

# Endoscopic plantar fasciotomy versus extracorporeal shock wave therapy for treatment of chronic plantar fasciitis

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## Abstract

**Background** Planter fasciitis is a common cause of heel pain in adults. Many treatment options exist. Most of patients resolve with conservative management. Approximately 10% of patients develop persistent and often disabling symptoms.

**Patients and methods** This prospective study includes 37 patients with an established diagnosis of chronic plantar fasciitis, aiming to compare two different techniques of treatment. First group includes 17 patients with a mean age of 42 years treated by endoscopic plantar fasciotomy (EPF); the mean follow-up was 11 months. Second group includes 20 patients with a mean age of 45 years treated by extracorporeal shock Wave Therapy (ESWT); the mean follow-up was 7.6 months.

**Results** In the first group (EPF), using the visual analog scale the average post-operative pain was improved from 9.1 to 1.6. Post-operatively, 58.8% had no limitation of functional activities, 35.3% had minimal limitation of activities and 5.9% had moderate limitation of activities. Concerning patient satisfaction, 82.3% of patients were completely satisfied, 11.8% of patients were satisfied with reservation and 5.9% of patients were unsatisfied. For the second group (ESWT), using the visual analog scale the average post-operative pain was improved from 9 to 2.1. Post-operatively, 50% had no functional limitation of

activities, 35% had minimal limitation of activities, 10% had moderate limitation of activities, and 5% had severe limitation of activities. Concerning patient satisfaction, 75% of patients were completely satisfied and 25% were satisfied with reservation or unsatisfied.

**Conclusion** Because of better results with endoscopic release versus the benefits of no complications, no immobilization, and early resumption of full activities with ESWT, we conclude that ESWT is a reasonable earlier line of treatment of chronic plantar fasciitis before EPF.

**Keywords** Plantar fasciitis · Endoscopic plantar fasciotomy · Extracorporeal shock wave therapy

## Introduction

The plantar fascia is a thickened fibrous aponeurosis that originates from the medial tubercle of the calcaneus and runs forward to form the longitudinal foot arch. The function of plantar fascia is to provide static support of the longitudinal arch and dynamic shock absorption. Patients with pes planus or pes cavus are at increased risk for developing plantar fasciitis. Other anatomical risks include overpronation, leg length discrepancy, excessive tibial torsion, excessive femoral anteversion, and increased body mass index. Functional risk factors include tightness or weakness of the gastrocnemius, soleus, Achilles tendon and intrinsic foot muscles [1].

Plantar fasciitis is a common cause of heel pain in adults. The pain is usually caused by collagen degeneration at the origin of the plantar fascia at the medial tubercle of the calcaneus. The cause of degeneration is repetitive microtears of the plantar fascia that overcome the body's capacity to repair itself [2].

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The classic sign of plantar fasciitis is that the worst pain occurs with the first few steps in the morning or at the beginning of the activity that lessens as the patient warms up. In more severe cases, the pain will also worsen toward the end of the day [3].

In general, plantar fasciitis is a self-limiting disease. Unfortunately, the time until resolution is often 6–18 months, which can lead to frustration for patients and physicians [4].

Conservative lines of treatment, including non-steroidal anti-inflammatory drugs, heel pads or orthotics, physical therapy, stretching exercises, corticosteroid injections, and extracorporeal shockwave therapy, are regarded as the mainstay of treatment and provide substantial relief to about 80% of patients [5]. The history of extracorporeal shock wave dates back to World War II [6].

The term “shock wave” denotes a high energy sound wave that terminates in a bursting of energy similar to a mini-explosion. Extracorporeal shock wave therapy (ESWT) utilizes a high peak pressure ranging from 5 to 130 Mpa, with a most common energy of 50 Mpa and a broad frequency of 14 Hz to 20 MHz. The most significant aspect of this unique form of energy is the rapid initial rise in pressure amplitude over a short life cycle of less than 10 ns [7].

The action of ESWT is a result of a process called cavitation, which is defined as the formation and movement of bubbles in a fluid. Strong forces exerted in the region of a moving bubble cause mechanical tissue disruption. The repair of the mechanical tissue disruption is the theoretical basis for the neo-vascularization process and subsequent pain relief following ESWT [8].

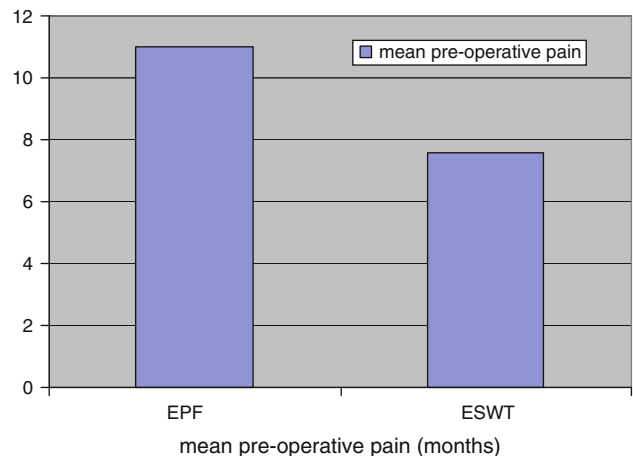
The mechanisms of pain relief are attributed to a release of enzymes, which effect nociceptor, and more importantly, the neovascularization occurs following the ESWT application [9].

When conservative measures fails, surgical plantar fasciotomy with or without heel spur removal may be employed. There is a consensus that release of the plantar fascia, either percutaneously, endoscopically, or through an open procedure, is an effective treatment without the need for removal of a calcaneal spur, when present [10].

The purpose of this prospective study was to compare the results of ESWT and EPF in treatment of chronic plantar fasciitis, in patients resistant to conservative treatment for a minimum of 6 months.

## Materials and methods

Between July 2007 and September 2008, 37 patients (22 females and 15 males) with chronic plantar fasciitis were treated at Madina National Hospital and Al-Rahma Hospital, Al-Madina Al-Munawara, KSA.



**Fig. 1** Mean pre-operative pain

Inclusion criteria in this prospective study were failure of conservative treatment for at least of 6 months which includes non-steroidal anti-inflammatory drugs, stretching exercises, orthoses, immobilization, and/or local steroid injection. Patients with previous heel surgery or painful heel due to other systemic or local causes were excluded from this study.

After failure of conservative treatment, personal interview with each patient was done to discuss the choice of the patient (either EPF or ESWT) and explain the possible outcome. Seventeen patients (8 males and 9 females) with a mean age of 42 years (range 29–59 years) chose to undergo endoscopic release of plantar fascia and constitute the first group. Using the VAS, the average pre-operative pain was 9.1 (range 8–10). Twenty patients (13 females and 7 males) with a mean age of 46 years (range 27–62 years) chose to undergo ESWT and constitute the second group. Using the VAS, the average pre-operative pain was 9 (range 8–10). All patients had a history of heel pain for greater than 6 months with median of 16.4 months (range 7–72 months) (Fig. 1).

## Technique of EPF

Under general anesthesia and supine position, the procedure was performed in all patients using medial and lateral portals. The medial portal was placed 2 cm above the distal heel skin and about 1 cm behind the posterior border of the medial malleolus. A small horizontal incision and blunt dissection of subcutaneous tissue medial to the plantar fascia were done. A path was created using a curved elevator just distal to the plantar fascia from medial to lateral border. A slotted arthroscopic cannula was introduced in this plane until impinging on the lateral skin of the heel to create the lateral portal through small incision. An arthroscope was

then introduced from medial portal for visualization of plantar fascia. Using a hook knife through the lateral portal and the slotted cannula, divided the medial half of the plantar fascia from medial to lateral direction under direct vision. The incisions were closed with one suture and dressings are applied. Partial weight-bearing was allowed when tolerable with soft shoes for the first 2 weeks post-operatively.

### Technique of ESWT

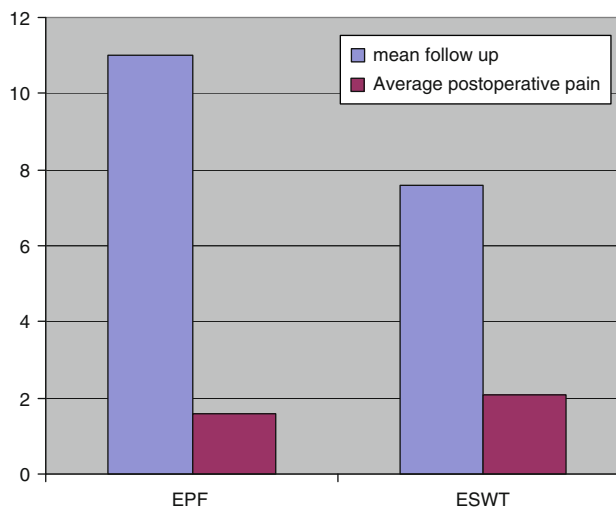
First, the area of intense pain was localized using a skin marker. All procedures were performed under local infiltration anesthesia using 5 cc of 0.5% bupivacaine. Using ultrasonic gel as a coupling medium, the head of shock wave device was applied to the inferior aspect of the calcaneus. The energy intensity applied ranged from 17 to 21 kV, 2 Hz, 1,500–3,000 pulses and were divided into two distinct directional application (one vertical and another one at 45° to the target area). All patients were allowed for weight bearing but no sport activities or excessive walking before 2 weeks.

### Follow-up

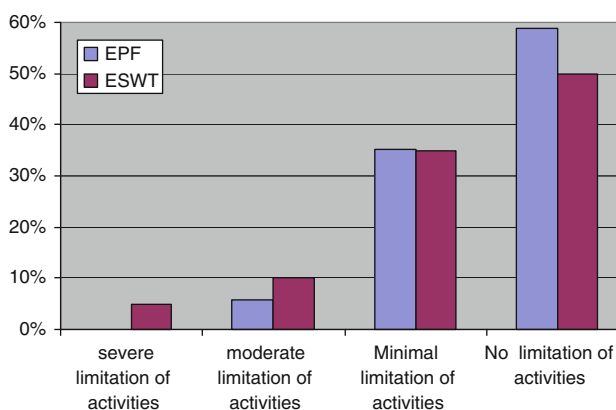
All patients were seen post-operatively at 1 week, 2 weeks, 6 weeks, 3 months, and 6 months. All patients continued with their prior conservative treatment including NSAIDs as needed, orthoses, and stretching exercises. Using the VAS, patients were evaluated for pre-procedure pain, pain at each post-operative visit. All patients in the study completed a questionnaire pre-operatively, at 3 and 6 months follow-up visits. This questionnaire included the following; pain level using VAS when getting out of bed, at rest, and after activity; effect of the procedure on patient condition; and patient satisfaction. All patients had a radiograph made of the heel before the treatment, immediately post-operatively, and at the 6 months follow-up evaluation for detection of any structural changes of the hindfoot or arch changes.

### Results

As regard the first group; the mean follow-up was 11 months (range 8–14 months). Using the VAS, the average pre-operative pain was 9.1 (range 8–10). According to patient's questionnaire; 64.7% of patients (11 patients) had severe limitation of activities, and 35.3% of patients (6 patients) had moderate limitation of activities pre-operatively. Post-operatively, using the same scale the pain decreased to average of 1.6 (range 0–6). Ten patients



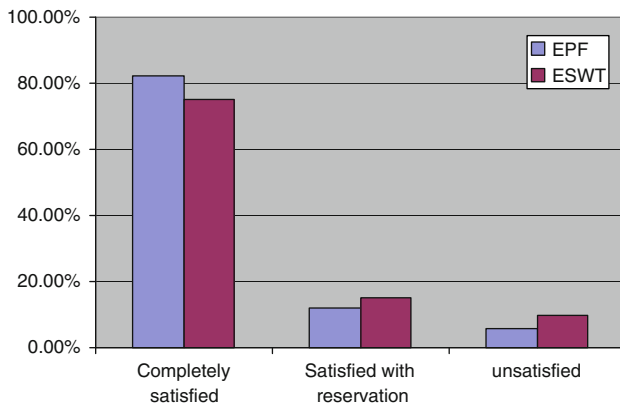
**Fig. 2** Mean follow-up duration and post-operative pain scale



**Fig. 3** Post-operative limitation of activities

(58.8%) had no functional limitations post-operatively, and six patients (35.3%) had minimal functional limitations. Only one patient (5.9%) had moderate functional limitation post-operatively. Fourteen patients (82.3%) were completely satisfied, two patients (11.8%) were satisfied with reservations, and one patient (5.9%) was unsatisfied with the end result of EPF (Fig. 2).

As regard the second group (ESWT), the mean follow-up was 7.6 months (range 6–11 months) using the same VAS, the pain was improved from average of 9 (range 0–10) pre-operatively to average of 2.1 (range 0–8) post-operatively. Prior to the procedure, 12 patients (60%) had severe limitation of functional activities, 8 patients (40%) had moderate limitation of functional activities. Post-procedure, ten patients (50%) had no functional limitations of activities, seven patients (35%) had minimal limitation of functional activities, two patients (10%) had moderate functional limitation, and one patient (5%) had marked limitation of functional activities (Fig. 3). Fifteen patients



**Fig. 4** Post-operative patient satisfaction

**Table 1** Results of the whole study

	EPF	ESWT
Mean follow up (months)	11	7.6
Average post-operative pain	1.6	2.1
Severe limitation of activities	0%	5%
Moderate limitation of activities	5.9%	10%
Minimal limitation of activities	35.3%	35%
No limitation of activities	58.8%	50%
Completely satisfied	82.3%	75%
Satisfied with reservation	11.8%	15%
Unsatisfied	5.9%	10%

(75%) were completely satisfied with end results, three patients (15%) were satisfied with reservations, and two patients (10%) were unsatisfied with ESWT end results. Between 6 weeks and 3 months, 6 of the 17 patients (35.3%) in the EPF group took oral non-steroidal anti-inflammatory drugs in comparison to 7 of the 20 patients (35%) in the ESWT group. Between 3 and 6 months only one patient in the EPF group (5.9%) took oral NSAIDs in comparison to three patients (15%) in the ESWT group (Fig. 4) (Table 1).

There were only two complications in the patients of first group; one has superficial wound infection that resolved completely after 5 days of oral antibiotics; one has numbness in the area of medial side of the heel that was relieved completely after 6 weeks. No post-operative foot deformities or changes in the arches were noted clinically or radiologically in patients who had EPF. The average period before return to work or daily activities was 6 weeks for patients of the EPF group in comparison to 2 weeks only for patients in the ESWT group.

## Discussion

The plantar fascia is one of the important static structures that support the medial longitudinal arch. Plantar fasciitis occurs as result of repetitive microtrauma at the origin of the medial tuberosity of the calcaneus; traction forces during sport lead to an inflammatory process that results in fibrosis and degeneration [11].

There is a professional consensus, 70–90% of heel pain patients can be managed by non-operative measures. When conservative treatment fails, surgical plantar fasciotomy with or without heel spur removal and neurolysis of the lateral plantar nerve have been employed [12]. Surgery of plantar fasciitis should be considered only after all other forms of treatment have failed. The most common procedure is a partial plantar fasciotomy that may be open, percutaneously, or endoscopically. The success rate of surgical release is variable 70–90%. Recovery from surgery can vary from several weeks to few months, and has potential complications including transient swelling of the heel, heel hyposthesia, rupture of plantar fascia, flattening of the longitudinal arch, and calcaneal fracture [13].

A new treatment being investigated is ESWT, which uses pulses of high-pressure sound waves to bombard damaged tissue to relieve pain associated with plantar fasciitis. ESWT has been known as the alternative to surgery for those with long-standing resistant heel pain. It is non-invasive, has a relatively short recovery time and claims a success rate comparable to surgery [14].

There is some dispute regarding how this treatment actually affects the body. Some say it stimulates blood flow and perhaps elicits a beneficial immune response, while others contend the shock waves in effect re-injure the tissue, thereby initiating a healing response. Yet other experts propose the pulses bombard the central nervous system, essentially shutting the neural pathways down to relieve the pain [15].

Lowell et al. [9] comparative study included two groups of patients, 82% of the patients treated with ESWT were successfully treated as compared to 83% of the patients treated with percutaneous plantar fasciotomy. The results of the first group were compared to the results of our study.

Urovitz et al. [5] in comparative study of the use of EPF in the treatment of chronic heel pain that was unresponsive to conservative treatment concluded that EPF gave favorable results over 80% of patients, and is a reasonable option in the treatment of chronic heel pain that failed to respond to a trial of conservative treatment. Our results of the prospective study of the first group EPF are comparable to results of the retrospective study of Urovitz et al. [5].

In the current study, although the results of surgery were slightly better, the benefits of no complications, no immobilization, and early return to work make ESWT an attractive

alternative for the treatment of chronic plantar fasciitis after failure of conservative treatment for at least 6 months.

## Conclusion

Endoscopic plantar fasciotomy gives better results than extra-corporeal shock wave therapy, but with liability of minor complications. ESWT has the advantages of no morbidity, and early resumption of full activities, but a large patient population and a longer follow-up will be needed to determine the curative and the adverse effects of this procedure.

ESWT is a reasonable earlier line of treatment of chronic plantar fasciitis before EPF is tried. That is to say that we can use it as a first line of treatment before surgery when conservative treatment fails to control the symptoms of plantar fasciitis after 6 months.

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## References

- Khan KM, Cook JL, Taunton JE, Bonar F (2000) Overuse tendinosis, not tendonitis; a new paradigm for a difficult clinical problem (part1). *Phys Sportsmed* 28:172–175
- Barrett SL, Robert OM (1999) Plantar fasciitis and other causes of heel pain. *Am Fam Physician* 59(8):2200–2206
- Lynch DM, Goforth WP, Martin JE, Odom RD, Preece CK, Kotter MW (1998) Conservative treatment of plantar fasciitis. A prospective study. *J Am Podiat Med Assoc* 88:375–380
- Craig CY, Darin SR, Mark WN (2001) Treatment of plantar fasciitis. *Am Fam Physician* 63(1):467–474
- Urovitz EP, Urovitz AB, Urovitz EB (2008) Endoscopic plantar fasciotomy in the treatment of chronic heel pain. *Can J Surg* 51(4):281–283
- Coombs T, Schaden S, Zhou L (2000) Musculoskeletal shockwave therapy. Greenwich Medical Media, Ltd, London
- Toth-Kischkat A (2000) Physical principles of shockwave. In: Presented at 3rd Congress of the international society of musculoskeletal shockwave therapy, Naples, Italy, June
- Wang CJ (2000) Shock wave enhanced neovascularization at the tendon bone junction: an experiment in dogs. In: Presented at 3rd congress of the international society of musculoskeletal shockwave therapy, Naples, Italy, June
- Lowell SW, Thomas SR, Borrelli AH (2002) Extracorporeal shock wave therapy for treatment of chronic plantar fasciitis: indications, protocol, intermediate results, and a comparison of results to fasciotomy. *J Foot Ankle Surg* 41(3):166–172
- Lundeen RO, Aziz S, Burks JB, Rose JM (2000) Endoscopic plantar fasciotomy: a retrospective analysis of results in 53 patients. *J Foot Ankle Surg* 39(4):208–217
- Roxas M (2005) Plantar fasciitis: diagnosis and therapeutic considerations. *Alt Med Rev* 10:83–93
- Martin R (1998) Outcomes study of subjects with insertional plantar fasciitis. *Foot Ankle Int* 19(12):803–811
- Young CC, Rutherford DS, Saxby TS (2001) Treatment of plantar fasciitis. *Am Fam Physician* 63:467–474, 477–478
- Theodore GH, Buch M, Amendola A (2004) Extracorporeal shock wave therapy for treatment of plantar fasciitis. *Foot Ankle Int* 25:290–297
- Ogden JA, Cross GL, Williams SS (2004) Bilateral chronic proximal plantar fasciopathy: treatment with electro hydraulic orthotripsy. *Foot Ankle Int* 25:298–302