Objective: 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.
Introduction

Plantar fasciitis is a frequent problem of pain in the plantar region in adults. It is a long-term, self-limited process. Its prompt diagnosis and treatment increases the probability of success. 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. Ecography and magnetic resonance 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, orthosis (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: 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>
<thead>
<tr>
<th>Key Words</th>
<th>Results</th>
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<tbody>
<tr>
<td>PubMed</td>
<td></td>
</tr>
<tr>
<td>1. Plantar fasciitis</td>
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<tr>
<td>2. Heel pain</td>
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</tr>
<tr>
<td>3. Painful heel</td>
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</tr>
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<tr>
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<td>6. Limits 5 to (All adults: 19+ years, clinical trial, review, randomized controlled trial)</td>
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<td>7. Limits 7 to abstracts</td>
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<td>EMBASE</td>
<td></td>
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<tr>
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</tr>
<tr>
<td>6. Clinical trial or review.mp</td>
<td>1 334  764</td>
</tr>
<tr>
<td>7. Five and 6</td>
<td>269</td>
</tr>
<tr>
<td>8. Limit 7 to (adult &lt;18 to 64 years &gt;)</td>
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<tr>
<td>9. Limit 8 to abstracts</td>
<td>95</td>
</tr>
<tr>
<td>PubMed and EMBASE Duplicates</td>
<td>35</td>
</tr>
</tbody>
</table>
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 patients 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
is seldom used, mainly because of the difficulty in patient compliance.

In a recent systematic review 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 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 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...
other therapies such as orthosis and exercise, so no evidence for their isolated benefit exists.

**Exercise**

The majority of exercise programs include combinations of stretching exercises of the Achilles tendon and of the plantar fascia, some also include muscle strengthening exercises for the intrinsic muscles of the foot, 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 that compared the practice of stretching exercises of the Achilles tendon and the plantar fascia with the performance of these same exercises plus several orthosis, 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, but better results were obtained with intermittent practice.

A clinical, prospective and randomized trial 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 ($P=0.02$), 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 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 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, the injection of anesthetics, and different orthosis 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. A relationship between multiple injections and weakness, and rupture of the fascia with plantar fat atrophy have been described, so steroid injections are usually reserved for cases that are refractory to other therapies.

**Steroid Iontophoresis**

One randomized and placebo-controlled clinical trial 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.

**Ultrasound**

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

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**Table 3. Scientific Evidence on the Treatment of Plantar Fasciitis**

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steroid infiltration</td>
<td>Limited (short-term)</td>
</tr>
<tr>
<td>Steroid Iontophoresis</td>
<td>Limited (short-term)</td>
</tr>
<tr>
<td>Nocturnal orthosis</td>
<td>Limited</td>
</tr>
<tr>
<td>Soft heel pads</td>
<td>Limited</td>
</tr>
<tr>
<td>Plantar fascia stretching exercises</td>
<td>Limited</td>
</tr>
<tr>
<td>Laser</td>
<td>No evidence</td>
</tr>
<tr>
<td>Ultrasound</td>
<td>No evidence</td>
</tr>
<tr>
<td>Extracorporeal shock waves</td>
<td>No evidence</td>
</tr>
<tr>
<td>Electromagnetic-plated insoles</td>
<td>No evidence</td>
</tr>
<tr>
<td>Surgery</td>
<td>No evidence</td>
</tr>
</tbody>
</table>
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 found6 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 fasciitis. The most common technique
is partial fasciotomy: it can be done either through open
or closed, endoscopic surgery, and both types of surgery,
equally efficacious.3 Neural decompression or burr
resection can be performed in the same surgical event.
Success rates of 70%-90%10,32 have been described and
recovery varies from weeks to months. Complications
such a ficial 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
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 orthosis 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.

References


