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Review Article

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Recent Advances in Physiotherapy Treatment Techniques for Plantar fasciitis- A Narrative Review

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Abstract

Background: Plantar fasciitis (PF) is a common musculoskeletal disorder primarily characterized by degeneration rather than inflammation of the heel's plantar fascia, causing localized pain. It affects approximately one in ten individuals during their lifetime, with factors such as reduced ankle dorsiflexion angle and calf muscle stiffness contributing to its development. PF typically presents with severe pain upon initial weight-bearing after rest, improving with movement throughout the day. Diagnosis involves tenderness at the medial calcaneal tubercle and pain upon passive dorsiflexion of the first toe.

Despite its high prevalence, effective and early diagnosis of PF remained challenging. A better understanding of its underlying mechanisms, such as the role of calf muscle stiffness and ankle dorsiflexion limitations, was needed to improve prevention and treatment strategies. Additionally, research into the long-term outcomes of various treatments for PF, particularly conservative methods versus more invasive interventions, was crucial to guide evidence-based clinical practice

Conclusion: Extracorporeal shockwave therapy, Tapping, Local vibration, stretching exercises and Dry needling with electrotherapy shows significant improvement in reducing pain, improving ROM and foot functions among patients with plantar fasciitis.

Keywords: Plantar fasciitis, range of motion, Extracorporeal shockwave therapy, Dry needling with electrotherapy

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1. Introduction

Plantar fasciitis (PF) is a common musculoskeletal disorder. Histological findings of patients reveal that PF is a degenerative process rather than inflammation. (1) PF is a disease caused by degeneration of the fascia. And it causes localized pain. (2) PF is a frequent problem that one in every ten people may face in their lives. (3) There are various elements that influence the development of PF. Reduction of the ankle dorsiflexion angle, along with calf muscular stiffness, has been seen for the development of the PF. (4) It's still unclear what causes. The majority of researchers think that overuse and degeneration are more likely to play a role in the pathophysiology of plantar fasciitis than inflammation. (5) The classic symptoms include excruciating pain that worsens with prolonged weight bearing but becomes better with movement on the morning or after a period of rest. Typically, a physical examination reveals pain with

passive dorsiflexion of the first toe and soreness to palpation on the medial calcaneal tubercle. (6) PF is a common cause of heel discomfort in adults. Taking the first step after a prolonged rest or walking up in the morning are common with pain in the medial side of the heel. PF should be distinguished from other conditions like osteomyelitis, calcaneal stress fractures, and rheumatoid nodules. It occurs between the 3 ages of 25 and 64 make up the bulk of the patients. (5) One of the main supporting elements of the foot's longitudinal arch is the plantar aponeurosis, or fascia, which emerges from the medial tubercle of the calcaneus and inserts into the phalanges via an intricate web of fibrous tissue. (7) The plantar fascia, which has three segments that begin at the calcaneus, is vital to preserving the foot's natural biomechanics, supporting the arch, and acting as a shock absorber.

Table 1. Type of study, Participants Details and study result

Sr.No.	Type of study, Year & Participants Details	Groups	Results
1.	RCT, 2023 25-56 Years of age group of patients included. (9)	69 participants divided into three groups Ultrasound, Radial Shock Wave therapy, Ultrasound and Radial Shock. Conventional therapy will be common in each group.	According to the study, RSW and US coupled with traditional physical therapy exercises has efficacy in improving foot function and active ROM of the ankle dorsiflexion.
2.	RCT, 2019 21-60 Years of age group of patients included. (10)	94 participants divided into two groups Dry needling group and Percutaneous needle electrolysis.	PNE is being increasingly used in order to promote the regeneration of tendon injury and gradually recognized as an invasive approach in physiotherapy.
3.	RCT, 2018 25-60 Years of age group of patients included. (11)	111 participants divided into two groups Manual Therapy, exercises, Ultrasound group and Electrical Dry Needling, Manual Therapy, exercises and Ultrasound group.	According to the study patients who received Manual Therapy, Exercises, Electrical Dry Needling and Ultrasound has significant improvement in the pain, function, foot health.
4.	RCT, 2023 20-60 Years of age group of patients included. (12)	34 participants divided into two groups Extracorporeal shockwave therapy and local vibration group and Extracorporeal shockwave therapy.	Treatment with ESWT and LV combined showed a significant difference between the 2 groups in thickness of the plantar fascia and the NRS.
5.	RCT, 2019 18-70 Years of age group of patients included. (13)	95 participants are randomly allocated and divided into two groups usual podiatric care + physical therapy treatment and usual podiatric care.	Upod+PT group shows the significant changes and improvement in the pain in the patients with plantar fasciitis.
6.	A Double-blind Randomized Clinical Trial, 2024 18-55 Years of age group of patients included. (14)	50 participants are randomly allocated and divided into two groups Extracorporeal shockwave therapy group and High-intensity Laser Therapy.	HILT is preferred because it is more effective in the improvement of pain and quality of life and is also more accessible with less pain and cost.
7.	RCT, 2019 20-60 Years of age group of patients included. (15)	71 participants are allocated and divided into two groups Cupping + active dorsiflexion + Self stretch group and Active dorsiflexion + self-stretch group	Dry cupping on MTrPs in the calf muscle in patients with heel pain can be the simple technique that could decreases pain.
8.	RCT, 2023 20-50 Years of age group of patients included. (5)	69 Participants are randomly allocated and divided into three groups Dynamic Taping group, Kinesiology Taping group and Conservative physical therapy group.	Dynamic taping with PT is the most effective method for FFI and YBT in patients with plantar fasciitis, and dynamic taping and KT with PT can be used as effective methods for pain and foot pressure.
9.	RCT, 2023 Subjects of all genders with plantar fasciitis of the age group 20–60 years. (16)	Thirty-six patients with PF were randomly allocated to three study groups. Group Gua Sha, group Cryostretch, and group Position release technique, respectively.	Gua Sha, Cryostretch and position technique are significantly improving the pain. Each and every technique have the respective terms to improve in the plantar fasciitis.
10.	RCT, 2024; Patients of both sexes with a unilateral diagnosis of PF. (17)	136 patients are allocated and divided into two groups Iontophoresis group and Shock wave treatment group	Shock wave therapy offers better effectiveness than iontophoresis therapy for the treatment of PF, offering improvement in pain reduction.
11.	RCT, 2023; Patients aged between 18 and 70, those previously diagnosed with PF, and patients who did not benefit from conservative treatment for at least six months. (18)	90 patients were randomized to three groups, with 30 feet in each group: the CI group, the ESWT group, and the KT group.	ESWT, CI, and KT, are effective in reducing pain and increasing function in chronic PF. where CIs can be more effective in relieving pain in the early period, the most significant improvement at the end of the sixth month was achieved by ESWT.
12.	RCT, 2021 40-70 Years of age group of patients included. (19)	30 patients are randomly allocated into 2 groups experimental group and control group.	ESWT is more efficient when compared with the traditional group on PF.
13.	RCC, 2021 30-50 Years of age group of patients included. (20)	60 patients are randomly allocated into 2 groups ACTIVE HILT+ ACTIVE US and SHAM HILT+ ACTIVE US	The HILT does not appear to be more effective in pain management of patients with calcaneal spurs and plantar fasciitis than the conservative standard physiotherapeutic procedures.
14.	RCT, 2021; The patients to be aged between 18 years and 60 years. (21)	50 patients are allocated into 2 groups foam roller group and self-stretching group.	The effectiveness of foam rolling was superior to stretching in terms of increase in the PPTs at gastrocnemius and soleus.
15.	RCT, 2021; 21-60 Years of age group of patients included. (22)	All participants signed the informed consent and were randomised to the DN or PNE group in blocks of 10 patients.	Although both DN and PNE were found to be effective in improving QoL for PHP management, PNE treatment was more cost-effective than DN, with significant differences at 52 weeks.

A common overuse injury that results in PF is micro tears and cause weakness in the plantar fascia from repetitive tension. Sharp, isolated heel pain is the traditional presentation. (8)

A higher prevalence of plantar fasciitis was observed in women compared to men, in those aged 45 to 64 versus those aged 18 to 44, and in those with a body mass index >25 kg/m². Some literature shows that runners' prevalence rates are as high as 22%.

Physiotherapy for Plantar Fasciitis (PF) focuses on relieving pain, improving mobility, and restoring function by addressing the underlying biomechanical causes. Physiotherapists use a range of non-invasive techniques, including manual therapy, therapeutic exercises, modalities (e.g., ultrasound, heat/cold therapy), and patient education. The primary goal is to reduce pain, improve ankle mobility, and strengthen supporting muscles like the calf and feet, particularly in mild to moderate cases of PF. These interventions aim to rehabilitate the affected area and prevent future injury.

2. Objectives of the study

To study most effective recent advances for managing pain range of motion in the patients with plantar fasciitis.

3. Methodology

There will be no limitation concerning sample size, age of patients, or study design. Studies published between 2018 and 2024 will be included. Studies will evaluate the effect of recent advanced technique in physiotherapy along with conventional therapy in patients with plantar fasciitis.

Exclusion Criteria: Studies that are not relevant or involve other plantar fasciitis pathologies, articles published before 2018, studies not in the English language, studies with fewer than 10 patients in the intervention cohort, studies that do not involve clinical trials, and those that are not full-text articles will be excluded. **Inclusion Criteria:** Eligible studies must evaluate the effects of recent advanced physiotherapy techniques, in conjunction with conventional therapy, for patients with plantar fasciitis. Only studies published between 2018 and 2024 will be considered. Additionally, only studies involving human subjects, written in English, and with an intervention cohort of more than 10 patients will be included. All included studies must be full-text articles.

4. Discussion

The goal of the study is found out the recent advances on the plantar fasciitis. Plantar fasciitis is a common musculoskeletal disorder which causes the localised heel pain. PF characterized by degeneration rather than inflammation of the heel's plantar fascia, causing localized pain. It affects approximately one in ten individuals during their lifetime, with factors such as reduced ankle dorsiflexion angle and calf muscle stiffness contributing to its development. PF typically presents with severe pain upon initial weight-bearing after rest, improving with movement throughout the day. Diagnosis involves tenderness at the medial calcaneal tubercle and pain upon passive dorsiflexion of the first toe. The plantar fascia, integral to foot biomechanics, supports the

longitudinal arch and acts as a shock absorber. Micro tears from repetitive stress are common, leading to sharp, isolated heel pain. (8)

A study found that combining Radial Shock Wave Therapy (RSWT), Ultrasound Therapy, and physical therapy exercises effectively improved foot function and ankle dorsiflexion in patients with chronic plantar fasciitis. RSWT enhances blood flow, reduces inflammation, and promotes tissue healing, while ultrasound increases circulation and stimulates collagen production. Physical therapy exercises improve flexibility, strengthen muscles, and correct movement imbalances, leading to better mobility and reduced pain. Together, these treatments address both the symptoms and underlying causes of the condition. (9).

A study found that PNE is being increasingly used in order to promote the regeneration of tendon injury and gradually recognized as an invasive approach in physiotherapy. Percutaneous Needle Electrolysis (PNE) involves inserting a needle into the injured tendon and applying a direct electrical current. This triggers microtrauma in the tissue, which stimulates the body's natural healing process, promoting inflammation and the recruitment of cells involved in repair. The electrical current also enhances cell activity, improving collagen synthesis and local circulation. This combination of effects accelerates tendon regeneration, reduces pain, and restores function. However, more research is needed to determine the best treatment parameters and confirm its long-term benefits. (10).

The patients with PF who received manual therapy, exercise, ultrasound, and electrical dry needling (EDN) can be explained by EDN's ability to reduce pain, enhance tissue healing, and improve muscle function. EDN stimulates sensory nerves to block pain signals, increases blood flow to promote healing, reduces muscle tension and trigger points that strain the plantar fascia, and accelerates collagen synthesis for better tissue repair. This comprehensive approach addresses multiple physiological mechanisms, leading to reduced pain, improved foot function, and quicker recovery compared to treatment with manual therapy, exercise, and ultrasound alone. ESWT uses high-energy acoustic waves to create microtrauma in the plantar fascia, stimulating the body's natural healing process, enhancing collagen production, improving blood circulation, and reducing inflammation. LV, on the other hand, increases local circulation, stimulates mechanoreceptors in the tissue, and promotes muscle relaxation, which can help reduce tension and improve tissue flexibility. Together, these therapies complement each other by accelerating tissue repair, reducing pain, and improving the thickness and health of the plantar fascia. (11,12).

In the study comparing two treatment groups Podiatric Care (Upod) with Physical Therapy (PT) versus Podiatric Care (Upod) alone the group receiving both Upod and PT showed significant improvements in pain levels in patients with plantar fasciitis. The combination of podiatric care and physical therapy likely contributes to better outcomes by addressing multiple aspects of the condition, such as pain, muscle imbalances, and

inflammation. However, due to the potential bias in pre-protocol analysis (where the groups may not have been equally matched or randomized), these findings need to be confirmed through more rigorous and controlled studies to ensure reliability and to rule out any confounding factors. (13).

The patients who received HILT was found to be more effective in improving pain and quality of life. HILT works by delivering deep tissue penetration of light energy, which stimulates cellular repair, reduces inflammation, and promotes collagen synthesis in the affected tissues, leading to pain relief and faster recovery. Additionally, HILT is preferred due to its higher accessibility, lower cost, and the fact that it is generally less painful during treatment compared to ESWT, which involves higher-intensity mechanical waves that can cause temporary discomfort. These factors make HILT a more patient-friendly and cost-effective treatment option for plantar fasciitis. The patients who received dry cupping on the myofascial trigger points in the calf muscle, along with active dorsiflexion and self-stretching, showed significant improvements in pain relief. Dry cupping helps by creating a vacuum effect that increases blood flow to the area, reduces muscle tension, and promotes the release of trigger points, which are often sources of referred pain in heel pain conditions like plantar fasciitis. This, combined with the benefits of self-stretching and active range-of-motion exercises, enhances flexibility and reduces strain on the plantar fascia, leading to reduced pain. Dry cupping on myofascial trigger points in the calf thus appears to be a simple yet effective technique to decrease pain and improve function in patients with heel pain. (14,15).

The patients who received Dynamic Taping with PT showed the most significant improvements in Foot Function Index (FFI) and Y Balance Test (YBT) scores. Dynamic Taping, combined with physical therapy, helps to provide mechanical support and offload stress from the plantar fascia, promoting better foot biomechanics and reducing pain. Kinesiology Taping, while less restrictive than Dynamic Taping, also helps by providing proprioceptive feedback, improving posture, and reducing pain, making both taping methods effective for enhancing foot pressure distribution and reducing discomfort. Overall, both Dynamic Taping and Kinesiology Taping with PT are effective methods for managing pain, improving foot function, and reducing pressure in patients with plantar fasciitis. (5).

The patients who received all three techniques shows the significant effect Gua Sha works by enhancing blood flow and breaking down fascial adhesions, promoting tissue healing and reducing muscle tension. Cryo stretch combines cold therapy to reduce inflammation and numb pain with stretching to improve flexibility and release muscle tightness. Positional Release Technique targets muscle imbalances and trigger points by positioning the body to relieve pressure on affected tissues, reducing muscle spasms and promoting relaxation. Together, these techniques improve circulation, decrease inflammation, and address muscle dysfunction, leading to pain relief and functional recovery. Shock wave therapy offers better

effectiveness that iontophoresis therapy for the treatment of PF, offering improvement in pain reduction (16,17).

A study found that all three treatment modalities—ESWT, CI, and KT—were effective in reducing pain and improving function in patients with chronic PF. However, while Corticosteroid Injections (CIs) were more effective at pain relief in the short term, ESWT provided the most significant improvement in both pain reduction and function by the sixth month. This suggests that while CIs may offer rapid relief, ESWT provides longer-lasting benefits and is the most effective treatment in the long-term management of chronic plantar fasciitis. ESWT is more efficient when compared with the traditional group on PF (18,19).

A study found that HILT did not show greater effectiveness in pain management compared to conservative physiotherapy procedures. While HILT uses high-energy light to stimulate tissue healing and reduce inflammation, the results indicated that the combination of Active Ultrasound and SHAM HILT was just as effective as ACTIVE HILT with Active Ultrasound. This suggests that HILT may not offer significant additional benefits over standard physiotherapeutic treatments for managing pain associated with calcaneal spurs and plantar fasciitis. (20).

The patients who received foam rolling was found to be more effective in increasing the Pressure Pain Thresholds (PPTs) in the gastrocnemius and soleus muscles. Foam rolling works by applying pressure to muscle tissue, which helps release muscle tightness, improve blood flow, and reduce fascial restrictions. This mechanical stimulation increases tissue flexibility, reduces muscle soreness, and elevates the PPT, indicating a decrease in muscle sensitivity and pain. In contrast, while self-stretching can improve flexibility, foam rolling provides deeper myofascial release and a more immediate increase in pain threshold, making it superior in improving muscle function and reducing discomfort in the calf muscles. (21).

The patients who received DN and PNE were found to be effective. Both treatments were found to be effective in improving Quality of Life (QoL) in PHP management. However, PNE was noted to be more cost-effective than DN, despite both therapies providing similar benefits in pain relief and functional improvement. PNE works by using a low-voltage electrical current delivered through a needle to promote tissue regeneration and reduce inflammation, while DN involves inserting a needle to trigger healing by stimulating the affected tissue. PNE's cost-effectiveness could be attributed to shorter treatment times and fewer resources required, making it a practical option for long-term management of plantar heel pain. (22).

5. Conclusion

Extracorporeal Shockwave Therapy (ESWT), Taping, Local Vibration Therapy, Stretching Exercises, and Dry Needling with Electrotherapy has proven effective in treating Plantar Fasciitis (PF) by reducing pain, improving range of motion, and enhancing foot function.

ESWT promotes healing and reduces pain, while taping provides support and alleviates strain. Local vibration therapy improves circulation and relaxes muscles, and stretching exercises enhance flexibility. Dry needling with electrotherapy targets muscle tension and improves muscle function, collectively addressing both symptoms and underlying causes of PF for better recovery.

Abbreviations

PF: Plantar Fasciitis
 ROM: Range of Motion
 KT: Kinesio taping
 ESWT: Extracorporeal shockwave therapy
 LV: Local vibration
 DT: Dynamic tapping
 HILT: High intensity laser therapy
 RCT: Randomised Control Trail

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

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