Plantar Fasciitis: Evidence-Based Review of Treatment

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Objetive: To analyze the effectiveness of the interventions in the management of plantar fasciitis.
Material and method: The main medical and biomedical databases have been used: MedLine, Evidence Based Medicine, Cochrane Database of Systematic Review, Cochrane Register of Controlled Trials, EMBASE, and PEDRO (Physiotherapy Evidence Database). Metaanalysis, systematic reviews, reviews, and controlled or randomized clinical trials of interventions for heel pain have been selected.
Results: After an updated review of the treatment of plantar fasciitis, we have found several therapy options to treat this problem, but their efficacy is variable, and none show strong evidence of benefit. The use of plantar insoles and stretching exercises focused on plantar fascia have demonstrated limited evidence of benefit. Corticosteroid injections and iontophoresis with steroids have also demonstrated evidence of benefit, although limited and during a short time. The rest of interventions have not demonstrated enough evidence of benefit.
Conclusions: An evidence-based review of treatments of plantar fasciitis suggests that we must first recommend the use of conservative measures, easy to perform and of low cost, such as plantar soft insoles, plus specific stretching plantar fascia exercises. Limited evidence suggest that steroid injection or iontophoresis may be useful, but of transient effect, when conservative options fail.

Key words: Plantar fasciitis. Heel pain. Painful heel syndrome. Review. Treatment. Clinical trial.

Fascitis plantar: revisión del tratamiento basado en la evidencia

Objetivos: Analizar la eficacia de los tratamientos utilizados en la fascitis plantar.
Material y método: Se ha consultado los principales buscadores y bases de datos biomédicas: MEDLINE, Evidence Based Medicine, Cochrane Database of Systematic Reviews, Cochrane Register of Controlled Trials, EMBASE y PEDRO (Physiotherapy Evidence Database). Se seleccionó los estudios de mayor calidad científica: metaanálisis, revisiones sistemáticas, revisiones y ensayos clínicos controlados y/o aleatorizados de una o varias intervenciones para tratar el dolor plantar del talón.
Resultados: Tras realizar una revisión bibliográfica actualizada sobre el tratamiento de las fascitis plantar, se encontró que existen múltiples opciones terapéuticas, pero su eficacia es variable y no hay evidencia fuerte del beneficio de ninguna modalidad de tratamiento. Únicamente se encontró limitada evidencia de beneficio con la utilización de taloneras blandas, junto con la realización de cinesiterapia, principalmente ejercicios específicos de estiramiento de la fascia plantar. Con las infiltraciones y la iontoforesis con corticoides también se ha demostrado beneficio, aunque limitado y a corto plazo. Con el resto de los tratamientos no se ha hallado suficiente evidencia de beneficio.
Conclusiones: Según el análisis de la evidencia científica, ante una fascitis plantar debemos recomendar primero la utilización de medidas conservadoras, sencillas y de bajo coste, como taloneras blandas y ejercicios específicos de estiramiento de la fascia plantar. Si lo anterior no es eficaz, se puede administrar corticoides locales mediante infiltraciones o iontoforesis, aunque su efecto es transitorio.

Palabras clave: Fascitis plantar. Dolor en la parte inferior del talón. Talalgia. Revisión. Tratamiento. Ensayo clínico.

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Introduction

Plantar fasciitis is a frequent problem of pain in the plantar region in adults. It is a long-term, self-limited process.[1] Its prompt diagnosis and treatment increases the probability of success.[2] The diagnosis is done through a clinical history and physical exploration.

Its typical clinical presentation is pain on the plantar part of the foot and concretely, in the inferior part of the heel. It is usually more intense upon the first steps in the morning or after a period of physical inactivity, increases with prolonged standing or activities that require weight lifting. It is not frequently associated to paresthesia or nocturnal pain.

Upon exploration, the patient feels pain when the interior part of the heel, the anteromedial calcaneus and/or along the plantar fascia is palpated. Pain increases on forced dorsiflexion of the foot and toes, with the extension of the knee when tensing the plantar aponeurosis and when walking on the tip of the toes. Simple foot x-rays are of little utility because no clinical-radiological correlation exists: up to 15%-20% of persons with a heel spur do not have plantar pain, and only 5% of patients with plantar pain have a heel spur visible on the x-ray.[3] Ecography[4] and magnetic resonance[5] are useful tests to visualize changes in the morphology of the plantar fascia such as thickening; however, it is not necessary to carry out any complementary testing, unless another problem is suspected.

Multiple treatment modalities are employed for plantar pain, from conservative measures—including massages, bandages, orthesis (foot and heel pads, nocturnal immobilization), therapeutic exercise, and physical therapy (laser, ultrasound, shock waves…)—to more aggressive steps, such as infiltrations and surgery. None of these treatments has proven to be effective, nor are there clinical practice guidelines and research on the subject is scarce. The objective of this review has been to determine the current state of the scientific evidence on the efficacy of different methods employed for the treatment of plantar fasciitis.

Material and Methods

A review on the efficacy of the treatments employed for plantar fasciitis was carried out. To that end a bibliographic search of all of the articles published from January 1985 to December 2006 was carried out. The following biomedical search engines and databases were consulted: MEDLINE, Evidence Based Medicine, Cochrane Database of Systematic Reviews, Cochrane Register of Controlled Trials, EMBASE, and PEDRO (Physiotherapy Evidence Database). The search was limited to English language texts.

The criteria for study selection were: *a)* type of study: metaanalysis, systematic review, reviews and/or clinical controlled, and randomized trials; *b)* population under study: humans, adults, diagnosed with plantar fasciitis or pain in the plantar, or heel region; *c)* intervention: assigned to receive 1 or more interventions, or a comparative study to treat plantar pain; and *d)* that carried out at least 1 measurement of pain improvement.

We used the following main key words for the search: "plantar fasciitis," "heel pain," and "painful heel," and were combined with other search terms: review, clinical trial, therapy, treatment, etc. The search strategy employed in PubMed and EMBASE is shown in Table 1.

In the efficacy analysis, special relevance was given to data proceeding from controlled and randomized clinical trials. The results of the studies have been classified (beneficial, non beneficial, reduced benefit) according to the levels of evidence normally employed by the Cochrane collaboration in its reviews[6,7]: *a)* strong evidence: concordant findings in multiple high-quality controlled and randomized trials; *b)* moderate evidence: findings limited to 1 high-quality randomized, controlled clinical

TABLE 1. PubMed and EMBASE Search Strategy

Key Words	Results
PubMed	
1. Plantar fasciitis	437
2. Heel pain	1056
3. Painful heel	787
4. One or 2, or 3	1383
5. Limits 4 to (Humans and English language and yr="1985-2006")	1020
6. Limits 5 to (All adult: 19+ years, clinical trial, review, randomized controlled trial)	136
7. Limits 7 to abstracts	131
EMBASE	
1. Plantar fasciitis.mp	447
2. Heel pain.mp	451
3. Painful heel.mp	39
4. One or 2, or 3	775
5. Limit 4 to (human and English language and yr="1985-2006")	630
6. Clinical trial or review.mp	1 334 764
7. Five and 6	269
8. Limit 7 to (adult <18 to 64 years >)	103
9. Limit 8 to abstracts	95
PubMed and EMBASE Duplicates	35

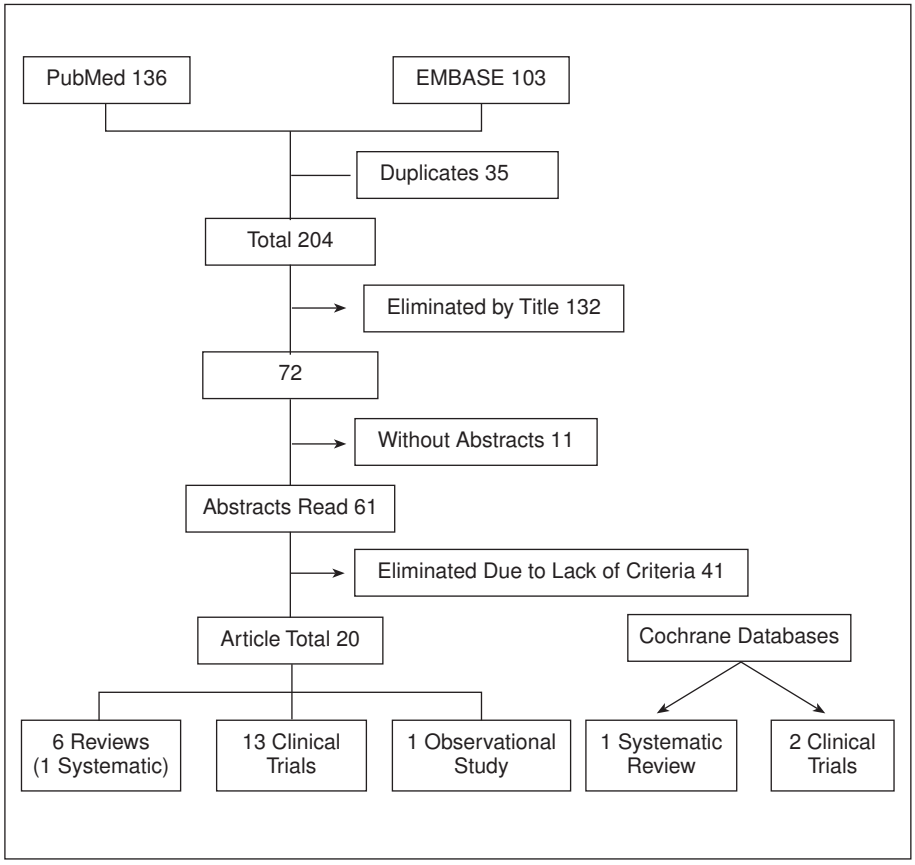

Figure 1. *Flow diagram of the studies.*

trial, or concordant evidence from multiple low-quality trials; *c)* limited evidence: 1 randomized low-quality trial; *d)* no clear evidence: discordant or contradictory results in multiple clinical trials; and *e)* no evidence: no studies identified.

Results

The results of the search on PubMed, EMBASE, and Cochrane is presented in Figure 1. Two hundred and thirty-nine studies were located on PubMed and EMBASE, 35 of which were duplicates; of the other 204, 132 were excluded by title and 11 for lack of an abstract; of the remaining 61, 20 were selected: 13 trials with random allocation, 6 reviews, 1 systematic review and 1 observational prospective study. One systematic review and 2 clinical trials were located on the Cochrane collaboration database. Trials that included diagnostic and therapeutic methods seldom employed in clinical practice were excluded (bandaging, creams, botulinic toxin, etc). The characteristics of the studies are shown in Table 2.

The different therapeutic options and scientific evidence of each one of them is presented below (Table 3).

Hygiene Measures

Relative rest avoiding mechanical overload and pain-aggravating activities: the use of soft-soled shoes, reducing body weight (obese and diabetic patients) applying ice after exercise. There is no scientific evidence of these measures.

Orthesis

Multiple types of orthesis exist, but the one most commonly employed are nocturnal orthesis and heel pads. The objective of the orthesis is to prevent plantar flexion by maintaining the ankle in a neutral position and passively stretching the gastrocnemius/soleus muscles and the plantar fascia during nighttime. The efficacy of nocturnal orthesis is controversial, with significant improvements in up to 80% of patents with respect to a control group,[8] without statistically significant differences in 2 clinical trials, one of them that compares it with another type of orthesis[9] and another one compared with stretching exercises,[10] or with 100% improvements when combining orthesis with soft heel pads, oral non-steroidal antinflammatory drugs (NSAID), and exercises.[11] Is Spain this type of orthesis

TABLE 2. Studies Included in Analysis*

Authors	Type of Study	N	Intervention	Comparator	Results
Powell et al, 1998	CCRT	37	Nocturnal immobilization	Control	Significant improvement
Martin et al, 2001	CCRT	255	Nocturnal immobilization	Insoles	NS
Probe et al, 1999	CCRT	116	Nocturnal immobilization + ankle stretching exercise	Ankle stretching exercise	NS
Batt et al, 1996	CRT	34	Nocturnal immobilization + ibuprofen + silicone heel pads + stretching exercises gastrocnemious/soleus	Ibruprofen + silicone heel pads + stretching exercises gastrocnemious/soleus	Significant improvement 100% of the nocturnal immobilization group
Pfeffer et al, 1999	CCRT	236	Plantar fascial and Achilles tendon stretching exercises	Insoles (4 types) and the same exercises	All groups improved, with significant differences in the silicone gel and rubber heel pad group
Porter et al, 2002	CRT, double blind	94	Continual Achilles tendon exercises	Intermittent Achilles tendon exercises	NS, best result with intermittent exercise
diGiovanni et al, 2003	CCRT	101	Unloaded plantar fascia stretching exercises	Loaded Achilles tendon exercises	Best results with statistically significant differences with plantar fascia
diGiovanni et al, 2006	Observational, prospective	101	Stretching exercises of unloaded plantar fascia		Improvement of pain, 90%; without need for other treatments
Crawford, 1999	CCRT	91	Steroid infiltration + anesthetic	Infiltration of local anesthetic	Improvement with steroids in the short-term (1 month)
Black, 1996	CCRT	17	Steroid infiltration	Silicone heel pad	NS
Lynch, 1998	CCRT	85	Steroid infiltration	Silicone heel pad versus adhesive bandage	NS
Kriss, 1990	CCRT	80	Steroid infiltration and orthesis	Infiltration of steroids versus orthesis	Best result with steroid infiltration alone
Gudemman, 1997	CCRT, double blind	40	Steroid Iontophoresis	Placebo	At 2 weeks, significant improvement; at 6 weeks, NS
Crawford et al, 1996	PCCT	19	Ultrasounds	Placebo	Both decrease pain (30 and 25%); NS
Basford et al, 1998	PCCT	28	Laser	Placebo	NS
Caselli et al, 1997	PCCT	34	Magnetic insoles	Placebo	NS

*CRT indicates clinical randomized trial; CCRT, clinical controlled randomized trial; PCCT, placebo controlled clinical trial; NS, no statistical significant differences.

is seldom used, mainly because of the difficulty in patient compliance.

In a recent systematic review[12] limited evidence supporting the use of nocturnal orthesis in patients with pain longer than 6 months was found.

Soft heel pads provide rest and reduce pressure on the heel by supporting the plantar arch. They are useful, comfortable and provide ample relief.

No clinical trials on the effect of heel pads compared to placebo or controls. In a clinical trial[13] in which steroid infiltration and the use of silicone heel pads was compared, no statistically significant difference was found between both treatments, but better results were obtained in the group using the heel pads. In the Cochrane[12] review, limited evidence on the effect of prefabricated soft heel pads was found (better results were shown with silicone and gel pads), compared to other treatment modalities.

Oral Non-Steroidal Anti-Inflammatory Drugs

They provide temporal relief of inflammation and pain. No clinical trials comparing the use of oral NSAID by themselves have been found, only in combination with

TABLE 3. Scientific Evidence on the Treatment of Plantar Fasciitis

Intervention	Evidence
Steroid infiltration	Limited (short-term)
Steroid Iontophoresis	Limited (short-term)
Nocturnal orthesis	Limited
Soft heel pads	Limited
Plantar fascia stretching exercises	Limited
Laser	No evidence
Ultrasound	No evidence
Extracorporeal shock waves	No evidence
Electromagnetic-plated insoles	No evidence
Surgery	No evidence

other therapies such as orthesis and exercise,[11] so no evidence for their isolated benefit[12] exists.

Exercise

The majority of exercise programs include combinations of stretching exercises of the Achilles tendon and of the plantar fascia,[3,14,15] some also include muscle strengthening exercises for the intrinsic muscles of the foot,[16] because they can help in correcting functional factors, such as Achilles tendon thinning and foot muscle weakness.

No clinical trial comparing stretching exercises and no treatment at all has been found. In 1 clinical trial[14] that compared the practice of stretching exercises of the Achilles tendon and the plantar fascia with the performance of these same exercises plus several orthesis, no statistically significant differences were found between both groups after 8 weeks of treatment, though the exercise and heel pad group experimented a larger reduction in plantar pain.

A clinical randomized, controlled trial did not find significant differences between carrying out Achilles tendon stretching exercises in a continuous manner and intermittently,[17] but better results were obtained with intermittent practice.

A clinical, prospective and randomized trial[18] that compared 2 exercise programs, 1 with stretching of the Achilles tendon and the other with stretching of the plantar fascia (in patients using the same kind of soft heel pad and oral NSAID), observed that patients that had followed the specific plantar fascia stretching exercises (done on discharge) obtained better results, with statistically significant differences with respect to pain improvement (P=.02), limitation of activities and patient satisfaction in the group of Achilles tendon stretching exercises (done on discharge).

Stretching exercises of the plantar fascia are very simple: the patient is sitting while crossing the affected leg over the contralateral one and takes his toes over their base and flexes them dorsally. The patient must confirm that the stretching is correct by palpating the plantar fascia tension. Each stretching lasts for 10 seconds. A series of 10 repetitions 3 times a day is recommended. The first series must take place before setting foot on the floor upon waking up.

Achilles tendon stretching exercises[18] are done standing up: with the affected foot behind the healthy one and with the toes directed in a straight line to the anterior foots heel, the forward knee is flexed and the posterior (affected) leg is extended, without lifting the feet off the ground. Each stretching lasts for 10 seconds. A series of 10 repetitions is done 3 times a day. The first series must be done upon waking up. This group also showed improvement in pain, though partially, with statistically significant differences versus the plantar fascia-stretching group.

These same authors later published[19] the results of the same patients 2-year follow-up (both groups of treatment) who continued exercising the plantar fascia. More than 90% had a reduction in symptoms and over 75% did not merit any additional treatment.

Steroid Infiltration

Four clinical trials comparing steroid infiltration to the use of silicone filled heel pads,[13] the injection of anesthetics,[20] and different orthesis[21,22] were found; their main finding was that steroid injections were useful in reducing plantar pain, but only in the short-term (1 month) and in a mild degree, so the evidence on their effectiveness was limited.[12] A relationship between multiple injections and weakness, and rupture of the fascia with plantar fat atrophy have been described,[20,23,24] so steroid injections are usually reserved for cases that are refractory to other therapies.

Steroid Iontophoresis

One randomized and placebo-controlled clinical trial[25] demonstrated a significant efficacy of steroids applied through iontophoresis, but only in the short term (2-3 weeks). There were no significant differences at 6 weeks, leading to limited evidence on the efficacy of steroids administered through iontophoresis to reduce plantar pain.[12]

Ultrasound

Only 1 small clinical trial controlled with placebo,[26] that did not find significant differences between ultrasound

treatment and placebo, was found, therefore there is no evidence that backs the claim the ultrasound improves the effectiveness of ultrasound.[12]

Laser

Only 1 small clinical trial was found, finding no significant difference between laser treatment and placebo.[27] Therefore, there is no evidence to back the effectiveness of laser.[12]

Electromagnetic-Plated Insoles

One placebo-controlled clinical trial was found[28] showing no significant difference; it even showed that persons without the electromagnetic insoles improved more than the ones treated with them. No evidence exists for their effectivity.[12]

Extracorporeal Low-Energy Shock Waves

There are contradictory tests on the effectiveness of low-energy extracorporeal shock-wave treatment, therefore evidence of its benefit is unclear.[12,29]

Surgery

No randomized clinical trials were found regarding surgery for pain in plantar fascitis. The most common technique is partial fasciotomy: it can be done either through open or closed, endoscopic surgery, and both types of surgery, and equally efficacious.[3] Neural decompression or burr resection can be performed in the same surgical event. Success rates of 70%-90%[30-32] have been described and recovery varies from weeks to months. Complications such a fascial rupture, damage to the tibialis posterior nerve, flattening of the longitudinal arc, or heel hypoesthesia.

Discussion

After analyzing the scientific evidence on different treatments employed for plantar fasciitis, no treatment option has shown strong evidence of benefit on which to base clinical practice (Table 3). Because this process can be long and incapacitating, one must start with simple measures and with a low probability of adverse events. Information on the norms that help reduce mechanical loads, such as weight loss, avoiding hard-soled shoes and limiting pain-inducing activities such as prolonged standing, can be provided. Other useful alternatives are the use of orthesis of the soft heel pad type and instructing the patient on a program of specific stretching exercises for the plantar fascia, as proposed by diGiovanni et al.[18,19] The patient can carry out the exercise program in his house. They are carried out while sitting down, daily and at least during 8 weeks. If after these measures the patient continues to have pain or pain is very limiting, a local application of steroids or through injections or iontophoresis, knowing that even though they are useful, it is only in a transitory manner (improvement lasts approximately a month). There is no sufficient evidence of the benefit of other measures, such as the application of ultrasound, laser, electromagnetic-plated insoles, or surgery. Evidence on shock waves is still contradictory. Future research should be focused to carrying out clinical trials that include a larger number of patients, comparing different combinations and treatment algorithms, to analyze cost-effectiveness in the medium-to-long term.

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