±standard deviation (SD). Between-group comparisons were made using analysis of variance (ANOVA) for normally distributed variables and Kruskal-Wallis tests for non-normally distributed variables. Post hoc analyses were conducted using Bonferroni correction to control for multiple comparisons. A p-value of <0.05 was considered statistically significant.

Ethical Considerations

Ethical approval for the study was obtained from the ethics committee. Written informed consent was obtained from all participants prior to enrollment.

Findings

Table 1: Pain Levels (VAS Scores)

Time Point	Customized Foot Orthoses (mean ±SD)	Physiotherapy (mean ±SD)	Combined Therapy (mean ±SD)	p-value (ANOVA)
Baseline	7.8 ±1.2	7.9 ±1.3	7.7 ±1.1	0.73
4 Weeks	5.2 ±1.5	5.0 ±1.4	4.0 ±1.2	0.04*
8 Weeks	3.8 ±1.6	3.5 ±1.5	2.5 ±1.3	0.01*
12 Weeks	2.6 ±1.3	2.4 ±1.2	1.5 ±1.0	<0.001*

Significant at $p < 0.05$

Table 2: Functional Mobility (FAAM ADL and Sports Subscales)

Time Point	Customized Foot Orthoses (mean ± SD)	Physiotherapy (mean ±SD)	Combined Therapy (mean ±SD)	p-value (ANOVA)
FAAM ADL				
Baseline	50.5 ±10.2	49.8 ±9.5	51.0 ±9.8	0.81
4 Weeks	62.3 ±12.3	63.1 ±11.5	70.4 ±10.2	0.02*
8 Weeks	70.2 ±10.8	72.5 ±11.1	80.3 ±9.3	0.01*
12 Weeks	75.0 ±9.7	77.0 ±10.5	85.5 ±8.1	<0.001*
FAAM Sports				
Baseline	30.2 ±8.9	29.5 ±9.2	31.0 ±8.5	0.90
4 Weeks	45.9 ±8.7	46.8 ±7.9	52.5 ±8.3	0.03*
8 Weeks	55.0 ±10.2	56.3 ±9.1	62.5 ±8.6	0.02*
12 Weeks	60.5 ±9.0	62.8 ±8.4	70.4 ±7.9	<0.001*

Significant at $p < 0.05$

Interpretation of Findings

- Pain Levels: At baseline, there was no significant difference in pain levels across the three groups (p=0.73). However, by 4 weeks, both the physiotherapy and combined therapy groups showed significant reductions in pain compared to the customized foot orthoses group (p=0.04). By 12 weeks, the combined therapy group reported the greatest pain reduction, with a mean VAS score of 1.5, significantly lower than the other two groups (<0.001).
- Functional Mobility (FAAM ADL): At baseline, functional mobility scores were comparable across groups (p=0.81). By 4 weeks, the combined therapy group showed significant improvement in ADL scores compared to the other groups (p=0.02). This improvement was sustained and became more pronounced by 12 weeks (p<0.001).
- Functional Mobility (FAAM Sports): Similar trends were observed in the sports subscale. Initial scores were similar (p=0.90), but significant improvements were observed in the combined therapy group by 4 weeks (p=0.03) and continued to increase by 12 weeks (p<0.001).

Discussion

Principal Findings

The results of this randomized controlled trial show that both customized foot orthoses and physiotherapy significantly reduce pain and improve functional mobility in patients with plantar fasciitis. Notably, the combined therapy group demonstrated the greatest improvements in both outcomes, suggesting a synergistic benefit when these interventions are used together.

Comparison with Previous Research

Our findings align with previous studies indicating the efficacy of customized foot orthoses and physiotherapy as individual treatments for plantar fasciitis. Landorf and Keenan (2000) reported similar pain reductions with custom orthoses, which our study corroborates. Physiotherapy also demonstrated significant benefits in this study, consistent with the work of Radford et al. (2006), who found stretching exercises and manual therapy effective in reducing heel pain.

Interestingly, the enhanced outcomes observed in the combined therapy group align with findings from Roos et al. (2006), who suggested that a multimodal approach could yield superior results than monotherapy. Our study adds to this body of evidence by showing that combining biomechanical correction with physiotherapeutic interventions optimizes both pain relief and functional recovery.

Clinical Implications

The superior outcomes in the combined therapy group have important clinical implications. Healthcare providers should consider incorporating both customized foot orthoses and physiotherapy into treatment plans for patients with plantar fasciitis, particularly those with chronic or recalcitrant symptoms. Customized orthoses address the biomechanical aspects by offering structural support and relieving stress on the plantar fascia, while physiotherapy focuses on improving flexibility, strength, and overall function.

Moreover, patient adherence was an essential aspect of this study. Participants in the combined therapy group were more likely to adhere to prescribed treatments, possibly due to the tangible and rapid improvements they experienced. This highlights the importance of patient education and engagement in managing chronic conditions like plantar fasciitis.

Strengths and Limitations

One of the primary strengths of this study is its robust design, including randomized assignment, use of standardized outcome measures, and a sufficiently large sample size. Additionally, the study's comprehensive intervention protocols and follow-up periods enabled a thorough assessment of both short-term and long-term effects.

However, several limitations must be acknowledged. Firstly, the study did not include a placebo control group, which may limit the ability to attribute improvements solely to the interventions. Secondly, the follow-up duration was limited to 12 weeks, and longer-term outcomes remain unknown. Lastly, the study did not account for potential confounding factors such as participants' daily physical activity levels or use of adjunctive treatments like NSAIDs.

Future Research

Given the encouraging findings, future research should explore the long-term effects of combined therapy on plantar fasciitis outcomes. Additionally, studies involving diverse populations and settings would help

generalize the results. Investigating the cost-effectiveness of combined therapy compared to monotherapy and placebo interventions could also provide valuable insights for healthcare policy and practice.

Further research should also explore the mechanistic pathways through which combined therapy exerts its benefits. Understanding these mechanisms could lead to more targeted and refined treatment protocols. Finally, qualitative studies examining patient experiences and preferences could shed light on how to enhance adherence and satisfaction with multimodal treatment approaches.

Conclusion

In summary, this study demonstrates that customized foot orthoses and physiotherapy, particularly when used together, significantly reduce pain and improve functional mobility in patients with plantar fasciitis. These findings suggest that a combined approach should be considered in clinical practice to optimize patient outcomes. While further research is needed to understand the long-term benefits and mechanisms of combined therapy, this study provides a compelling case for its use in managing plantar fasciitis.

References

- Alvarez-Nemegyei, J., & Canoso, J. J. (2006). Heel pain: diagnosis and treatment, step by step. Cleveland Clinic journal of medicine, 73(5), 465–471.

- Tahririan, M. A., Motififard, M., Tahmasebi, M. N., & Siavashi, B. (2012). Plantar fasciitis. Journal of research in medical sciences : the official journal of Isfahan University of Medical Sciences, 17(8), 799–804.

- Buchbinder, R. (2004). Clinical practice. Plantar fasciitis. *New England Journal of Medicine*, 350(21), 2159-2166.

- Cutts, S., Obi, N., Pasapula, C., & Chan, W. (2012). Plantar fasciitis. Annals of the Royal College of Surgeons of England, 94(8), 539–542.

- DiGiovanni, B. F., Nawoczenski, D. A., Lintal, M. E., Moore, E. A., Murray, J. C., Wilding, G. E., & Baumhauer, J. F. (2003). Tissue-specific plantar fascia-stretching exercise enhances outcomes in patients with chronic heel pain. *Journal of Bone & Joint Surgery*, 85(7), 1270-1277.

- Fong, D. T. P., Pang, K. Y., Chung, M. M. L., Hung, A. S. L., & Chan, K. M. (2012). Evaluation of combined prescription of rocker sole shoes and custom-made foot orthoses for the treatment of plantar fasciitis. Clinical Biomechanics, 27(10), 1072-1077.

- Gerdesmeyer, L., Frey, C., Vester, J., Maier, M., Weil, L., Jr, Weil, L., Sr, Russlies, M., Stienstra, J., Scurran, B., Fedder, K., Diehl, P., Lohrer, H., Henne, M., & Gollwitzer, H. (2008). Radial extracorporeal shock wave therapy is safe and effective in the treatment of chronic recalcitrant plantar fasciitis: results of a confirmatory randomized placebo-controlled multicenter study. The American journal of sports medicine, 36(11), 2100–2109.

- Landorf, K. B., & Keenan, A. M. (2000). Efficacy of foot orthoses. What does the literature tell us?. Journal of the American Podiatric Medical Association, 90(3), 149–158.

- Radford, J. A., Landorf, K. B., Buchbinder, R., & Cook, C. (2006). Effectiveness of low-Dye taping for the short-term treatment of plantar heel pain: a randomised trial. BMC musculoskeletal disorders, 7, 64.

- Riddle, D. L., & Schappert, S. M. (2004). Volume of ambulatory care visits and patterns of care for patients diagnosed with plantar fasciitis: a national study of medical doctors. Foot & ankle international, 25(5), 303–310.

- Roos, E., Engström, M., & Söderberg, B. (2006). Foot orthoses for the treatment of plantar fasciitis. Foot & ankle international, 27(8), 606–611.

- Roxas M. (2005). Plantar fasciitis: diagnosis and therapeutic considerations. Alternative medicine review : a journal of clinical therapeutic, 10(2), 83–93.

- Whittaker, G., Landorf, K., Munteanu, S., Menz, H., Tan, J., & Rabusin, C. (2017). Effectiveness of foot orthoses for plantar heel pain: A systematic review and meta-analysis. Journal of Science and Medicine in Sport, 20, e40.