

Review Article

Efficacy of Extracorporeal Shock Wave Therapy for Pain Relief in Plantar Fasciitis: A Narrative Review

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A B S T R A C T

Background: The most frequent cause of discomfort in the inferior heel is plantar fasciitis, and extracorporeal shock wave therapy (ESWT) is one of the most effective therapies for plantar fasciitis. It was aimed to determine how extracorporeal shock wave therapy would affect plantar fasciitis.

Method: Studies were searched on Google Scholar and PubMed over the last 10 years. Randomised control trials (RCT), meta-analysis, cohort, and observational studies which used extracorporeal shock wave therapy for the treatment of plantar fasciitis were included and the primary outcome of this study is variation in pain relief.

Results: Patients with persistent plantar fasciitis who had extracorporeal shock wave therapy showed a moderately positive correlation with reduced pain and improved foot function of individuals.

Conclusion: Extracorporeal shock wave therapy is effective in decreasing pain in patients with plantar fasciitis.

Keywords: Extracorporeal Shock Wave Therapy, Plantar Fasciitis, Pain

Introduction

Extracorporeal shock wave therapy (ESWT) began to gain clinical application in the early 1990s for the management of various musculoskeletal disorders, including calcific tendinopathy of the shoulder, chronic plantar fasciitis, and painful tendinopathies.¹⁻³ ESWT has subsequently been proposed as a therapeutic option for several chronic musculoskeletal conditions.² Shock waves are high-energy acoustic waves that deliver a rapid release of energy into the targeted tissue, producing a mechanical effect similar to a localized burst of energy.⁴ The development of ESWT originated from extracorporeal shock wave lithotripsy, which was initially used for the fragmentation of renal and urinary calculi. Although ESWT is generally considered safe, some

treatment-related adverse effects may occur, including discomfort or pain during application. Mild erythema and petechial hemorrhage can also develop, particularly when higher energy levels or excessive contact pressure are applied to the treatment area. ESWT may facilitate tissue repair and regeneration; however, appropriate precautions, such as immobilization during bone healing, remain essential to prevent disruption of newly formed regenerative tissue. Patients should also be informed that tissue healing is a gradual process and may require considerable time.⁵

ESWT has emerged as an effective non-invasive treatment option for several causes of heel pain, including plantar fasciitis and insertional Achilles tendinopathy. It is generally well tolerated and is associated with minimal adverse

effects, most commonly transient treatment-related pain and minor hematoma, with serious complications being uncommon.⁵ ESWT utilizes high-pressure acoustic waves, with reported peak pressures ranging from approximately 5 to 130 MPa and varying treatment frequencies depending on the device and therapeutic protocol.¹ The therapy may provide sustained analgesic effects while simultaneously promoting tissue repair and the healing process.^{4,5}

Plantar fasciitis is one of the most common causes of inferior heel pain and is generally considered a self-limiting condition. It affects approximately 10% of the population and can occur in both physically active individuals and those with sedentary lifestyles.^{6,7} The condition is associated with repetitive stress and microdamage at the origin of the plantar fascia, as well as biomechanical abnormalities of the foot.^{3,6} Although the term “plantar fasciitis” implies an inflammatory process because of the suffix “-itis,” histopathological findings frequently demonstrate degenerative and non-inflammatory changes.⁸ Patients typically present with pain beneath the heel, particularly during the first few steps after waking or following prolonged periods of sitting, standing, or rest. The onset of symptoms is usually gradual.⁶ Plantar fasciitis is most frequently reported among individuals between 40 and 60 years of age.⁹

Despite the widespread use of ESWT for plantar fasciitis, uncertainty remains regarding its effectiveness because of methodological limitations and variability among previous studies. Therefore, the present review was undertaken to evaluate the available evidence regarding the effect of extracorporeal shock wave therapy on pain and clinical outcomes in patients with plantar fasciitis.

Methodology

A comprehensive literature search was conducted using PubMed and Google Scholar to identify relevant articles published in English between 2012 and 2022. The search strategy employed the following keywords and combinations: “*extracorporeal shock wave therapy*,” “*plantar fasciitis*,” and “*effect of extracorporeal shock wave therapy in plantar fasciitis*.” Retrieved articles were initially screened based on their titles and abstracts. Observational studies, meta-analyses, and multicentre randomized controlled trials were considered eligible for inclusion. Articles that were unrelated to the research topic or did not specifically examine the relationship between ESWT and plantar fasciitis were excluded.

A total of 186 records were identified through the database searches after duplicate records were removed. No additional relevant studies were identified from other data sources. Following title and abstract screening, 160 records were excluded because they investigated ESWT for conditions other than plantar fasciitis, involved ongoing trials, were retrospective studies, were published in languages other than English, or were otherwise unrelated to the research question. After full-text assessment and further evaluation, 20 studies were considered eligible and were included in the review. In addition, the reference lists of previously published randomized controlled trials, meta-analyses, cohort studies, and observational studies concerning plantar fasciitis were manually screened to identify any additional relevant studies. The outlining of the process of study methodology is seen in the flowchart (Figure 1).

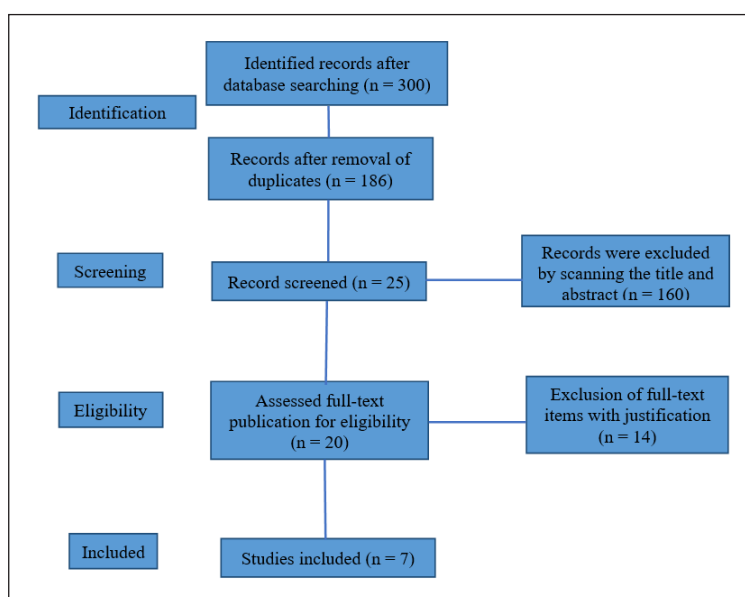


Figure 1. Flowchart illustrating the Process of the Research Identification, Inclusion, Eligibility and Exclusion, and Screening

Table 1. ESWT protocols and pain outcomes measured using the VAS

Author (Year)	ESWT protocol	Follow-up	VAS outcome (mean $\pm$ SD)
Kim TG et al. (2015)	1 session/week $\times$ 3 weeks; 1500 shocks; 4 Hz; 0.089 mJ/mm ²	0–6 weeks	5.30 $\pm$ 0.82
Ordahan B et al. (2017)	2500 pulses; 12–15 Hz; once weekly $\times$ 5 weeks	0–6 weeks	5.5 $\pm$ 1.1 / 5.6 $\pm$ 1.0
Purcell RL et al. (2017)	2000 shocks; 24 kV; no local anaesthesia	0–6 weeks	2.5 $\pm$ 2.0
Okur SC et al. (2019)	2000 pulses; 12 Hz	0–6 weeks	3.9 $\pm$ 1.7 / 4.1 $\pm$ 1.8
Lea RG et al. (2020)	Protocols varied across included studies	2–4 months; 6–12 months	5.08 $\pm$ 3.24*
Bahar-Özdemir Y et al. (2020)	3000 shock waves; 11 Hz; 5 sessions	0–6 weeks	8.3 $\pm$ 1.5; 7.8 $\pm$ 2.0; 7.6 $\pm$ 1.6*
Haake M et al. (2022)	3 $\times$ 4000 impulses; 0.08 mJ/mm ² ; every 2 weeks $\pm$ 2 days	0–6 weeks; 2–4 months	3.1 $\pm$ 2.4; 2.7 $\pm$ 2.5*

Results

According to the included observational studies, randomized controlled trials, meta-analysis, and cohort studies, a range of interventions was evaluated for the management of plantar fasciitis, including extracorporeal shock wave therapy (ESWT), Kinesio taping (KT), sham taping, low-dye taping, and custom foot orthosis (CFO). The studies included in this review were published between 2012 and 2022. The participants were predominantly adults aged 18 years or older, and most studies included patients who had experienced symptoms for at least 6 months. The ESWT protocols varied across studies, with treatment frequencies generally ranging from 12 to 15 Hz, while one study reported a frequency of 7.5 MHz. The number of shock-wave impulses ranged from approximately 900 to 3000 pulses. Treatment duration also varied between studies, ranging from 3 to 12 weeks, with ESWT sessions generally administered once weekly.

Pain severity was assessed using the Visual Analogue Scale (VAS), with outcomes reported as mean $\pm$ standard deviation (SD). The VAS outcomes at different follow-up periods, including 0–6 weeks, 2–4 months, and 6–12 months, are presented in Table 1. The findings indicated an improvement in pain following ESWT compared with several comparator interventions, including KT, sham or low-dye taping, placebo treatment, and CFO. Among the randomized controlled trials, the reported mean $\pm$ SD VAS scores at 0–6 weeks were 5.5 $\pm$ 1.1 versus 5.6 $\pm$ 1.0 for ESWT and KT, respectively; 3.9 $\pm$ 1.7 versus 4.1 $\pm$ 1.8 for ESWT and CFO, respectively; 8.3 $\pm$ 1.5, 7.8 $\pm$ 2.0, and 7.6 $\pm$ 1.6 for ESWT + low-dye taping, ESWT + sham taping, and ESWT, respectively; and 3.1 $\pm$ 2.4 versus 2.7 $\pm$ 2.5 for ESWT and placebo, respectively.

Overall, the findings suggest that ESWT may be an effective non-invasive intervention for reducing pain associated with plantar fasciitis. However, differences in treatment protocols, follow-up periods, comparator interventions, and outcome measurements across the included studies should be considered when interpreting these findings.

Discussion

Heel pain is one of the most common clinical manifestations of plantar fasciitis and is typically aggravated by prolonged standing and walking. Although the precise aetiology and underlying mechanisms remain incompletely understood, evidence suggests that repetitive mechanical strain, degenerative changes, and alterations at the plantar fascia–calcaneal interface may contribute to the development and persistence of symptoms. Management of plantar fasciitis is primarily conservative and may include analgesics, physical therapy, stretching and strengthening exercises, local therapeutic interventions, and other modalities aimed at reducing pain and improving function. Surgical intervention is generally reserved for patients who fail to respond to an adequate course of conservative treatment. The choice of surgical procedure depends on the underlying pathology and may include procedures such as nerve release or calcaneal spur resection. However, surgical treatment may be associated with complications, and recurrent or persistent calcaneal spurs may occur.

The findings of the present review suggest that extracorporeal shock wave therapy (ESWT) may represent a useful alternative for patients with chronic plantar fasciitis who do not achieve adequate relief with conventional conservative management. Some studies demonstrated meaningful improvements after approximately 2–3 weeks of treatment. However, direct comparisons between

studies should be interpreted cautiously because of differences in ESWT protocols, treatment parameters, patient characteristics, outcome measures, and follow-up periods. Conservative management remains effective for most patients; however, individuals with persistent symptoms despite at least 6 months of appropriate treatment, particularly those with symptoms lasting more than 12 months, may be less responsive to conventional measures and may benefit from alternative interventions such as ESWT.

Kim et al.¹¹ reported that ESWT in patients with hemiplegia and plantar fasciitis produced beneficial effects on plantar fascia thickness, spasticity, pain, and gait performance. Their findings suggest that ESWT may improve the extensibility of the plantar fascia, reduce spasticity, alleviate pain, and consequently enhance walking ability. These findings support the potential role of ESWT not only in pain management but also in improving functional outcomes.

Ordahan et al.¹² reported that both ESWT and Kinesio taping (KT) produced improvements in pain, physical performance, and quality of life among patients with plantar fasciitis. Their findings indicated that neither intervention demonstrated clear superiority over the other, suggesting that both approaches may be useful conservative treatment options. However, further studies, particularly those with longer follow-up periods, are required to determine whether these effects are maintained over time.

Purcell et al.⁸ found that ESWT was an effective and sustained treatment for plantar fascia-related pain in physically active individuals. The relatively low morbidity associated with ESWT may make it particularly attractive for patients who wish to return to physical activity rapidly. Nevertheless, further prospective randomized controlled trials are required to determine whether ESWT provides different benefits in physically active and less-active populations and to establish the most appropriate treatment protocol for chronic plantar fasciitis.

In the study by Caglar Okur et al.¹³, custom foot orthosis (CFO) demonstrated effectiveness comparable to ESWT in reducing pain and improving foot-related function. Plantar fasciitis is common in the general population, may persist for several months, and can substantially impair daily activities and quality of life. Both ESWT and CFO were found to be useful conservative treatment modalities for reducing pain, improving foot function, and maintaining overall foot health. Short- and intermediate-term comparisons did not demonstrate a clear superiority of one treatment over the other. However, CFO appeared to provide greater benefits than ESWT for long-term pain reduction, functional improvement, and maintenance of foot health.

Leão et al.⁷ concluded that ESWT was beneficial in the management of plantar fasciitis, with improvements observed in pain, functional ability, and quality of life. Their findings further support the therapeutic potential of ESWT in patients with chronic plantar fascia-related symptoms. However, they did not establish a clear association between body mass index and treatment response, indicating that BMI may not be a reliable predictor of the effectiveness of ESWT.

Bahar-Özdemir and Atan¹⁰ investigated ESWT combined with low-dye Kinesio taping and compared it with ESWT combined with sham taping. Their findings indicated that the addition of low-dye taping did not provide a significant additional benefit in terms of heel pain or tenderness compared with sham taping. However, the combination of ESWT and low-dye taping was superior in improving foot function during the 4-week follow-up period. These findings suggest that ESWT is an effective treatment for plantar fasciitis and that combining it with an easily applicable taping technique may provide additional functional benefits. Nevertheless, studies involving larger samples and longer follow-up periods are needed to determine whether combined treatment provides sustained clinical benefits.

Haake et al.⁴ reported that the findings of their study were applicable to the therapeutic variables evaluated, as the ESWT parameters used reflected commonly applied clinical treatment conditions. However, the total shock-wave energy used in their trial was greater than that reported in several previous studies. Differences in treatment parameters, including energy level, number of impulses, frequency, and type of lithotripter, may contribute to variations in treatment outcomes. Therefore, the results of individual studies should not be generalized to all ESWT protocols. Further well-designed clinical trials using standardized treatment parameters are required to determine the optimal ESWT protocol for plantar fasciitis. The heterogeneity of shock-wave variables and treatment devices used across previous trials makes it difficult to recommend a single standardized treatment regimen.

Overall, the available evidence suggests that ESWT is a safe and potentially effective non-invasive treatment for reducing pain and improving function in patients with chronic plantar fasciitis. Its relatively low risk of serious complications and potential for sustained symptom improvement make it a promising option for patients who do not respond adequately to conventional conservative treatment. However, ESWT should generally be considered after an appropriate course of conservative management, particularly in patients with symptoms persisting for at least 6 months.

Further research is necessary to clarify the physiological and anatomical effects of ESWT on the plantar fascia and to establish the optimal treatment parameters, including energy density, number of impulses, frequency, number of sessions, and treatment intervals. Large, well-designed randomized controlled trials with follow-up periods of at least 6 months are particularly needed to determine the long-term effectiveness, durability of pain relief, functional outcomes, and recurrence rates associated with ESWT in plantar fasciitis.

Abbreviations: ESWT (Extra corporeal shock wave therapy), RCT (Randomised control trial), CFO (Custom foot orthosis), KT (Kinesio Taping), VAS (Visual Analogue Scale)

Conclusion

The findings of this review suggest that extracorporeal shock wave therapy (ESWT) is an effective non-invasive intervention for reducing pain in patients with chronic plantar fasciitis. Its potential to provide meaningful symptom relief may reduce the need for surgical intervention in patients who do not respond adequately to conservative treatment. Although transient pain or discomfort may occur during or shortly after ESWT, these adverse effects are generally well tolerated and tend to resolve rapidly.

Further research is needed to establish the optimal ESWT treatment parameters, including the lowest effective energy intensity, treatment duration, frequency, and number of sessions required to achieve clinically meaningful pain relief. Future studies should also investigate the effectiveness of ESWT in patients with acute plantar fasciitis, as evidence in this population remains limited. In addition, further investigation of pooled treatment effects and dose–response relationships is required to determine the most appropriate ESWT dosage for chronic plantar fasciitis and to support the development of standardized clinical treatment protocols.

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Conflict of Interest: None

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