Plantar Fasciitis: Analysis of Therapeutic Options

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ABSTRACT
This report aims to review the different treatment options for plantar fasciitis. We conducted a virtual survey of foot and ankle specialists in our country where we asked for their opinion on the treatment of plantar fasciitis. The results varied, which shows that there is no single response to chronic treatment. **Conclusion:** Plantar fasciitis is a frequent, painful condition. The origin is unknown, but the association with multiple factors is known. Many treatment modalities have been recommended, including drugs, physiotherapy, orthotic devices, and surgery, but no report analyzes the effectiveness of each of them separately or categorically confirms its benefits.
Keywords: Plantar fasciitis; fasciotomy; gastrocnemius resection; plantar orthosis.
Level of Evidence: V

Fascitis plantar: análisis de opciones terapéuticas

RESUMEN
El objetivo de este artículo es analizar las distintas opciones de tratamiento. Se realizó una encuesta virtual a diferentes traumatólogos especialistas en pierna y pie, sobre el tratamiento de la fascitis plantar. Los resultados fueron variados, lo que demuestra que no hay una respuesta concreta ante el tratamiento crónico. **Conclusiones:** La fascitis plantar es un cuadro doloroso frecuente. Su origen es desconocido, pero está relacionada con múltiples factores. Se han recomendado muchas modalidades terapéuticas, como fármacos, fisioterapia, ortesis y cirugía, pero no existe un estudio que analice la eficacia de cada una de ellas por separado ni que confirme categóricamente su utilidad.
Palabras clave: Fascitis plantar; fasciotomía; liberación de gastrocnemio; ortesis plantar.
Nivel de Evidencia: V

INTRODUCTION

Heel pain is a frequent medical concern and plantar fasciitis is its most common cause, accounting for approximately 80% of cases.[1]

Plantar fasciitis is caused by a chronic inflammatory/degenerative irritation of the plantar fascia, mainly in its proximal insertion in the tubercle of the calcaneus.[1] Its origin is still unknown and multiple factors are attributed to it, including myxoid degeneration, collagen necrosis, microtears in the fascia and micro angioblastic hyperplasia.[1] Although its cause is unknown, there are known predisposing situations, such as foot support disorders (flat/cavus foot, varus/valgus foot), overweight, lower limb asymmetries, musculotendinous contractures or shortening, trades or jobs that require long periods of standing and certain jogging or high-impact physical activities, e.g. running. The clinical diagnosis is simple and the characteristic presentation is pain in the proximal insertion of the plantar fascia, on the medial tubercle of the calcaneus, commonly more pronounced in the morning or after periods of resting or sitting; it tends to decrease with activity and may increase after prolonged standing. Passive dorsiflexion of the toes and foot exacerbates the pain by tightening the plantar fascia (Figure 1).

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Figure 1. A. Characteristic location of pain. B. Clinical maneuver that exacerbates the pain at the indicated point.

In general, not many complementary studies are required for its diagnosis, simple radiographs can show chronic calcifications in the insertion of the plantar fascia or eventually associated foot support disorders, such as flat or cavovarus foot; ultrasound and magnetic resonance imaging confirm the diagnosis by showing inflammation, degeneration, or thickening of the plantar fascia and are also useful for evaluating additional situations or ruling out other causes of heel pain (Figure 2).

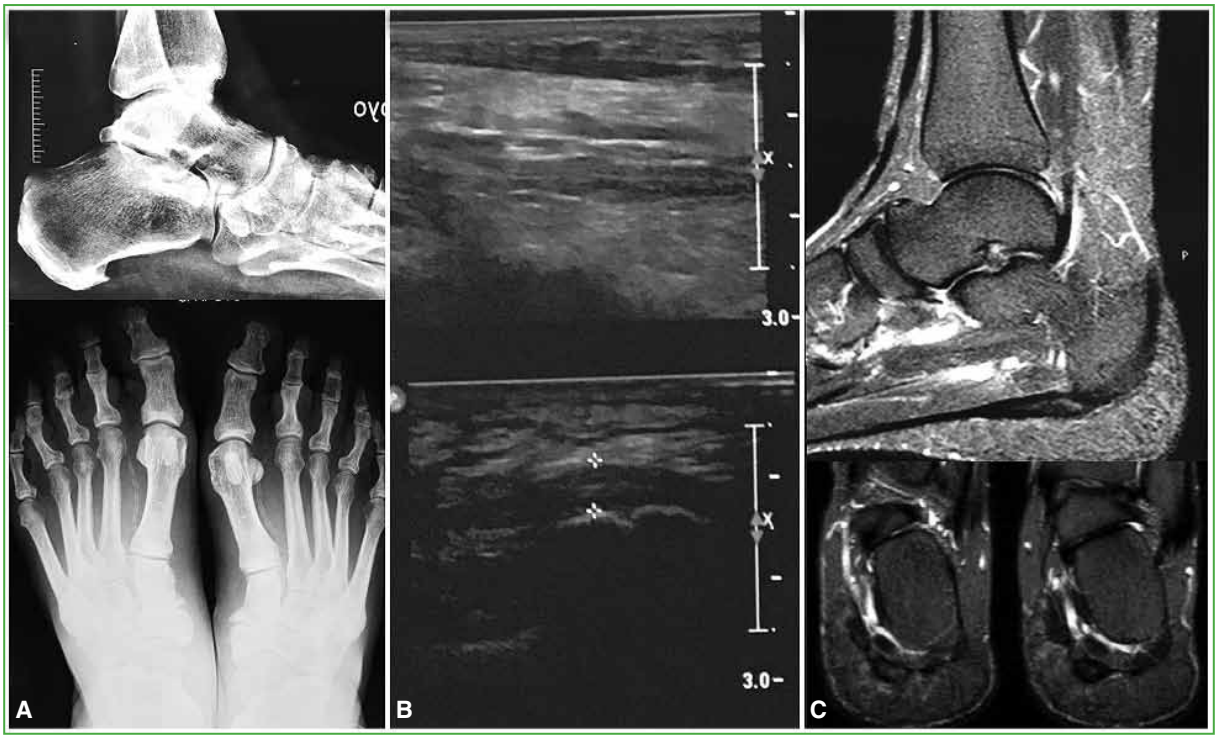

Figure 2. A. Lateral radiograph of the foot and anteroposterior radiograph of both feet. A bone spur is seen. **B.** Ultrasound. Thickening of the plantar fascia **C.** Magnetic resonance imaging of the hindfoot, without contrast. Thickening of the plantar fascia with mild edema.

There is currently no single therapeutic modality of choice. It is known with certainty that 80-90% of cases of plantar fasciitis are cured with non-surgical measures in a period of up to 12 months of therapy. Two major treatment options are described: non-surgical and surgical. Within the non-surgical modalities, various strategies have been developed that can be summarized and grouped into: pharmacological, physiotherapeutic, orthotic, infiltrations, and extracorporeal shock wave therapy. Regarding surgical strategies, open, arthroscopic, and percutaneous partial fasciotomy techniques can be mentioned.

The objective of this article is to analyze the different treatment options described in the literature and communicate the result of a virtual survey carried out on trauma specialists in our country.

MATERIALS AND METHODS

A virtual survey designed with the Google Drive® application and sent by WhatsApp® was carried out in June 2020. The participants (98 surgeons) belong to the fortnightly virtual meeting group of leg and foot conferences.

We proposed a fictitious case of recalcitrant plantar fasciitis that had already exhausted instances of physical therapy, posterior chain elongation, orthoses, and shock wave therapy. The following therapeutic options were proposed:

- Corticosteroid infiltration
- Platelet-rich plasma infiltration
- Open proximal plantar fasciotomy
- Percutaneous proximal plantar fasciotomy
- Endoscopic proximal plantar fasciotomy
- Proximal medial gastrocnemius elongation

RESULTS

81.63% of the group of surgeons participated in the survey. The results correspond to the opinion of leg and foot specialists regarding the treatments that they would carry out. The Table details the main behavior they would adopt.

Table. Therapeutic options adopted by physicians.

Therapeutic options	Percentage/Number of physicians
Continue with conservative measures	5%/4
Corticosteroid infiltration	23.8%/19
Platelet-rich plasma infiltration	6.3%/5
Open proximal plantar fasciotomy	8.8%/7
Percutaneous proximal plantar fasciotomy	16.2%/13
Endoscopic proximal plantar fasciotomy	1.2%/1
Gastrocnemius lengthening	38.7%/31

DISCUSSION

Plantar fasciitis is a very common condition in foot and leg consultations.[2-4] Several studies suggest that it is a degenerative process rather than an inflammatory one.[5] This observation was determined by histology. These findings included myxoid degeneration with fragmentation and degeneration, and vascular ectasia of the bone marrow.[6]

Some of the conservative therapeutic options are: **Orthotic treatment.** The different orthotic devices available to treat plantar fasciitis have the general objectives of optimizing the biomechanical loads on the foot, unloading painful areas, recreating heel protection, treating associated support disorders, and helping to achieve and maintain, once achieved, the adequate stretching of the plantar fascia and the gastrocnemius-soleus-Achilles musculotendinous apparatus. The orthotic options used for treatment are: heel pads, insoles (prefabricated and custom-made), and night splints.

Heel pads

Heel pads or heel protectors are viscoelastic devices, commonly prefabricated, that are used inside the shoe, in the rearfoot, and serve to absorb impacts, decompress painful points, elevate the heel and recreate local protection in cases of plantar fat pad atrophy. They can be made of different materials, among the most used are rubber, gel, and silicone (Figure 3).

There are no studies analyzing the outcomes of using heel pads in isolation or evaluating the advantages of any particular design over another. Pfeffer et al. evaluated the use of different types of heel pads and prefabricated insoles in 236 patients and concluded that the use of these together with an adequate stretching protocol for the plantar and Achilles fascia was associated with a significant improvement in heel pain. The UCBL orthosis (*University of California Berkeley Laboratory*) seems to be the one that offers the best results. It differs from other foot orthoses in that it fully encompasses the heel and rearfoot, holding it in a neutral upright position, and also controls the inner arch of the foot and the outer edge of the forefoot (Figure 3).[7]

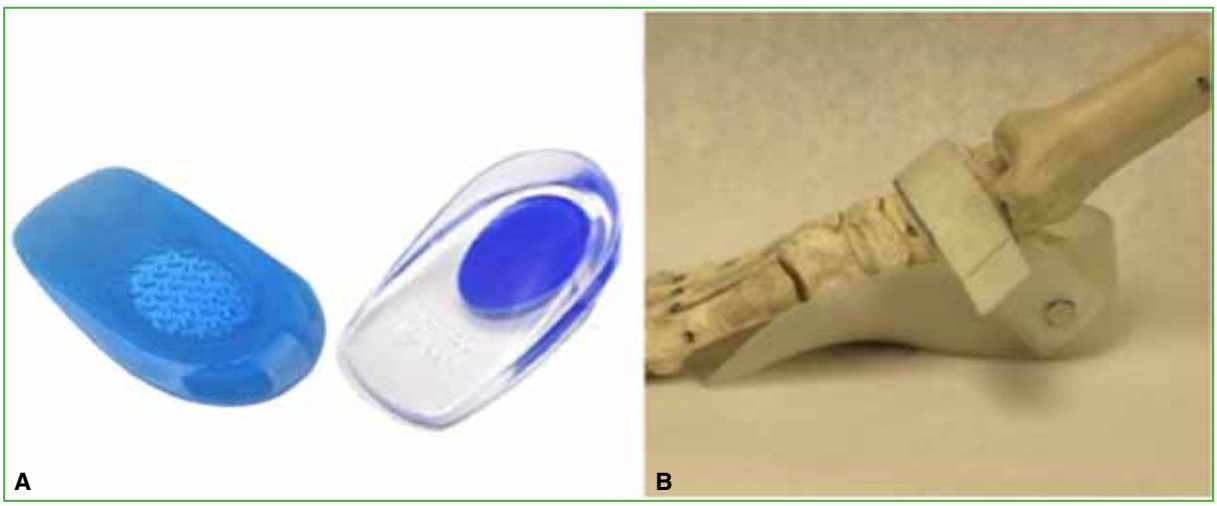

Figure 3. A. Classic heel pad. **B.** UCBL foot orthosis (taken from Rosenbaum et al.[8])

Insoles

Insoles, regardless of type or design, along with heel pads have been one of the main therapeutic measures for heel pain. They are commonly recommended so as to place the foot and lower extremity in a more advantageous position, helping to prevent overpronation of the foot and offload stress forces on the plantar fascia, as well as to recreate heel protection. There are countless styles of prefabricated and custom-made insoles (Figure 4) and this is where the largest number of bibliographic descriptions were found that analyze the results according to the type of orthosis, but few have investigated their long-term efficacy to draw precise conclusions.

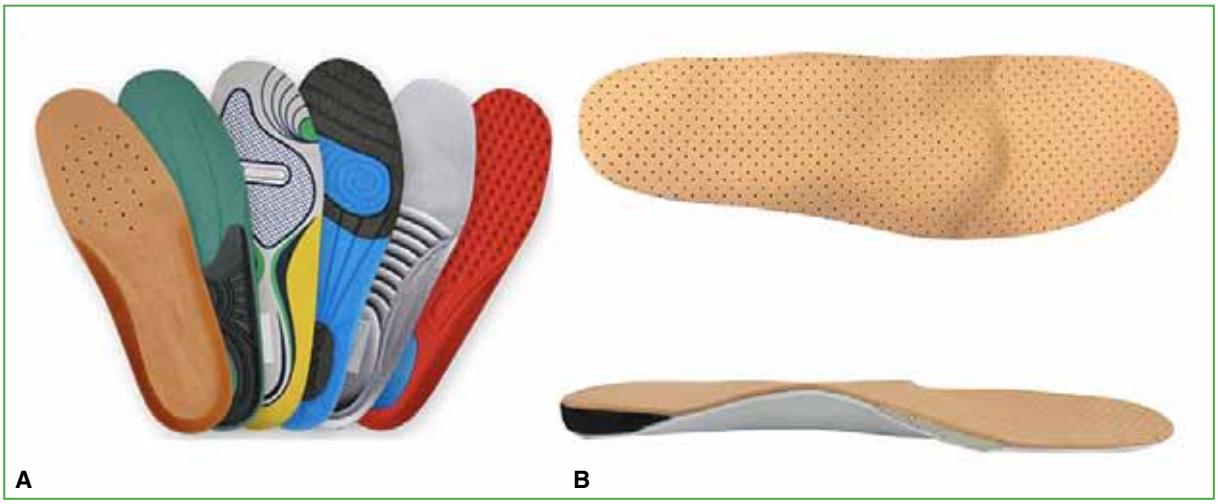

Figure 4. Prefabricated (**A**) and custom (**B**) insoles.

In a 2006 study, 135 patients with plantar fasciitis were divided into three groups treated with placebo insoles made of thin, soft foam, firm foam prefabricated insoles, and custom-made, semi-rigid plastic insoles. At three months of treatment, the groups treated with prefabricated and custom orthoses were found to have better outcomes in terms of pain control and foot function, but at the 12-month follow-up, no significant differences were found between the three groups.[9] More recent studies evaluated the clinical efficacy and cost-effectiveness of prefabricated and custom foot orthoses for plantar heel pain and concluded that there is moderate evidence that foot orthoses are effective in reducing pain in the medium term for most patients and that prefabricated semi-rigid insoles provide equivalent short-term benefit to custom-molded foot orthoses, but at lower costs.

Night splints

It has been published that the use of night splints would relieve the morning pain of plantar fasciitis.[10] These are rigid or semi-rigid splints that keep the foot and ankle in a neutral position of 90° or up to 5° of dorsiflexion and are used during the night, in order to maintain the stretch of the plantar fascia during rest or to avoid its contracture (Figure 5).

Figure 5. Night splint.

Wapner and Sharkey reported that 80% of their patients (out of 14) improved with the use of night splints in the 5° dorsiflexion position;[11] in contrast, Probe et al. found no significant differences when adding night splints to protocols of anti-inflammatory agents and stretching.[12] They also reported that they produce local discomfort and the consequent sleep disturbance, which has led, in some cases, to non-compliance with treatment. More recently, Lee et al. concluded that the use of adjustable neoprene dorsiflexion night splints was more effective than the application of foot orthoses alone in relieving pain in patients with plantar fasciitis and that, being made of more comfortable and adjustable material, they decreased the inconvenience or discomfort of rigid splints.[13]

Through the survey of specialists, it was possible to demonstrate that there is no clearly defined behavior in the face of failure of conservative treatment. The lengthening or proximal release of the medial gastrocnemius is the treatment with the highest percentage in the opinion of surgeons.

For this reason, and given the failure of orthopedic treatment after 4-6 months, minimally invasive techniques can be chosen, such as infiltration with corticosteroids or platelet-rich plasma.

Platelet-rich plasma is a platelet concentrate that provides autologous growth factors, such as insulin-like growth factor, transforming growth factor beta, vascular endothelial growth factor, platelet-derived growth factor, and basic fibroblast growth factor, helps cell migration, collagen synthesis and angiogenesis and, therefore, aids healing in tendons and ligaments.[14]

The infiltration can be guided by physical examination or by ultrasound. The injection should be administered in close proximity to the insertion of the fascia in the calcaneus.[3] 2 or 3 injections of corticosteroids can be applied in a maximum period of 12 months; it is necessary to take into account the risk of tear or fat atrophy if infiltrations continue, even with the high dose of corticosteroid infiltration.

Platelet-rich plasma and corticosteroids have been shown to reduce the widening of the plantar fascia.[15]

The literature demonstrates the efficacy of corticosteroids as a short- and long-term treatment.[14]

In the study by Jain et al.[6] (level of evidence: II), a randomized comparison was made between 40 patients who received platelet-rich plasma infiltration and 40 with corticosteroid infiltration. In this last group, the pain visual analog scale score decreased compared to the pre-injection value and was maintained up to 6 months post-injection.

A systematic review by Monteagudo et al. revealed a difference in the improvement of pain and function in favor of platelet-rich plasma compared to corticosteroids, after three months of follow-up.[15]

The consensus of the *American Orthopedic Foot and Ankle Society* of 2017 determined that corticosteroids do not modify the condition and their beneficial effect after four weeks would not be as relevant.[3]

After 4-6 months of treatment, and if no results have been obtained, shock wave therapy is a possible option and its efficacy is 60-80%.[16] A micro-tear is performed, exacerbating an inflammatory reaction and giving a greater response to healing. Shock waves can be of high or low energy, they can be applied with local anesthesia and the application can be single or serial. It is done once a week, and for a total of 3-5 sessions. They are contraindicated if the patient has hemophilia, coagulopathies, malignant processes, or open physis.

In the consensus of the *American Orthopedic Foot and Ankle Society,* it was reported that pain improved significantly at 12 weeks in 70% of patients with subacute or chronic fasciitis. However, they are not effective in acute heel pain.[3]

Surgical treatment

Despite conservative treatments, 5-10% will require surgery.[17] The two most used techniques are partial fasciotomy and proximal release of the medial gastrocnemius.

Partial fasciotomy consists of a 4 cm incision in the medial proximal plantar region and about 3 cm from the distal insertion of the calcaneus. The fascia is exposed and one-third of the fascia is released.[2] No more than 50% of the fascia should be resected. Brugh et al.[18] operated on 50 feet (72% open surgery and 28% endoscopic surgery). Patients with lateral column pain were those in whom an average of 60.6% of the plantar fascia had been resected. In contrast, those without pain had an average of 48.7% of the fascia resected. The reason for this change is to avoid the potential complication on the lateral column by destabilizing it through the disruption of the calcaneocuboid locking mechanism.

In a cadaveric study, it was described that fasciotomy reduces arch stiffness by 25%; the authors even indicated not to carry out this treatment if the patient has flat feet, since a greater deterioration of the plantar arch would be possible.[19]

According to Monteagudo et al.,[2] another complication is increased intertarsal joint range of motion, giving as a result an unstable foot.

For the percutaneous technique, a stab incision is used around the medial band at the junction between the medial arch and the heel. The benefits of this technique are: shorter surgical time, fewer postoperative complications, less postoperative pain, and early rehabilitation.[4]

Endoscopic treatment is performed through two portals: one medial portal in the midline with the metatarsal medial to the medial tubercle, 10 mm from the medial tubercle of the calcaneus; and a lateral portal at the same level, but relative to the lateral side of the lateral tubercle. A 4 mm arthroscope at 30º is used. Using a shaver, the soft tissues are released. A guide needle is inserted vertically into the calcaneus, forming part of the landmark which marks the end of the fascia resection, for which a scalpel is used. It is again debrided with the shaver for soft tissue resection. The great advantage of this technique is that it allows dynamic visualization. The objective of this technique is to reduce complications, shorten the time to return to activities and further relieve pain.[20] Some of the complications described are: risk of injury to the posterior tibial nerve branches, stress fractures, persistence of pain, and infection.[4]

Calcaneal spur reduction used to be a common procedure. Manoli et al.[21] reported fractures associated with exaggerated reduction. Today, it is known that the spur is not a cause of plantar fasciitis.

Proximal release of the medial gastrocnemius

Achilles tendon strain and plantar fascia loading are closely related. Physical examination of patients with posterior shortening and contracture of the gastrocnemius reveals a decreased range of motion of the ankle joint and this has been shown to increase the risk of plantar fasciitis.

This procedure was described by Barouk,[22] it is performed with local anesthesia plus sedation and the patient in the prone position. A 3-cm incision is made at the level of the popliteal fossa, the fascia is opened, and the medial gastrocnemius tendon is visualized and released. The range of dorsiflexion obtained is controlled. The patient is mobilized immediately after surgery.[15]

Abbassian et al.[23] carried out a study of gastrocnemius release in 21 hindfeet (17 patients) with more than one year of follow-up. They reported an improvement in pain at the end of follow-up, a rapid recovery, and a reduction in morbidities in 81% of the patients. Two patients had subjective weakness and three had an evident weakness, which, however, did not affect the results and satisfaction with the procedure.

Proximal release of the medial gastrocnemius is associated with fewer complications than open surgery.

Monteagudo et al.[15] compared 30 patients with open surgery and 30 patients with proximal medial gastrocnemius release for the chronic treatment of plantar fasciitis, and gastrocnemius release was superior to open fasciotomy for all outcomes. Patient satisfaction was 95% (60% for fasciotomy). In addition, patients who underwent proximal release of the medial gastrocnemius returned to work and sports activity, on average, at three weeks, and functional and pain scores were better in the group with gastrocnemius release.

Cychosz et al. assigned a grade B recommendation to the release of the medial gastrocnemius, according to the different level III, IV and V studies evaluated.[24]

In 1995, Tomczak and Haverstock[25] conducted a retrospective study comparing endoscopy with open surgery (plantar fasciotomy with heel spur resection). At nine months, patients in both groups were asymptomatic, but the endoscopic treatment group returned to work and all activities 55 days earlier than the open surgery group.

Fallat et al.[26] retrospectively evaluated percutaneous treatment and open surgery with calcaneal spur resection, and reported that percutaneous treatment improved pain and allowed a more rapid return to full activity.

CONCLUSIONS

There is no therapeutic modality superior to another with solid bibliographic support, as can be deduced from the survey carried out in our country with the opinion of specialists. The treatment of choice is conservative, if this fails, surgery is chosen and the proximal release of the medial gastrocnemius is the recommended option.

Conflict of interest: The authors declare no conflicts of interest.

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