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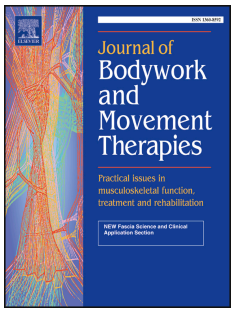


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# Minimally invasive non-surgical management of plantar fasciitis: A systematic review

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**Abstract**

**Background:** Minimally invasive non-surgical techniques have been widely used worldwide to treat musculoskeletal injuries. Of these techniques, injectable pharmaceutical agents are the most commonly employed treatments, with corticosteroids being the most widely used drugs. The aim of this article is to review current scientific evidence as well as the effectiveness of minimally invasive non-surgical techniques, either alone or combined, for the treatment of plantar fasciitis.

**Methods:** This systematic review was conducted from April 2016 until March 2017, in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement and was registered with PROSPERO. Randomized controlled trials (RCTs) of adult patients diagnosed with plantar fasciitis were included as well as intervention studies, with a minimal sample size of 20 subjects per study (10 per group). Assessment of study eligibility was developed by three reviewers independently in an unblinded standardized manner. The physiotherapy evidence database (PEDro) scale was used to analyse the methodological quality of studies.

**Results:** Twenty-nine full-text articles on minimally invasive techniques were reviewed. These articles focused on corticosteroid injections, platelet-rich plasma, Botox, dextrose injections, as well as comparative studies with dry needling vs sham needling.

**Conclusion:** The treatment of plantar fasciitis has dramatically improved in the past decade with minimally invasive techniques becoming increasingly available. Research findings have shown that the long term effects of minimally invasive (non-surgical) treatments such as

shock wave therapy, botulinum toxin type-A injections, platelet-rich plasma injections and intratissue percutaneous electrolysis dry needling show similar and sometimes better results when compared to only corticosteroid injections. The latter have been the mainstay of treatment for many years despite their associated side effects both locally and systemically. To date, there is no definitive treatment guideline for plantar fasciitis, however the findings of this literature review may help inform practitioners and clinicians who use invasive methods for the treatment of plantar fasciitis regarding the levels of evidence for the different treatment modalities available.

**KEY-WORDS:** Plantar heel pain, Plantar fasciitis, Pain, Therapeutics, Physical Therapy Modalities, Dry needling, Injections, Invasive.

## INTRODUCTION

Plantar heel pain (PHP) is one of the main sources of complaint in the general population, affecting approximately 2 million Americans each year and as much as 10% of the population over the course of a life-time (Martin et al., 2014; McPoil et al., 2008). Plantar heel pain may include different sources of pain, and involves different diagnoses such as myofascial pain syndrome, plantar fasciitis or neuritis, amongst others. Although there are few high quality epidemiological studies available, one study conducted in the United States between 1995 and 2000 found that consultations for PHP equalled approximately one million patient visits to physicians per year (Riddle and Schappert, 2004).

Plantar fasciitis (PF) is the most common cause of chronic pain beneath the heel in adults and may be treated using different therapeutic strategies (Martin et al., 2014; McPoil et al., 2008). Conservative treatments have always been the first approach for treating PF, as recommended by the APTA (Martin et al., 2014; McPoil et al., 2008). However, in some cases, minimally invasive therapies such as corticosteroid injections (Grice et al., 2017; Karls et al., 2016; Yucel et al., 2009), platelet-rich plasma (Ragab and Othman, 2012; Sharma, 2013; van Egmond et al., 2015; Moraes, 2013; Franceschi et al., 2014; Lee, 2013; Monto, 2014b; Monto, 2013), botulinum toxin (Venancio Rde, 2009; Diaz-Llopis et al., 2013), acupuncture (Zhang et al., 2011; Tough, 2009; Barbagli, 2003; Abbasoğlu et al., 2015), dry needling (Cotchett et al., 2014a; Cotchett et al., 2014b; Cotchett, 2014; Eftekharsadat et al., 2016) and prolotherapy (Kim and Lee, 2014; Demir et al., 2015) have been used. Also, a recent meta-analysis was published on the effect of dry needling on the treatment of PHP (He and Ma, 2017).

The aim of this study was to review the current scientific evidence regarding minimally invasive non-surgical techniques for PF.

## METHODS

This systematic review was conducted from April 2016 to March 2017. Its purpose was to answer the following question: what is the effectiveness of minimally invasive non-surgical interventions, either alone or combined for the treatment of plantar fasciitis? The review was conducted in accordance with the Preferred Reporting System Items for Systematic Reviews and Meta-analyses (PRISMA) statement, and was registered with PROSPERO (CRD42018083734).

### Design

A systematic review of scientific studies was conducted for the treatment of plantar fasciitis using minimally invasive non-surgical interventions.

### Search strategy:

Our literature search aimed to identify all available experimental studies evaluating the invasive non-surgical management of PF. Searches of MEDLINE, Web of Science, Cochrane, and PEDro databases were conducted. The last search was performed in March 2017. The search strategy was: ((Efficacy OR management OR effectiveness) AND (plantar OR fasciitis OR fasciosis OR fascitis OR heel) AND (dry need* OR intratissue percutaneous electrolysis or acupuncture or electroacupuncture or injection or injectabl* or puncture and infiltrat*)). These keywords were identified after preliminary literature searches. There was no restriction by date. The inclusion criteria were: 1) Randomized controlled clinical trials with a sample size of at least 20 subjects per study (10 per group); 2) Age of subjects: 18 years and older; 3) Diagnosis of plantar fasciitis (or equivalent terms such as fasciosis or fascitis or heel pain); 4) Studies investigating the effectiveness of any invasive non-surgical treatment for PF (e.g. dry

needling and/or injections, acupuncture, infiltration). The exclusion criteria were: 1) Any study including a surgical procedure or pharmacological oral agents or topical ointment; 2) Studies with animals 3) Trials whose sample or participants included any of the following terms: diabetes, spasticity, neuropathy, tumour, fracture, haemophilia, stroke, amputation, artificial limbs and rheumatoid arthritis; 4) Articles for which the full text was not in English; 5) RCTs not reaching a score of 5 in the PEDro scale (Figure 1). The evaluation of the eligibility of the studies was carried out by three independent reviewers (ZA, ML, MA) who did an initial filter by title, a second filter by abstract and subsequently compared the results. In case of disagreements, a fourth reviewer was consulted (EG). Thereafter, the full text of selected articles was read to verify whether they met the inclusion and exclusion criteria. Subsequently, they were evaluated with the PEDro scale and those obtaining less than 5 points were excluded. For the data extraction, a table was generated containing all the results classified by the outcome measurements, which helped to group the results and enabled a comparison amongst the different studies.

PLACE FIGURE 1 HERE

**Evaluation of risk of bias**

We evaluated articles using the Physiotherapy Evidence Database (PEDro) Scale checklist (https://www.pedro.org.au/wp-content/uploads/PEDro_scale.pdf) for RCTs (figure 2). In the PEDro checklists, each article is scored as “high quality, low risk of bias,” “acceptable quality, moderate risk of bias,” “low quality, high risk of bias,” or “unacceptable quality” which resulted in rejection. We defined each level based on scoring the checklists by assigning a value of 0 or 1 for each “no” or “yes” response, respectively.

PLACE FIGURE 2 HERE

For RCTs, checklists had 10 items and quality scores were assigned as follows: high quality, low risk of bias, 9-10; acceptable quality, moderate risk of bias, 6-8; low quality, high risk of bias, 3-5; unacceptable (reject), 0-2 (Fig 3).

At least three investigators evaluated each article. If there was disagreement between reviewers, a fourth investigator reviewed the paper and the majority rating was used after discussion among reviewers. Studies of unacceptable quality were excluded from the evidence tables.

**Data extraction**

Data were extracted from all included studies by at least three investigators, with one serving as the primary extractor and the second and third verifying the data. Disagreements were resolved by discussion, including a fourth reviewer if necessary. The extracted data were entered into a Microsoft Word table grouped by the condition as outlined in the included studies (table 1). Items included on the data extraction form were as follows: *study identification* (first author); *participants* (dosage, gender, age, number of treatment sessions over period); *comparator* (age, dosage, number of treatment sessions over period); pain and functional outcome measures used; *results* (in terms of pain and functional outcomes); *conclusions*, (possible side effects).

PLACE TABLE 1 HERE

A total of 1141 studies were identified from the databases. Following inspection of the articles, 734 articles were excluded due to the language or other exclusion criteria. Studies following the inclusion criteria were filtered by title (n=407) and then by abstracts (n=140).

Further analysis of the remaining text yielded 29 articles which fulfilled the inclusion criteria (figure 3).

PLACE FIGURE 3 HERE

We scored the 29 articles using the PEDro scale and excluded studies that obtained less than 6 points (n=1). All the trials included had a score of more than 5 in the PEDro scale (tables 2 and 3).

PLACE TABLE 2 HERE

PLACE TABLE 3 HERE

## RESULTS

Twenty-nine full-text articles of minimally invasive techniques were reviewed and included in this systemic review. These articles focused on corticosteroid injections, platelet rich plasma, botulinum toxin, dextrose injections, as well as comparative studies with dry needling. Each intervention claims that the patients improved, and that the pain was decreased. There is no superior treatment but rather a choice of interventions, as each treatment shows some significant improvement.

### Corticosteroids

The most common treatment that has been employed over the past decades is corticosteroid injections. Our literature search of invasive methods retrieved 26 RCTs investigating the use of different types of corticosteroids for the treatment of plantar fasciitis. Some studies used long-acting corticosteroids such as dexamethasone (Ryan et al., 2014), and betamethasone (Li et al., 2014a), while other studies employed intermediate-acting corticosteroids such as methylprednisolone (Eslamian et al., 2016b; Celik et al., 2016; Canyilmaz et al., 2015; Ball et al., 2012; Guner et al., 2013b; Mahindra et al., 2016; Kiter et al., 2006a), prednisolone (Jain

et al., 2015a), dopomedrol (Jain et al., 2015a) and tenoxicam (Guner et al., 2013b). There was no significant criteria or protocol used for choosing the type of corticosteroid. A meta-analysis conducted by Gaujoux-Viala et. al (Gaujoux-Viala et al., 2009) found no difference between the various types of corticosteroid used. In addition, the technique and application of the medication differed between the studies; some studies used a medial approach to inject the patients, while others used either a posterior approach or through the plantar aspect of the heel pad. The approach used also depended on whether the study was conducted using the palpation intervention approach or under ultrasound guidance.

**Botulinum Toxin Type-A**

Traditionally, botulinum toxin has been used in the treatment of spasticity and nerve blocks. Only recently has it found its way into musculoskeletal medicine. Three RCTs compared the effect of botulinum toxin type-A (BTA) on heel pain with steroids (Huang et al., 2010a; Peterlein et al., 2012a; Díaz-Llopis et al., 2012). The studies reported significant improvements with BTA. Furthermore, patients with plantar fasciitis who received BTA had significantly longer lasting relief of dysfunction and pain than those who received placebo. Further comparative studies are needed with larger sample sizes (Ahmad et al., 2017).

**Autologous platelet-rich plasma therapy**

Platelet-rich plasma (PRP) therapy showed significant improvements in the 3-month follow-up. The use of PRP improves blood flow at the site of injection, which aids in the regeneration at the site of pain and inflammation, and the boost that occurs after the injections help the regeneration of the site of pain and inflammation. In chronic plantar fasciitis, local autologous whole blood (AWB) injections were superior to conservative treatment and comparable to corticosteroids, however the effects of AWB last longer than

those of corticosteroids and either can be used as a second-line treatment, although the use of corticosteroids is associated with a slightly higher risk of complications (Jain et al., 2015b; Karimzadeh et al., 2017). This approach has been studied in nine RCTs for plantar heel pain showing that PRP injections are as effective as corticosteroids and, in most cases, superior to the use of corticosteroids. Some of the papers reviewed compared PRP with corticosteroid injections, and some with other treatment modalities.

**Polydeoxyribonucleotide (PDRN) injections**

Polydeoxyribonucleotide injections have clinical efficacy with no notable complications and were associated with symptomatic improvement in refractory plantar fasciitis. Two main pharmacological effects of PDRN are hypothesized: the stimulation of VEGF and a decrease in inflammatory cytokines, such as TNF-α and IL-6, and an increase in the anti-inflammatory cytokine IL-10, which could result in the treatment effect on plantar fasciitis (Kim and Chung, 2015).

**Acupuncture**

Acupuncture has been used in Chinese medicine for hundreds of years however few RCTs were available in English. We retrieved two articles that used acupuncture for the relief of heel pain with high significant outcome, however these were based on small samples and were lacking evidence supporting the use of the acupuncture (Kumnerddee and Pattapong, 2012; Zhang et al., 2009).

**Dry needling**

Dry needling is a more recent minimally invasive technique. Considerable research has been conducted in the past few years to prove the effectiveness of this technique, which shows

promising results with fewer side effects. The theory behind dry needling is the release of the myofascial trigger point (MTrP), which is a hyperirritable spot in the skeletal muscle tissue. The reasons for trigger point production are multifactorial and include micro-tears, smoking, or a lack of oxygenated blood at the site of trigger point which decreases the pH level and renders the site more acidic and vulnerable to changes at the cytoskeletal level as well the cellular level, and thus produces pain. To date, there are few studies supporting the use of dry needling and its effects. Recently, two RCTs have reported a good outcome for these patients with minimal side effects. Over recent years, the use of dry needling is gaining popularity within the medical field [23, 24].

## DISCUSSION

If any future plans to update the protocol and guidelines for the treatment of plantar fasciitis are to be undertaken, treatment protocols should be put in place with emphasis on first- and second-line treatments. The concept of referred pain to the heel, which can originate from a myofascial trigger point, has been neglected. A more in-depth assessment of patients must be considered before prescribing any treatments. The needle effect was described by Lewit in 1979, who emphasized that the trigger point can be the source of the pain.

Clinicians should consider starting treatment with non-invasive techniques and lack of improvement following these techniques should indicate the need to proceed towards minimally invasive techniques (figure 4).

PLACE FIGURE 4 HERE

First line treatment should include exercise therapy and one additional treatment modality, either shockwave therapy or manual therapy, to treat the trigger points. As a second-line treatment, dry needling techniques should be employed initially as these are non-

pharmacological and show promising results. However, this technique should be investigated further on a bigger sample group with a longer follow-up period (Eslamian et al., 2016a).

The use of intratissue percutaneous electrolysis has been widely used in Europe, mainly in Spain, however, to date, there are no published studies comparing its effectiveness for the treatment of plantar fasciitis. Preliminary studies with prolotherapy are promising and this technique can be used if dry needling fails. Also, prolotherapy has a better side effect profile compared to steroid injections. Injectable corticosteroids have been the mainstay of treatment for many years despite their associated side effects both locally and systemically (Cole and Schumacher, 2005). Despite this, there are no specific guidelines for the use of steroids indicating the dosage, type or frequency of injections.

Radiation therapy is another treatment approach that has been employed for pain relief of plantar fasciitis. Its mechanism of action is unknown, however, it is thought to have anti-inflammatory properties in low doses which may be attributed to the pain relief seen when used in treatment of plantar fasciitis. Fractional doses of 0.5 to 1.0 Gy and total doses of 3-6 Gy are employed in the treatment of plantar fasciitis. It is important to note that radiation therapy is carcinogenic and patient selection is crucial as well as their informed consent (Canyilmaz et al., 2015).

## Conclusion

Based on the findings of all the RCTs analysed, many authors consider that plantar fasciitis is a degenerative tissue condition rather than an inflammation at the site of origin of the plantar fascia at the medial calcaneal tuberosity. The histology of plantar fasciitis is the same as that of tendinopathies. This implies that degeneration can cause a micro tear within the fascia that does not heal, which can trigger inflammation. However an interruption in the healing process due to poor circulation leads to degenerative changes in the connective tissues.

The treatment of plantar fasciitis has dramatically improved in the past decade with more minimally invasive techniques becoming increasingly available. The results demonstrate that the long term effects of minimally invasive (non-surgical) treatments such as shock wave therapy, botulinum toxin type-A injections, platelet-rich plasma injections and intratissue percutaneous electrolysis dry needling show similar and sometimes better results when compared to corticosteroid injections. Most studies have been using corticosteroids which, as well as being associated with transient effects on pain and function, are associated with a number of complications, including infections, contact allergic dermatitis due to preservatives, skin atrophy, osteomyelitis of the calcaneus and rupture of the plantar fascia (Canyilmaz et al., 2015; Karimzadeh et al., 2017). Furthermore, higher doses of corticosteroids can be contraindicated in certain patients (Karimzadeh et al., 2017). Corticosteroids, the current mainstay of plantar fasciitis treatment, are divided based on their duration of action and, as of yet, consensuated guidelines regarding corticosteroid use are lacking. In conclusion, definitive treatment guidelines for plantar fasciitis are still lacking. The best results were obtained by combining several techniques with minimal invasive therapy such as stretching or exercises in additional to the treatment that been prescribed.

The findings of this literature review may help inform practitioners and clinicians who use invasive methods for the treatment of plantar fasciitis regarding the levels of evidence for the different treatment modalities available.

**Limitations and future study recommendations**

We have identified 29 relevant RCTs, which covered a wide variety of interventions and several procedural approaches that can be employed to establish treatment protocols for plantar heel pain. However, a wide range of dosages were used in some of the treatments (number of treatments and interval of care), making it difficult to draw exact conclusions about optimal

dosage. Studies should clearly describe treatment protocols, including frequency, intensity and duration in order to reach optimal management. Further research is needed to investigate the value of single and combined modalities. Additionally, it is possible that some studies were missed, despite the formal literature search.

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No conflict of interest was reported for this study.

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**Table 1.** Characteristics of the included studies.

| Author | Participants | Comparator | Outcome | Results | Conclusion |
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| **Eslamian, F (Eslamian et al., 2016b)** | *(n=40) Age 18-65 years. Chronic plantar fasciitis.*<br><br>**Group 1:** (n=20) ESWT with (41.45 ± 8.05) years, 18 (90%) female. 2000 shock waves/session of 0.2 mJ/mm(2) for 15 min, 5 sessions in 3 days intervals. Only Acetaminophen was recommended during the trail. | **Group 2:** (n = 20) local methylprednisolone injection with the age of (42.85 ± 8.62) years, 15(75%) females<br>**Corticosteroid injection** 40 mg local methylprednisolone, 1% lidocaine on palpation at the most tender point, medial plantar or inferior calcaneal area. | Outcome measures: pre-treatment 4 weeks, and post treatment 8 weeks.<br>**Pain:** (VAS)<br>**Functional:** (FFI) | *[FFI decreased to 19.65 ± 21.26 points (67.4% improvement) in ESWT vs 31.50 ± 20.53 points (47.7%) in injection group at week 8, P = 0.072)]*<br><br>*The inter-group differences were not significant, FFI was enhanced more with ESWT and patients were more satisfied with ESWT.* | The shock-wave therapy seems a safe alternative for management of chronic plantar fasciitis. |
| **Mardani-Kivi, M (Mardani-Kivi et al., 2015)** | (n=68) Acute plantar fasciitis > 18 years.<br>**Group 1:** (n=43) CSI *(44.68±9.20) years ,(28) female and (6) Male* 40 mg of methyl prednisolone acetate plus 1mL of lidocaine 2% was injected into maximal tenderness point at the infra | **Group 2:** (n=41) ESWT *(43.91±7.96), (29) females and (5) males*<br>ESWT 2000 impulses with energy of 0.15 mJ/mm, total energy flux density of 900mJ/mm for consecutive 3 sessions at 1 week intervals<br>3 times weekly intervals, at | **Pain:** VAS-3,6,12 weeks follow-up. | *The pain reduction in CSI group was significantly in those in the ESWT group (p<.0001).*<br><br>*In the ESWT and CSI groups, 19 (55.9%) and 5 (14.7%) patients experienced treatment failure, respectively. Age, gender,* | ESWT and CSI can be used as a primary treatment option for treating patients with acute plantar fasciitis; however, the CSI technique had better therapeutic outcomes. |

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| | medial calcaneal tuberosity. | the maximum tender point marked with a skin marker with an US gel applied as a medium. No anaesthesia or narcotics applied. | | *body mass index, and recurrence rate were similar between the two groups (p > .05)*<br><br>*The patient were 4 times more irresponsive to ESWT than CSI* | |
| **Canyilmaz, E (Canyilmaz et al., 2015)** | (n=128) Chronic Fasciitis> 6 months of evolution, have calcaneal spur and are over 40, no previous pharmacological treatment is restricted.<br><br>**Group 1:** (n=64) Receive radiation therapy mean ± SD, years<br>52.6 (40-74) years, 46 (76.7%) female<br>14 (23,3%) in male.<br>(A total dose of 6.0 Gy applied in 6 fractions of 1.0 Gy three times a week). | **Group 2:** (n=64) PG-Steroid injection mean ± SD, years<br>54.7 (40-74) years, 51 (79.7%) female<br>13 (20.3%)<br>Local corticosteroid injections; A 22-gauge 1.5-inch needle with 40 mg of methylprednisolone (1 ml) mixed with 0.5 ml of 1% lidocaine. The painful area and medial tubercle of calcaneus were determined by palpation. | **Pain:** VAS<br>**Functionality**: a modified von Pannewitz scale, and a 5-level function score.<br>Post treatment is: 3 months<br>Follow-up period of up to 6 months.<br>*The patient underwent the radiation therapy; the median follow-up was 13 months*<br>*(PG) steroid injection arm, it was* | *The pre-treatment VAS score was higher in radiation therapy:*<br>***VAS**: 7.6 in radiation*<br>*6.9 in PG-Steroid*<br>*After three months, results in*<br>*the radiation therapy arm were*<br>*significantly superior to those in the*<br>*PG steroid injection arm (VAS P<.001; modified von Pannewitz scale, P<.001; 5-level function score, P<.001). Requirements for a second treatment was not significant.* | This study confirms the better analgesic effect of radiation therapy compared to mean Palpation Guided steroid injection on plantar fasciitis for at least six months after treatment |

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| | | | *12.1 months;* | *The time intervals for the second treatment was significantly shorter in the PG-Steroid groups (p=.045)* | |
| **Monto, RR(Monto, 2014b)** | (n=40)<br>Unilateral chronic PF whom did not respond to minimum 4 months of standardized non-operative treatment modalities, no pharmacological treatment's.<br><br>**Group 1**: (n=20) 9 males, 11 females 59 years average of age range (24-74 years); 40 mg DepoMedrol cortisone<br><br>Both group used 2% of chlorhexidine, gluconate/70% isopropyl alcohol and then local anaesthesia. Insertion of the injection at the medial calcaneal tubercle. Patients were placed into calm walker for 2 weeks, | **Group 2**: (n=20); 51 average age (21-67 years) 8 male and 12 females.<br>single guided US PRP<br>Both group used 2% of chlorhexidine, gluconate/70% isopropyl alcohol and then local anaesthesia. Insertion of the injection at the medial calcaneal tubercle. Patients were placed into calm walker for 2 weeks, allowed to return to activity as tolerated with daily home eccentric exercises and calf stretch<br>PRP=27 cc venous blood sample mixed with 3 cc of anticoagulation citrate dextrose solution formula to prevent clotting of the sample, then centrifuged at 2400 rpm/12 minutes using a soft spin | **Pain:** VAS<br>**Functionally:** (AOFAS) (pre-treatment = time 0) and at 3, 6, 12, and 24 months following injection treatment.<br>Baseline pre-treatment radiographs and MRI studies were obtained in all cases to confirm the diagnosis. | *The cortisone group had AOFAS: score of 52 pre-treatments, which initially improved to 81 at three months post treatment but decreased to 74 at six months, suddenly dropped to near baseline levels of 58 at 12 months and proceeded to decline to a final score of 56 at 24 months.*<br><br>*The PRP group began with an average pre-treatment AOFAS score of 37, which increased to 95 at three months, remained elevated at 94 at 6 and 12 months, and had a final score of 92 at 24 months.* | PRP was more efficient and durable than cortisone injection for the treatment of chronic cases of plantar fasciitis. |

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| | allowed to return to activity as tolerated with daily home eccentric exercises and calf stretch | | | | |
| **Kim, E (Kim and Lee, 2014)** | (n=21) with unilateral foot pain for more than 6 months with chronic PF confirmed with an US (thickness >4 mm) It is chronic fasciitis that has failed conservative treatment even with corticosteroid injections before 6 months prior to the study, no pharmacological Treatment. | **Group 1:** (n=10) PRP 36.2 (20-57 years), 6 females & 4 males Whole blood (20 mL) was collected from the antecubital fossa into a 25-mL syringe that contained 2 mL of anticoagulant (Huons ACD-soln; sodium citrate 22 mg, citric acid 7.3 mg, glucose monohydrate 24.5 mg). | **Functionally**: FFI **Follow-up:** Data collected before the first injection at 2 weeks and at 2- and 6$^{th}$ month | An improvement in the mean FFI total scores from 132.5 ± 31.1 at baseline to 123.7 ±47.4 (3.8% improvement) at 10 weeks and to 97.7 ±52.5 (15.1% improvement) at 28 weeks' follow-up was achieved in the DP group.<br><br>*The main FFI improves were greater in PPR group compared with DP* | Both treatments seem to be effective for chronic recalcitrant PF, but after 2 month. Improvement achieved over time with no adverse events accept of the pain after injections.<br>PRP also may lead better initial improvements in function compare with DP. |

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| | **Group 2**: (n=11) DP 37.8 (19-51 years), DP 4 females & 7 males Dextrose Prolotherapy, 1.5 mL of 20% dextrose and 0.5 mL of 0.5% lidocaine, resulting in a 15% dextrose solution, within a 2.5-mL syringe. | *Injection was given in both group 2 times. 2 weeks and then after the next 2 weeks the second injection*<br><br>*Patients were kept sitting position for 30 minutes. They were sent home with instructions (allowing only indoor activities of daily living) for approximately 72 hours & to use acetaminophen for pain. The use of nonsteroidal anti-inflammatory drugs and any type of foot orthoses was not allowed.* | | *(30.4% vs.15.1%)*<br>*Pain: 29.7 % vs.17.1%*<br>*Disability: 26.6% vs.14.5%*<br>*Activity limitation: 28.0% vs 12.4%* | |
| **Yucel, U (Yucel et al., 2013)** | (n=67) with unilateral Chronic plantar fasciitis of 3 months' duration, exclude those who previously had shock waves and corticosteroid injections.<br><br>**Group 1 :** (n=22) Full length silicone insole 45.6±9.3, 16 (80%) were female. A prefabricated full-length silicone insole daily lives for 1 month | **Group 2:** (n=22) 47.4±7.9, 16 (80%) were female Guided corticosteroid injections<br>To injection group, A 4-cm 21-gauge needle was positioned in a caudo-cranial oblique manner into the area of maximal ultrasound abnormality, 1 mL of betamethasone dipropionate (6.43 mg/ mL) and betamethasone sodium phosphate (2.63 mg/mL) combina- | **Pain:** first step heel pain via VAS & heel tenderness<br>**Functionally:** (FAOS)<br>And ultrasonographic thickness of PF in both groups. | *Both groups showed significant change in VAS at one month from baseline*<br>***Injection group:*** *6.45 ± 1.23 to 3.70 ±1.45*<br>***Insole group****:*<br>*6.95 ±0.94 to 4.65 ± 1.34 VAS scores were* ***significantly better*** *in injection group than in insole group (p < 0.05)* | Both ultrasound-guided corticosteroid injection and wearing full-length silicone insole were effective in the conservative treatment of PF.<br><br>The study recommends the use of silicone insole as the first line of treatment for persons with plantar fasciitis.<br><br>No adverse events oc- |

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| | both indoors and outdoors as possible, (acetaminophen) was allowed if necessary, except last 24 h before evaluations. | tion. Plus 1 mL lidocaine HCL. (20mg/2mL) | | | curred |
| **Chew, KTL (Chew et al., 2013)** | (n=54) with unilateral chronic plantar fasciitis with more than 4 months of symptoms. excluding those who have injection with corticosteroids or another injection 4 months before the study, did not exclude those who had physiotherapeutic treatment or splints, all carry conventional treatment<br><br>3 Groups<br><br>**Group 3:** (n=16) 47.5 (41-53 years) 8 Male/8 Females to conventional treatment alone. Conventional treatment included stretching exercises and orthotics if indicated. | **Group 1: ACP** (n=19) age 46 years (38-51), 10 males/9 females. 10 mL of peripheral blood drawn and centrifuged at 1500 rpm for 5 minutes No buffer or preservative was added, per manufacturer's protocol. 23-gauge, 1.5-inch needle at a single perifascial target at the site of plantar fascia thickening and tenderness at the medial calcaneal tubercle.<br><br>**Group 2:** (n=19) 45 (37-53 years) 11 Male/8 Female to **ESWT**: 2000 shockwaves with energy levels progressing gradually from 0.02 mJ/mm3 to 0.42 mJ/mm3. The total treatment duration was 10 minutes. No local anaesthetic was administered. | **Pain:** VAS **Functionally:** AOFAS<br><br>US thickness assessed at baseline and 1,3,6 months | *ACP Group: significant VAS pain score improvements compared with the conventional treatment at month 1 (p=.037)* *The AOFAS ankle-hind foot scale improved in ACP at third month and sixth month ( p=0.04 and p=.013)* *PF thickness was seen in the ACP at 1st and three months (p=.015 and p=.14)* ESWT: 1,3,6 months (p=017 , p=0.22, p=0.42)<br><br>The AOFAS ankle-hind foot scale improved in ESWT at the first month and third month ( p=0.11 and p=.003) PF thickness was seen in the ACP at 1st, and three months (p=.019 and p=.027) | ACP treatment resulted in greater decreases in ultrasound plantar fascia thickness than ESWT, The ACP treatment group displayed better objective improvements, when compared with the conventional treatment group at the 6-month follow-up. with an overall median decrease of ultrasound plantar fascia thickness by 1.3 mm at the 6-month follow-up. Changes in plantar fascia thickness more than 0.6 mm are considered changes in thickness not due to measurement error<br><br>*No adverse events occurs.* |

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| | | | | *PF thickness improved in all groups.*<br>There was no significant difference between ACP & ESWT regarding VAS & AOFAS ankle-hind foot scale improvements, although the ACP group showed a greater reduction in PF thickness. | |
| **Kumnerddee, W (Kumnerddee and Pattapong, 2012)** | (n=30) Chronic Fasciitis of 6 months of evolution that does not work conservative treatment, excluding those who have received injection of corticosteroids in less than 6 month.<br><br>**Group 1:** (n=15) (52.4±10.5) years, 12 females conventional treatment stretching exercise, shoe modification and rescue analgesics | **Group 2:** (n=15) (52.4±10.5) years, (12) females, 3 males. same conventional plus 10 sessions of electro-acupuncture twice weekly. **Acupuncture group:** Topical 5% lidocaine/prilocaine cream (Emla) was applied 30 min prior treatment 2-6 needles were inserted at the most tender spot over anteromedial aspect no manipulation or twisting applied only a stimulated for 30 mins using the SDZ- II nerve and muscle stimulator | **Pain:** VAS<br>**Function:** FFI<br><br>Endpoints included a success rate determined by a minimum of a 50% decrease (VAS) and (FFI). | VAS decreased significantly from 6.00±1.69 to 1.89±1.59 and from 6.27±2.34 to 5.40±2.26 in acupuncture and control group ($p<0.05$) acupuncture group had higher success rate than the control group (80% and 13.3% respectively) FFI was in acupuncture group was better than those control group (<0.001)<br><br>Six week follow up acupuncture group showed a better FFI and success rate for pain during the day than those in control group ($p<0.05$) | Electro-acupuncture coupled with conventional treatment provide success rate of 80% in chronic PF which was more effective than conventional treatment alone, the effect lasted for at least six weeks. |

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| **Huang, YC (Huang et al., 2010b)** | (n=50) unilateral chronic plantar fasciitis, double blind<br><br>**Group 1**: (n=25) (54.4 SD 9.6), 6:19 male to female.<br>50 units of botulinum toxin type A | **Group 2:** (N=25) (51.5 5.5 years) Normal saline under US. 1 ml normal saline, by injection into the plantar fascia under ultrasonographic guidance us- ing a 25-gauge, 1.5 inch needle. Subjects in the control group were injected with 1 ml normal saline into the plantar fascia under ultrasonographic guidance. | **Pain**: VAS Measuring the fat pad of thickness.<br>**Functionally:** Gait assessment including maximal centre of pressure during the first loading step. | *Follow up three weeks and three months after Botox-A injection ($p<0.001$).*<br>*The fat pad thickness remained unchanged, the centre of pressure velocity during loading response increased three months after injection ($p<0.05$) outcome measure of the control group remained unchanged.* | BTX- A is effective in the treatment of foot pain associated with PF and increases the centre of pressure velocity during loading response without inducing fat pad atrophy. |
| **Kalaci, A (Kalaci et al., 2009)** | (n=100) with PF using four different methods of local injection, patients were blinded to the treatment given. Exclusion were if previous 6 months any surgery was done , or an abnormal erythrocyte sedimentation rate or C-reactive protein level, previous injections for plantar fasciitis were not included.<br><br>**Group A**: (n=25) Age (52.88±11.11), 6 males were treated with 2 mL | **Group C**: (n=25) age (49.87±9.36), 8 males a corticosteroid (2 mL of triamcinolone) alone<br><br>**Group D**: (n=25) age 52.22±8.49, 9 males, a corticosteroid (2 mL of triamcinolone) combined with peppering.<br><br>*No additional medication was given, and no restriction of activity was advised. Patients were evaluated by re- viewers who were blinded to the study method.* | **Pain:** 10-cm VAS and modified criteria of the Roles and Maudsley score.<br><br>**Follow-up:** in 3 weeks and 6 months after the injection and compared with the pre-treatment condition. | *Successful results in all the groups post-treatment were higher than those in the pre-treatment condition ($P = .000$).*<br>*In both C and D groups, in which local corticosteroid injections used, excellent results were obtained, with excellent effect in the group in which peppering was used ($P < .05$).* | The treatment of PF, combined corticosteroid injections and peppering is efficient and produces better clinical results. |

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| | of autologous blood alone<br>**Group B**: (n=25) Age (49.92±10.8), 7 males an anaesthetic (2 mL of lidocaine) combined with peppering | | | | |
| **Porter, MD (Porter and Shadbolt, 2005)** | (n=132) unilateral with manifest of 6 weeks PF. Exclusion of Previous surgery, CSI, or ESWT for heel pain.<br>, Clinical features suggestive of seronegative spondyloarthropathy, Clinical features suggestive of regional pain syndrome.<br><br>**Group C:** (n=19) age 38.1 (21-61) 6 males. non-randomized patients who performed stretching program only<br><br>*All patients standardized a stretching program of the soleus, gastrocnemius, and plantar fascia each stretch consists of 2 min/4 times a day, ice massage and continuing* | **Group A:** (n=64) age 39.9 (21-80 years) 20 males single CSI.<br>One millilitre betamethasone (5.7 mg) and 2 mL of lignocaine 1% were injected into the site of maximal tenderness. The medial calcaneal tuberosity was infiltrated until the patient declared that his/her tenderness and symptoms had gone. Patients were instructed not to take part in any running or impact activities for at least 10 days following the injection.<br><br>**Group B:** (n=61) age 38.6 (18-81 years) 22 males<br>Low dose of ESWT 3 treatments over 3 weeks. Patients randomized to group B each received 3 applications of 1000 pulses | **Pain:** VAS, PPT<br>**Follow-up:** baseline, 3- 12 months. | VAS pain scores, values for the CSI (1.48; 0–7) were significantly lower than both ESWT (3.69; 0–8), and controls (3.58; 2–5) at 3 months. At 12 months, VAS scores for CSI (0.84; 0–7) and ESWT (0.84; 0–4) were both significantly lower than controls (2.42; 1–4). The tenderness values at 3 months were significantly higher for CSI (9.42; 7–11) than both ESWT (6.72; 4–11) and controls (7.63; 6–9). P< 0.05 was used throughout | Corticosteroid injection is more efficient and more cost-effective than ESWT in the treatment of plantar fasciitis that has been symptomatic for more than six weeks.<br><br>*Of the 64 heels that received CSI, there were no infections and no cases of rupture of the plantar fascia. There were 8 cases of post-injection pain that required analgesia and/or ice application* |

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| | *the ADL with tolerance to pain.* | of an energy flux density of 0.08/mm2. 1000 impulses were applied 3 times at weekly intervals. Neither local anaesthesia nor sedation was used. | | | |

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| **Demir G , (Demir et al., 2015)** | (n=150)<br>**Group 1:** received Dextrose Prolotherapy<br>**Group 2:** corticosteroid injection as a single dose.<br>**Group 3:** phonophoresis<br><br>All patients were given exercises program. | | Pain: VAS, THI<br>Functionally: FFI and FAOS, SF-36<br>Measurements at baseline, 1,3-month follow-up.<br>Besides PF thickness was measured with US. | *The analysis demonstrated statistically significant improvements in all parameters from baseline to 1 and three months (p <0.05). There was no significant difference between groups regarding the efficacy of treatment (p> 0.05).*<br>*The plantar fascial thickness between the baseline and final measurements revealed a mean decrease in thickness, statistically significant difference (p <0.05) in three groups. Between groups before treatment, 1 and three months after treatment in terms of plantar fascia thickness there was no statistically significant difference (p> 0.05)* | Prolotherapy, corticosteroid, and phonophorosis therapies were well tolerated and appeared to provide the benefit of patients with PF. As a result, Prolotherapy can be an effective way to treat PF.<br><br>*Aside from injection-associated pain, no adverse reactions were reported.* |
| **Li S , Shen T (Li et al., 2014a)** | (n=61) after 6 months of filed conservative treatments. patients were excluded if they had fracture or arthritis of the ankle and knee, previous foot surgery or trauma, | **Group 2**: **CSI** (n=30) age(56.93±9.25, 7 males, 25 females) steroid injection<br>2mL of 2% lidocaine plus 2mL triamcinolone acetonide (20 mg) was inject- | **Pain**: morning pain , (VAS) 0-10<br>**Follow-up:** 1,6,12 month follow up | *In the MSN group, the VAS scores for morning pain, and overall pain were significantly improved at 1, 6, and 12 months after intervention compared to the baseline* | The study suggests that the MSN release treatment is safe and has a significant benefit for PF compared to steroid injection. |

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| | nerve injury, a severe systemic disease, contralateral heel pain, or a history of MSN release treatment or local steroid injection<br>age (54.74±10.16), 10 males, 19 females )<br><br>**Group 1**: **MSN** (n=31)<br>age (54.74±10.16), 10 males, 19 females)<br>2 mL of 2% lidocaine. then, the MSN(diameter 0.80mm, length 50mm), inserted into the tender point vertically with the direction of the MSN parallel to the long axis of the foot. the release of plantar fasciitis was performed by moving the MSN up and down 3–5 times without rotation, the MSN was withdrawn, and pressure was applied to the wound for 2 min to avoid bleeding the hole was covered with a simple adhesive bandage for 2 days. | ed into the most painful tender point. After treatment, the patients in both groups were observed for 30min to record any adverse reaction. All patients were asked to avoid bearing weight on the heel pad for 2 days. | | *scores ( < 0.01).*<br><br>*There were no statistical differences in the VAS scores observed between 1, 6, and but no significant improvement in pain was experienced at 6 or 12 months after intervention compared to the baseline levels ( > 0.05 )* | *No severe side effects were observed with MSN treatment. The study suggests that MSN release treatment is safe and has a significant benefit for plantar fasciitis compared to steroid injection.* |

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| **Mahindra P (Mahindra et al., 2016)** | (n=75) Patients had not responded to at least 3 months of conservative therapy, including physical therapy, NSAIDs, bracing, and orthotics. Treatment with NSAIDs was discontinued 1 week before injection.<br><br>**Group C (Normal saline):** age (35.48±9.54) 11 males. assigned to receive normal saline. | **Group A (PRP):** (n=25) age (30.72±7.42) 8 males was assigned to receive platelet-rich plasma<br>27 mL of blood was withdrawn placed in a glass tube containing 3 mL of citrate dextrose solution. Citrate dextrose solution was used to prevent clotting. The blood was centrifuged at 3200 rpm for 12 minutes, and 2.5 to 3 mL of platelet-rich plasma was obtained by this method. No activating agents were used.<br><br>**Group B** (**CSI):** age (33.92±8.61) 12 males was assigned to receive corticosteroid<br>2 mL of 40 mg of methylprednisolone was used for injection<br>Injection was given at the point of maximum tenderness in the heel with a 22-g needle using a peppering technique | **Outcome measure:** VAS and AOFAS<br>**Follow-up at** 3 weeks and 3 months by a blinded observer. | Mean VAS and AOFAS scores improved over time after injection in groups A and B.<br><br>In group A, VAS score decreased significantly from the pre-injection level at follow-up of three weeks (P=0) and 3 months (P=0).<br><br>Compared with the pre-injection level, AOFAS score improved significantly at follow-up of three weeks (P=0) and 3 months (P=0). Similarly, in group B, VAS score decreased significantly from pre- injection level at follow-up of three weeks (P=0) and 3 months (P=0). The AOFAS score improved significantly at follow-up of three weeks (P=0) and 3 months (P=0) in group B.<br><br>In group C, no significant difference was observed in VAS score pre, and | PRP is as effective or more than corticosteroid injection in treating PF |

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| | | | | post injections score at three weeks (P=.11); at three months (P=.41).<br><br>There were no significant difference observed between pre-injection AOFAS score and the score at three weeks (P=.06); at three months (P=.39) | |
| **Crawford F , Atkins D (Crawford et al., 1999)** | (n=106) patients, above the age of 18 and pain from 1-120 months. Median duration 6 months (±20.6)<br>excluding patient who received corticosteroid in less than 6 months.<br><br>69 female and 37 males mean age was 57 year (±12.9).<br><br>**Group 1:** (n=27), Mean: (53.69), SD: (14.28); 1ml of 25mg/ml of prednisolone acetate with 1 ml of 2% lignocaine;<br><br>**Group 2:** (n=26), Mean (56.88) SD: (13.02); 1 ml | **Group 3:** (n=27) Mean (59.41), SD (11.84);2 ml of 1% lignocaine hydrochloride<br><br>**Group 4:** (n=26) Mean (58.81)<br>SD: (12.48);2 ml of 1% lignocaine hydrochloride given after a<br>After a tibial nerve block. | **Pain:** 10 cm VAS.<br>**Follow-up:** 1,3,6 months | *There was a statistical difference between the groups in favour of treatment with steroid at one month (p=0.02)*<br><br>No statistically significant difference in pain reduction could be detected between the injected substances for pain outcomes taken at 3 and 6 months; the *P* values were 0.9 and 0.8, respectively.<br><br>No statistical difference existed in the numbers of patients lost to follow-up between the four groups (*P*=0.7) | A steroid injection can provide relief from heel pain in the short term; there appears to be no increase in patients comfort from anesthetizing using tibial nerve block prior heel infiltrations.<br><br>No adverse event mentioned |

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| | of 25 mg/ml of predniso-lone<br>acetate with 1 ml of 2% lignocaine given after a tibial nerve block | | | *Mean VAS score at one month (p=0.02)*<br><br>*There was no statistically significant difference in pain reduction among the groups for pain outcomes taken at three months (p=0.9) and six months ( p=0.8)* but thereafter no differences could be de-tected. Patient comfort was not significantly af-fected by anaesthesia of the heel (P = 0.5) | |

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| **Kiter E (Kiter et al., 2006b)** | (n=45) PHP in 3 groups, patients who received CSI last year they were excluded, average duration of heel pain was 19.3 months (range, 6–180 months).<br><br>**Age and Gender:** 31 Females and 14 Males. The mean patient age was 50.7 years (range, 26–70 years)<br><br>**Group 1:**(n=15) patients underwent the peppering technique<br><br>**Group 2:** (n=15) underwent autologous blood injection, a mixture of 2 mL of autologous blood drawn from the ipsilateral or contralateral upper extremity and 1 mL of 2% prilocaine was infiltrated.<br><br>**Group 3:** (n=15) underwent corticosteroid injection. 40 mg of | **Peppering group:** In the peppering technique group, after infiltration of 1 mL of 2% prilocaine<br>the needle was inserted, withdrawn, slightly redirected, and reinserted 10 to 15 times with- out emerging from the skin. During injection, a sensation similar to crepitation due to dissection of the fascia or degenerative tissue was felt | **Pain:** 10 cm VAS, Rear foot score of AOFAS 0-100 (100-best score)<br>**Follow-up**: 6 months. | *At six-months assessment, statistically significant improvement found in all groups (VAS and rear foot scores) there was no significant difference among the three groups.*<br><br>Rear foot score in 6-months:<br>Peppering group: (P .018)<br>Autologous blood injection: (P .025)<br>Corticosteroid injection: (P .30)<br><br>VAS score in 6-months:<br>Peppering group: (P <.001)<br>Autologous blood injection:(P <.001)<br>Corticosteroid injection: (P <.001)<br><br>Mean ± SD visual analogue scale scores in the peppering technique, autologous blood injection, and corticosteroid injection groups improved from 6.4 ± 1.1, 7.6 ± 1.3, and 7.28 ± 1.2 to 2.0 ± 2.2 | The curative mechanisms of both injection modalities based on a hypothesis, they seem to be great alternatives to corticosteroid injection for the treatment of plantar heel pain<br><br>*No adverse events mentioned* |

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| | methylprednisolone acetate mixed with 1 mL of 2% prilocaine was injected.<br><br>3 injections were given to all groups | | | (P < .001), 2.4 ± 1.8 (P < .001), and 2.57 ± 2.9 (P < .001), respectively. Mean ± SD rear foot scores in the same groups improved from 64.1 ± 15.1, 71.6 ± 1, and 65.7 ± 12.7 to 78.2 ± 12.4 (P = .018), 80.9 ± 13.9 (P = .025), and 80.07 ± 17.5 (P = .030), respectively. There were no statistically significant differences among the groups. | |
| **Zhang SP (Zhang et al., 2009)** | (n=89) onset of heel pain <3 months. Excluding needle phobic, fractures, pregnant and breast feeding.<br><br>**Control group:** (n=25) age *(50.0±2.0, 6 males & 19 females)*<br>The control group received needling at the acupoint Hegu (LI 4), which has analgesic properties | **Treatment group:** (n=28)**:** *(47.0±2.2, Males 8 & 20 females)* needling at the acupoint PC 7, which is purported to have a specific effect for heel pain | **Pain**: VAS, PPT<br>**Follow-up:** 1,3,6 months | *There was a significant difference in reduction in pain scores, favouring the treatment group.*<br><br>*At one month for morning pain (22.6 ±4.0 versus 12.0 ±3.0, mean ±SEM). Overall pain (20.3 ±3.7 versus 9.5 ±3.6)*<br>*PPT (145.5 ±32.9 versus -15.5 ±39.4)* | The study provided that acupuncture can cause a pain relief to the patient with PF, The PC 7 point is a relatively specific acupoint for heel pain.<br><br>*No serious adverse event noted in either group* |

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| **Yucel I, (Yucel et al., 2010)** | (n=60) < 6 month of pain with previously field treatments, excluding previous CSI, surgery. Patients were allowed to continue their heel cup.<br><br>**Group B:** (n=27), age (42.9 ± 7.08<br>13 males and 14 females) ESWT<br>A fivefold nerve block (posterior tibial, superficial and deep peroneal, sural, and saphenous nerves) was applied to each operative ankle with 20 mL of prilocaine hydrochloride, 2%. Patients received a single application of 3,000 shockwaves using an electrohydraulic shockwave generator. Com- mon ultrasound gel was used as a contact medium<br><br>no additional treatment was permitted during the study period, including night splints, nonsteroidal anti-inflammatory | **Group A:** (n=33), age **(**44.7 ± 9.20, 5 males, 8 females) CSI<br><br>A 22- gauge, 1.5-inch needle was connected to a 2-mL syringe filled with 0.5 mL of combined betamethasone dipropionate (6.43 mg/mL) and betamethasone sodium phosphate (2.63 mg/mL) (Diprospan; and 0.5 mL of prilocaine hydrochloride, 2% (20 mg/mL) The injections were performed from the medial side of the heel. The most painful area over the medial calcaneal tuberosity was determined by palpation, and the injection was performed at this spot. Care was taken to avoid the fat pad and injection into the skin or subcutaneous tissues. Patients were instructed to refrain from running and impact activities for 10 days. | **Pain:** 100-mm VAS and a physician-assessed heel tenderness index. Follow-up: 3-months. | The mean visual analogue scale score changes were 4.0 for group A and 5.3 for group B ($P < .05$ for both). Both groups showed significant improvement in visual analogue scale scores, but there were no significant differences in scores between the groups 3 months after treatment ($P > .05$).<br><br>Results of the visual analogue scale and heel tender- ness index scores between patients with and without a spur in groups A and B were not significantly different ($P > .05$). Eleven of the 13 patients (84.6%) in group A and 10 of the 12 patients (83.3%) in group B responded to therapy. | ESWT and corticosteroid injection provided significant improvements in VAS and HTI scores.<br><br>All of the patients in group A had pain during injection. The pain lasted an average of 5 days, 4 patients required analgesia. No infections or other major complications occurred in group A.<br><br>None of the patients experienced pain during the ESWT protocol. Two patients had a mild throbbing sensation that lasted an average of 5 days, but did not require analgesia. Two patients had mild erythema. |

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| | drugs, and physical therapy. | | | | |
| **Celik D** (Celik et al., 2016) | (n=46) with unilateral PF<br><br>**Group 1:** (n = 22) age (45.4 ± 9.3), 6 male and 14 females.<br>Joint Mobilization & Stretching. | **Group 2**: (n = 21) age (45.6 ± 7.9), 5 males & 14 females. Stretching & mobilizations + one CSI 1mL of corticosteroids (40 mg methylprednisolone acetate) or 4 mL of 2% (prilocaine HCL) using 22-guage at the heel around the PF ***(no stretching was performed)*** | **Pain**: VAS<br>**Functionally:** FAAM<br>**Follow-up:** at baseline and at 3-week, 6-week, 12-week, and 1-year. | *Significantly improvement in VAS & FAAM pain and functional outcome in only 12 weeks and 1 year in group 1 (P = .002)*<br>*Both groups were statistically significant for both FAAM (P = .001; F = 7.0) and VAS (P = .001; F = 8.3) scores*<br>*At 3 weeks,-6 weeks and -12 weeks.*<br><br>*Between-group differences in VAS & FAAM favoured the SI group at the 3-week (P = .001, P = .001), 6-week (P = .002, P = .001), and 12-week (P = .008, P = .001).* | The Steroid Injection group exhibited better outcomes at all 3-time points. The noted improvements continued group 1 in 12-weeks to one year. |

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| **Jain K** **(Jain et al., 2015a)** | (n=46) heels with intractable plantar fasciitis who had failed conservative treatments for 12 months (ESE, cushioned insole, physical therapy) 14 patients were treated bilateral heel, 19 left heel 31 right heel.<br><br>**Age & Gender:** (mean 55.6 years) 31-79 years, 16 male<br><br>**Group 2:** (n=)Steroid injection.<br>Triamcinolone (Kenalog) 40 mg and Levobupivacaine hydrochloride (Chirocaine) injection | **Group 1:** (n=)PRP injections 6 underwent bilateral heel injection<br>27 (ml) of blood was withdrawn from the patient and added to 3ml of sodium citrate (anticoagulant). then centrifuge and spun for 15 min at 3200 rpm. The plasma portion of the centrifuged mixture was discarded. Since the anticoagulant introduced to the whole blood used to produce the platelet concentrate is acidic, the PRP portion harvested is buffered with 8.4% sodium bicarbonate, to increase the Ph to normal physiological levels. | **Pain:** VAS, RM<br>**Functionally:** AOFAS<br>**Follow-up:** pre-treatment, at 3, 6 and 12 months. | *Pre-injection, the two groups were well matched with no statistically significant difference. At three months, all three outcome scores had significantly improved from their pre-treatment level in both groups.*<br>*At 12 months, the RM, VAS and AOFAS scores in the PRP arm (1.9, 3.3 and 88.5) were significantly better than the Steroid arm (2.6, 5.3 and 75) with P values of .013, .028 and .033, respectively.* | PRP is significantly more efficient than Steroid, making it better and more durable than cortisone injection.<br>PRP is doesn't wear off with time.<br>At 12 months, PRP is significantly more effective. |

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| **Kim JK** (Kim and Chung, 2015) | (n=40) Patients with PF, excluding patients underwent injections within 6 months.<br><br>**Group 2:** (n=20) age 55 (42-71 years n 4 male & 16 females) Placebo injected with normal saline.<br><br>Injections were performed weekly for three weeks. | **Group 1:** (n=20) age was 52 (34-68 years , 7 male & 13 female) injection (PDRN)<br>In the PDRN group, a half vial of PDRN (1.5 ml, was injected into the tender region of the heel, medial to the insertion of the plantar fascia. In the placebo group, the same volume of nor- mal saline was injected at the same site. | **Pain:** (VAS)<br>**Functionally:** (MOXFQ)<br>**Follow-up:** Done at baseline and 4,12 weeks after treatment began.<br><br>*P value represent pairs t-test with values of initial status* | *The PDRN group show a significant improvement in VAS and MOXFQ scores at four weeks' post-treatment, and this continued until 12 weeks' post-treatment.*<br>*The placebo group did not achieve a significant improvement in the VAS or MOXFQ scored at four or 12 weeks.* | PDRN is an efficient and safe treatment option and may be considered for PF treatment.<br><br>We noticed no injection-related complications, such as itching, urticaria, redness or infection signs around the injection site in either group. |
| **Cotchett MP** (Cotchett et al., 2011) | (n= 84) patients with plantar heel pain of at least one month's duration.<br>**Age:** mean ± SD age of 56.1 ± 12.2 years and 52% were male. The mean ± SD duration of plantar heel pain was 13.6 ± 12.2 months (range 1 to 95). | **Group 1:** (n=42) Real Dry needling<br>The most frequently treated muscles were soleus, gastrocnemius, quadratus plantae, flexor digitorum brevis and abductor halluces. Less frequently needled muscles included abductor digiti minimi, and flexor hallucis longus. Treatments averaged four | **Pain**: first step in the morning (VAS), FHSQ<br>**Follow-up:** 2,4,6,12 weeks | *Significant results favoured real dry needling over sham dry needling for pain (adjusted mean difference: VAS first-step pain=-14.4 mm, 95% confidence interval [95% CI]=-23.5 to -5.2; FHSQ foot pain=10.0 points, 95% CI=1.0 to 19.1)* | Dry needling provided statistically significant reduction in PHP.<br><br>*However, the magnitude of this effect should be studied against the frequency of minor transitory adverse events.* |

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| | **Group 1:** (n=42) Real Dry needling<br>**Group 2:** (n=42) Sham Dry needling<br><br>Patients received dry needling once per week for six weeks | needles per session (range 2 to 8), each retained for 5 minutes. | | | |
| **Ryan M (Ryan et al., 2014)** | (n=56) workers required to stand for greater than 5 hours/day with chronic plantar fasciopathy took part.<br>Duration of heel pain at least 12 months no mention of prior treatment<br>**Group 1**: Physiotherapy-lead exercises 7 different exercises.<br><br>**Group 2**: Dexamethasone Injection with routine calf stretch. | The steroid injection procedure has been described previously in the literature. A 22-guage, 1.5" needle and 3 cm3 syringe filled with 1ml of dexamethasone mixed with 0.5ml of 1% lidocaine was prepared. | **Primary outcome measure:** FADI (0-136, 136=no disability)<br>**Secondary outcome:** 100mm VAS for patients<br><br>**Follow up:** 6 and 12 weeks | *The follow-up showed significant improvement in FADI & VAS compared with baseline scores (P < 0.001).*<br><br>*There were no significant between-group differences.*<br><br>*No significant changes to PF thickness reported at the 6- and 12-week follow-up point.*<br>*Both improved significantly in the PHYSIO (P = 0.003) and INJECTION (P < 0.001) groups at 12-week follow-up.* | The study showed that prolong standing period workers experienced the same short-term therapeutic effect. With a physiotherapy-led exercise program compared with an injection of corticosteroid with stretching. |

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| **Guner S (Guner et al., 2013a)** | (n=69) participants<br>**Gender**: 47 (77%) women and 14 (23%) men)<br>Mean age of 41.4 12.23 years (range, 18-60 years).<br>A total of 28 (45.9%) left, and 33 (54.1%) right feet were studied.<br>*Single injection for both groups*<br>**Group 1:** (n= 31) Tenoxicam group treated with local injection of 1 mL of Tenoxicam (20 mg/2 mL) and one mL of 2% lidocaine. | **Group 2:** (n= 30) Steroid injection The steroid group using a local 1-mL injection containing 40 mg of methylprednisolone acetate and one mL of 2% lidocaine. | **Pain:** VAS<br>**Follow-up:** 12 months. | Mean VAS reduction from pre-treatment to 12 month post-treatment was statistically significant for both groups<br>***Mean VAS scores of tenoxicam group:*** *8.26 (pre) → 2.94 (12 month) ($p < 0.05$)*<br>***Steroid group:*** *7.97 (pre) → 3.17 (12 month) ($p < 0.05$)*<br>No significant difference was found between the steroid and tenoxicam groups in terms of VAS | Tenoxicam is an effective treatment for PF.<br><br>*No complications attribute to either injection was observed.* |
| **Peterlein CD (Peterlein et al., 2012a)** | (n=40) the pain > 4 months, had at least two previous non-successful treatments of non-operative therapy strategy.<br>**Age:** 51.54 (28-77) years old<br>**Gender:** 80% women's<br><br>**Group 2:** Normal saline injection<br><br>***Weakness side****: Concom-* | **Group 1:** BoNT-A injection<br>Botox (200 units) in 2mL 0.9% saline solution or same volume in placebo with saline solution's. | **Pain**: VAS<br>**Follow-up:** 2,6,10,14,18 weeks. | *The participants in the BoNT-A group achieved a response at the 6th week (25% vs. 5% for placebo; P=0.18).*<br>*Differences between treatments were for BoNT-A on secondary measures of pain but did not reach statistical significance.*<br>*Most of the participants in the BoNT-A group achieved a response at* | BoNT-A achieved a good response a large prospective long-term should is recommended.<br><br>*(The author did not stop other intervention which can be causing some effects of the treatments, if not the control group the placebo shall have some results which affect the final findings).* |

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| | *itant treatment such as the application of ice, iontophoresis, ESWT, heel cups and orthosis, activity modification, or stretching/strengthening programs, which were prescribed before study start**, was not interrupted.***<br>*Medication changes were not recommended.* | | | *week 6 (25% vs. 5% for placebo; P=0.18).*<br>*The difference was favouring the BoNT-A on secondary measures of pain but did not reach statistical significance. In the BoNT-A group, 52.7% (vs. 40% for placebo) assessed their condition as slightly/significantly improved at week 6* | *No adverse events occur or was noticed.* |
| **Ball EM (Ball et al., 2012)** | (n=65) PHP failed to response to 8 weeks of conservative therapy, excluding previous injection in heel pad.<br><br>**Group 3:** (n=22) age [50.1 (10.6) 11 males,(52%)] ultrasound guided placebo; 1 ml of 0.9% saline (placebo group) was injected along the superficial border of the plantar fascia enthesis under direct ultrasound guidance. | **Group 1:** (n=22) age [49.0 (12.9) male 10, (45%)] patient received ultrasound guided steroid injections<br>A 21-gauge needle was inserted parallel to the heel pad in line with the long axis of the transducer, Either<br>0.5 ml (20 mg) of methylprednisolone acetate +0.5 ml of 0.9% saline (ultrasound guided steroid group) or<br><br>**Group 2:** (n=21) age [49.1(10.7), males 8(36%)]patients given steroid under palpations | **Pain**: VAS (100) at 6, 12.<br>Change in the PF thickness by US.<br>**Follow-up:** 6,12 weeks' post-injections. | *The difference significantly in VAS scores between the groups at 6 and 12 weeks (p=0.018 and p=0.004, respectively).*<br><br>*19.7 (95% CI 2.5 to 37.0) difference in mean VAS scores at six weeks between the US-guided steroid group, & the placebo group.*<br>*24.0 (95% CI 6.6 to 41.3) difference between the unguided steroid group & the placebo group at six weeks.*<br><br>*At the 12 weeks, the mean* | Although both ultrasound-guided corticosteroid injection and wearing a full-length silicone insole were effective in the conservative treatment of plantar fasciitis, we recommend the use of silicone insoles as the first line of treatment for persons with plantar fasciitis.<br><br>*There were no adverse events.*<br><br>Any patient who failed to respond clinically to injection at 12 weeks was |

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| | *All patients were asked to avoid weight bearing on the heel pad for 48 h and could continue with their usual analgesia*. | A 21-gauge needle was inserted parallel to the heel pad in the direction of the medial tubercle of the calcaneus. An amount of 0.5 ml (20 mg) of methylprednisolone acetate and 0.5 ml of 0.9% saline was injected once the needle had been inserted to the hilt. | | *difference was 25.1 (95% CI 6.5 to 43.6) and 28.4 (95% CI 11.1 to 45.7) respectively between both steroid injection groups and the placebo group.*<br><br>*No difference in VAS scores following steroid injection within the US-guided & the unguided groups at either time point.*<br><br>*PF thickness significantly reduced after injection in both active treatment groups (p=0.00).*<br>*Patients in both injection groups showed a* ***statistically significant reduction*** *in VAS pain scores compared with the placebo group There were* ***no significant differences*** *between the steroid groups at either time point (p = 0.58)* ***VAS score difference.*** | then offered an ultrasound guided steroid injection outside the trial |
| **Díaz-Llopis** | (n=56) patient who undergo for 6 month of | two different phases; patients with therapeutic fail- | **Functionally and Pain: (**FHSQ 4 | At 1 month, there was **significant improvement** | BoTX-A should be considered for the treatment |

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| **IV** (Díaz-Llopis et al., 2012) | conservative treatment's for PF. all patients were initially treated with stretching, with revision after several weeks patients with injections in the last 6 months were excluded.<br>**Group 1:** (n=28) received Botox injection [BTX, SD 51.50 (14.79), 9 males (32.14%)]<br><br>100 U of botulinum toxin type A were diluted in 1 mL of normal saline and 70 U were injected: 40 U in the tender region of the heel medial to the insertion of the plantar fascia and 30U in the area between one inch (2.5 cm) distal to the talar insertion of the plantar fascia and the midpoint of the plantar arch<br><br>**Group 2**: (n=28) [CS, SD 56.36 (14.71), 10 males (35.7%)]<br>receive corticosteroid injection | ure after the 1st intervention crosses to the comparator group (after one month) duration of heel pain at least six months; prior conservative treatment (NSAIDs, heel pads, insoles, night splints) for at least 6 months without succeeding<br><br>**Phase 1 BTX group** Injection of 40 units in tender region of heel medial to insertion of plantar fascia and<br>**Unguided steroid injection group** 2 mL (12 mg) betamethasone acetate + 0.5 mL 1% mepivacaine (LA) in the same tender region of the heel and a subcutaneous injection of placebo (normal saline) in the middle of the medial side of the fascia | items) foot pain, foot function, foot shoe, and general foot health.<br>**Follow-up:** 1, 6 months | in all the item scores of both groups compared to baseline, except in item 3 (shoe) in the steroid injection group<br>**Change at 1 month from baseline FSHQ1** BTX-A: 34.24 (21.10), $p < 0.001$ CS: 22.12 (27.42), $p < 0.001$<br>**FSHQ2**<br>BTX-A: 27.45 (20.58), $p < 0.001$ CS: 21.43 (24.85), $p < 0.001$ | of chronic PF, the change found by one month, in particularly at six months, when this treatment clearly has better results than corticosteroid injections.<br><br>*There were no early or late adverse effects related*<br>*to either of the two treatments administered* |

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| | corticosteroid (2 mL of betamethasone 6 mg/mL (as acetate and disodium phosphate)) plus local anaesthetic (0.5 mL of 1% mepivacaine) in the same area of the calcaneal tuberosity. In addition, a small sub- cutaneous injection of placebo (normal saline) was performed in the middle of the medial side of the fascia to make the injections | | | | |
| **Lee TG** (Lee and Ahmad, 2007) | (n=61) PF for 6 weeks, excluding previous surgery.<br><br>**Group 2:** (n=31) age (49.2 ± 11.1) (29 – 66) 2 males 29 females. received corticosteroid group.<br>A combination of 20 mg (0.5 ml of a 40 mg/ml solution) of Triamcinolone Acetonide with 2 ml of Lignocaine HCL 1% was used. | **Group 1:** (n=30) age **(**48.3 ± 10.5), range (28 – 65) 4 males 28 females received autologous blood group<br>For autologous blood injection, 1.5 ml of autologous blood obtained from the antecubital vein, and this was combined with 1 ml of Lignocaine HCL 2%. Thus, for both groups, there was an equal volume of injection solution as well as an equal amount of Ligno- | **Pain**: VAS, TT<br><br>**Follow-up:** 6-weeks,3-months, 6-months. | Before treatment, both the autologous blood group and corticosteroid group had similarly high levels of pain ($p = 0.306$). Over the 6-month follow-up, a significant reduction in pain levels was noted in both groups ($p < 0.0001$).<br><br>*Significant difference was noticed in VAS in CSI*<br>*6-week p = 0.011*<br>*3-month p = 0.005* | Intralesional autologous blood injection is efficacious in lowering pain and tenderness in chronic plantar fasciitis, but corticosteroid is more superior concerning speed and probably extent of improvement<br><br>*There was no fat pad atrophy, infection or rupture of the plantar fascia*<br>*All patients found the injection painful* |

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| | All patients could walk but were advised to avoid impact-loading activities, such as running or jumping, for at least 10 days. Nonsteroidal anti-inflammatory drugs were prescribed for not more than 3 days, and ice packs were allowed for post-injection pain. Elevation of the foot was advised for swelling | caine HCL used. | | *6-month p = 0.094* | |
| **Eftekharsadat (Eftekharsadat et al., 2016)** | (n=20) patients with chronic plantar fasciitis, Refuse needling and routine physical therapy (e.g., cooling, stretch, massage therapy and/or footwear modifications),; diagnosis of coagulopathy or taking anticoagulants except for acetylsalicylic acid at dosages up to 325 mg/day<br><br>**Case Group** 1: (n=10) Age [Mean SD | **DN:** dry needling of MTPs one session per week for four consecutive weeks. Diagnosis of MTPs was based on detecting a tender spot or nodule in a taut band of skeletal muscle. Dry needling was based on calf muscles trigger points, especially four trigger points of gastrocnemius muscle<br>using a dry needle with the length of 30-50mm and diameter of 0.6mm. Treat- | **Pain**: VAS (0-10 cm) , FFI<br>**Functionally**: Range of motion of ankle joint in dorsi- flexion (ROMDF) and plantar extension (ROMPE) was measured at baseline | DN effect was evaluated at three-time points of baseline, 4 weeks after intervention and 4 weeks after withdrawing treatment.<br><br>Based on paired t-test, the mean VAS scores were significantly decreased after four weeks of intervention ($p<0.001$) and four weeks of cessation period ($p<0.001$). | There was an insignificant effect on ROMDF and ROMPE, trigger point dry needling.<br>dry needling and/or injection of therapeutic medications (local anaesthetics, steroids, botulinum toxin A) have been studied for plantar fasciitis treatment. Of these treatment options, steroid injections are more commonly used in treating acute and chron- |

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| | (50.3±8.9) 3 male & 7 females]<br><br>**Control Group** 2: (n=10) [4 male & 6 females (50.9±8.9)] Control group<br>50 mg diclofenac sodium /12 hours and orthostatic plantar pad were prescribed for all patients.<br><br>All patients were trained to do cold ice massage and self-stretching for four weeks | ment was conducted within a 30-minute timeframe. | | ROMDF of ankle joint was significantly increased both after four weeks of intervention ($p<0.001$) and four weeks of cessation period ($p<0.001$).<br><br>ROMPE of ankle joint was not significant after four weeks of intervention ($p=0.34$), the mean ROMPE of ankle joint was significantly increased after four weeks of cessation period ($p<0.04$). | ic plantar fasciitis, especially when more conservative managements are unsuccessful. |

**Abbreviations:**

**VAS**: visual analogue scale SFMPQ: **AOFAS**: American Orthopedic Foot and Ankle Society , **FFI**: Foot Function Index ,**ESWT**: Extracorporeal Shock Wave Therapy, **ESE:** Eccentric stretching exercises. **Gy**: *is a derived unit of ionizing radiation dose in the International System of Units*, **PG**: Palpation Guide, **PF**: Plantar Fasciitis **PHP**: plantar heel pain. **ISI**: Intralesional Steroid Injection , **AVBI**: Autologous Venous Blood Injection , **AOFAS**: American orthopedic foot ankle society , **PRP**: Platelet Rich Plasma Therapy , **FAOS**: Foot & Ankle outcome score , **FHSQ**: Foot Health status questioner , **TT**: Tenderness Threshold, **HTI**: Heel Tenderness Index , **US**: Ultrasonography , **MSN**: Miniscalpel needle , **PPT**: Pain Pressure Threshold , **ACP**: Autologous condition plasma , **FAAM**: Foot Ankle Ability Measure , **MOXFQ**: Manchester Oxford Foot Questioner , **PDRN**: Polydeoxyribonucleotide , **FADI**: Foot Ankle Disability Index, **BoNT-A**: Botulinum toxin type-A, **BTX**: Botox , **ROMDF**: range of motion in dorsiflexion ,**ROMPE**: range of motion in plantar extension, **DN:** dry needling, **RM**: Roles-Maudsley

**Table 2.** Summary of PEDro scale scores

| PEDro Scale Score | Number of articles Found |
|---|---|
| **5/10** | (n=1) article |
| **6/10** | (n=4) articles |
| **7/10** | (n=12) articles |
| **8/10** | (n=3) articles |
| **9/10** | (n=9) articles |
| **10/10** | (n=0) articles |

**Table 3**. PEDro scale scores.

| | Author | Random Allocation | Concealed Allocation | No Bassline Capability | Blind Subject | Blind Clinician | Blind Assessor | Adequate Follow Up | Intention-To Treat Analysis | Between Group Comparison | Point Estimate & Variability | **TOTAL** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***1*** | Eslamian, F (Eslamian et al., 2016b) | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | **7/10** |
| ***2*** | Mardani-Kivi, M (Mardani-Kivi et al., 2015) | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | **7/10** |
| ***3*** | Canyilmaz, E (Canyilmaz et al., 2015) | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | **7/10** |
| ***4*** | Monto, RR(Monto, 2014b) | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | **7/10** |
| ***5*** | Kim, E (Kim and Lee, 2014) | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | **9/10** |
| ***6*** | Yucel, U (Yucel et al., 2013) | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | **7/10** |
| ***7*** | Chew, KTL (Chew et al., 2013) | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | **6/10** |
| ***8*** | Kumnerddee, W (Kumnerddee and | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | **6/10** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pattapong, 2012) | | | | | | | | | | | |
| ***9*** | Huang, YC (Huang et al., 2010b) | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **9/10** |
| ***10*** | Kalaci, A (Kalaci et al., 2009) | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **9/10** |
| ***11*** | Porter, MD (Porter and Shadbolt, 2005) | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 1 | **7/10** |
| ***12*** | Demir G , (Demir et al., 2015) | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **9/10** |
| ***13*** | Li S , Shen T (Li et al., 2014b; Monto, 2014a) | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **9/10** |
| ***14*** | Mahindra P (Mahindra et al., 2016) | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | **7/10** |
| ***15*** | Crawford F , Atkins D (Crawford et al., 1999) | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **9/10** |
| ***16*** | Kiter E (Kiter et al., 2006b) | 1 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **8/10** |
| ***17*** | Zhang SP (Zhang et al., 2009) | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 1 | **6/10** |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ***18*** | Yucel I, (Yucel et al., 2010) | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | **7/10** |
| ***19*** | Celik D (Celik et al., 2016) | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | **7/10** |
| ***20*** | Jain K (Jain et al., 2015a) | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | **5/10** |
| ***21*** | Kim JK (Kim and Chung, 2015) | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **9/10** |
| ***22*** | Cotchett MP (Cotchett et al., 2011) | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | **6/10** |
| ***23*** | Ryan M (Ryan et al., 2014) | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 0 | **8/10** |
| ***24*** | Guner S (Guner et al., 2013a) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | **7/10** |
| ***25*** | Peterlein CD (Peterlein et al., 2012b) | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **9/10** |
| ***26*** | Ball EM (Ball et al., 2012) | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | **7/10** |
| ***27*** | Díaz-Llopis IV (Díaz-Llopis et al., 2012) | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | **7/10** |
| ***28*** | Lee TG (Lee and Ahmad, 2007) | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 1 | **9/10** |
| ***29*** | Eftekharsadat (Eftekharsadat et al., 2016) | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | **8/10** |

| *Inclusion* | **Exclusion** |
| --- | --- |
| • ***Published in a peer-reviewed journal between January 2000 and March 2017*** | • Interventions delivered only to hospitalized patients |
| • ***Human subjects aged 18 or older presenting to ambulatory care*** | • Commentaries/editorials/letters |
| • ***English language*** | • Non-peer-reviewed publications |
| • ***Treatment of non-acute (≥ 4 weeks duration) heel pain/condition*** | • Conference abstracts |
| • ***Intervention included at least one group with only nondrug, nonsurgical treatment(s)*** | • Case reports/series |
| • ***Randomized controlled trial*** | • Pilot RCTs not designed or powered to assess effectiveness |
| | • No treatment outcomes |
| | • Non-clinical studies |
| | • Oral or topical medications/surgery used in all treatment groups |
| | • Systematic review & Meta- analyses |

**Figure 1.** Inclusion and exclusion criteria

1. **Eligibility criteria were specified**
2. **Subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)**
3. **Allocation was concealed**
4. **The groups were similar at baseline regarding the most important prognostic indicators**
5. **There was blinding of all subjects**
6. **There was blinding of all therapists who administered the therapy**
7. **There was blinding of all assessors who measured at least one key outcome**
8. **Measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups**
9. **All subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case data for at least one key outcome was analysed by "intention to treat".**
10. **The results of between- group statistical comparisons are reported for at least one outcome.**
11. **The study provided point measure for both point measure and measures variability for at least one key outcome.**

**Figure 2.** Randomized controlled trial checklist (PEDro scale).

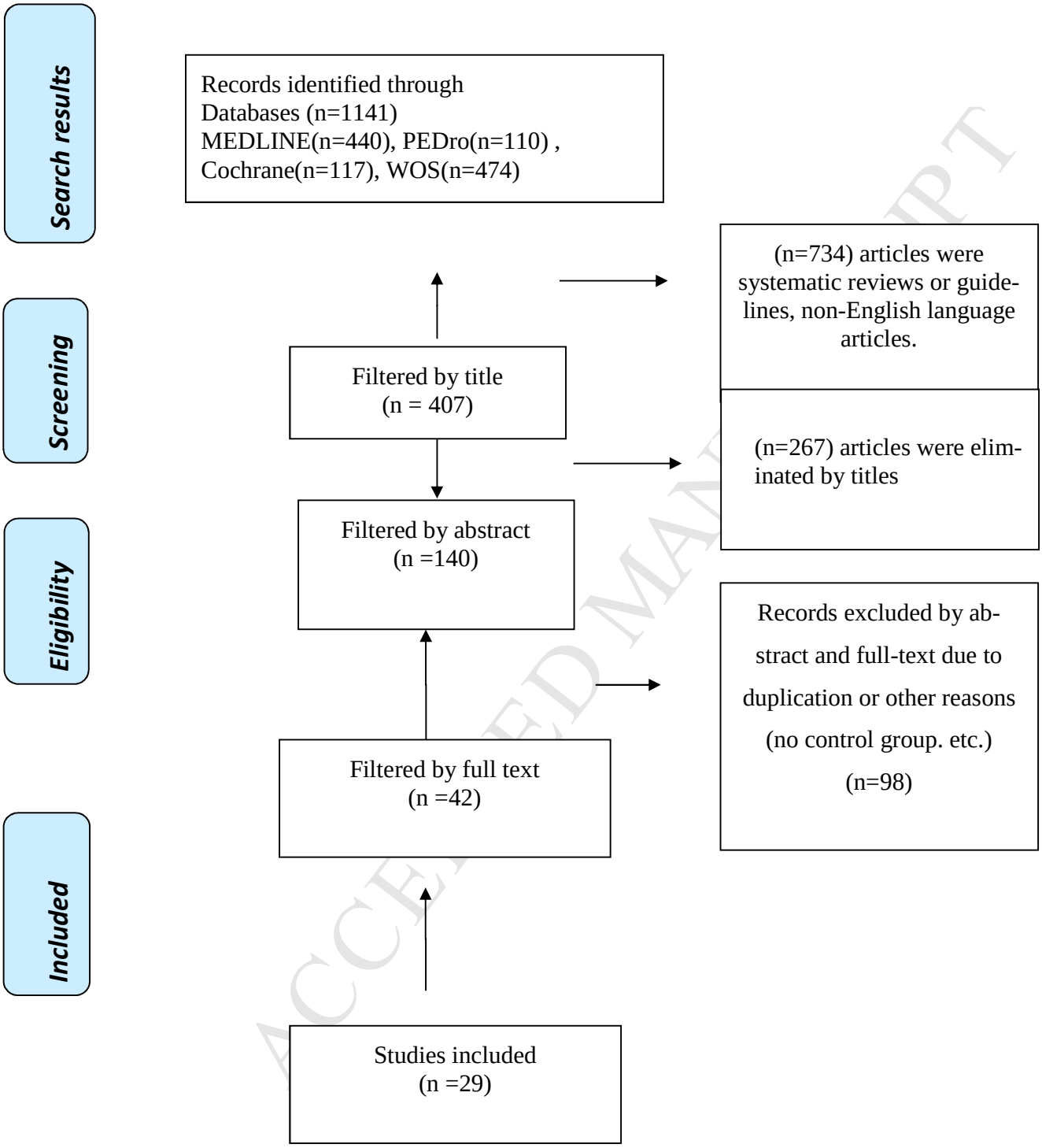


**Figure 3.** Flow diagram of studies through the different phases of the review.

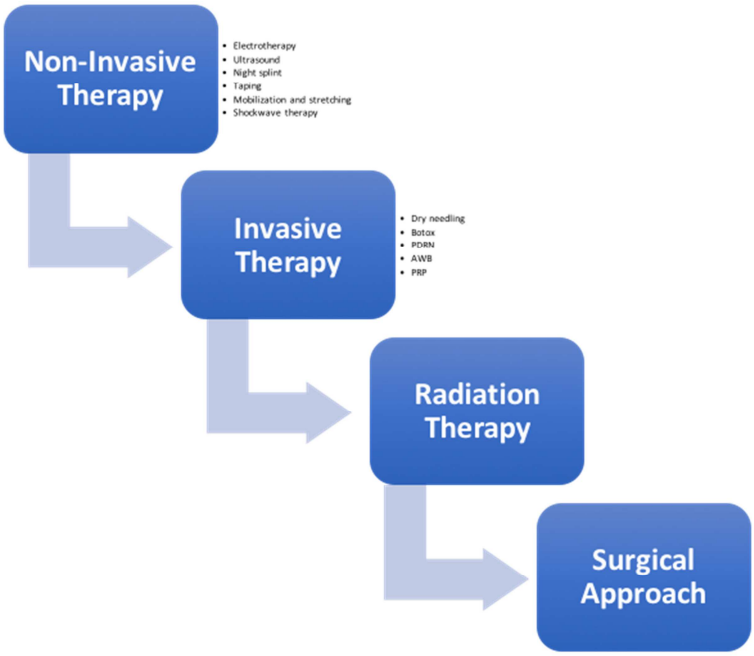


**Figure 4:** Schematic diagram to demonstrate the approach to treatment.