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Is Acupuncture, Including Electroacupuncture, Effective in Treating Pain in Plantar Fasciitis?

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A SELECTIVE EVIDENCE BASED MEDICINE REVIEW

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ABSTRACT

Objective: The objective of this selective EBM review is to determine whether the use of acupuncture, including electroacupuncture, is effective in treating pain in patients with plantar fasciitis.

Study Design: Review of 3 RCTs published between 2011-current, all in the English language.

Data sources: Three RCTs analyzed the effectiveness of acupuncture therapy compared to a control group using alternate analgesic therapies. All studies were found using EBSCOhost and PubMed and were selected based on relevance to the proposed clinical question.

Outcomes measured: Each of the 3 articles analyzed the effectiveness of treating pain with acupuncture treatment in patients diagnosed with plantar fasciitis. The Visual Analog Scale (VAS), Function Foot Index (FFI), and Plantar Fasciitis Pain Scale (PFPS) were the tools used to measure pain. Significance of the outcomes was determined using analysis of variance (ANOVA), Chi-square test, independent t-tests, paired t-tests, and covariance with Bonforroni correction and regression analysis.

Results: All 3 studies showed a significant decrease in pain following treatment with acupuncture. Karagounis et al[10] found a statistically significant reduction in pain at the 8 week follow up measurement in patients who had conventional therapy plus acupuncture compared to those who had conventional therapy only. However, at the 1 month follow up, the results showed no significant difference in pain between the two groups. This differed from the Zhang et al[11] study in which researchers found a significant difference between the two groups in morning pain at the 1 month follow up. Kumnerddee and Pattapong[12] found that the success rate for pain reduction during the day for the acupuncture group was significantly higher than the control group at both the completion of treatment and at the 6 week follow up.

Conclusions: The RCTs discussed in this review suggest that acupuncture is an effective alternative treatment for pain management in patients diagnosed with plantar fasciitis when considered in comparison to conventional analgesic therapies. However, it is inconclusive as to at what point between the completion of treatment and the follow up period do patients attain relief of symptoms.

Keywords: plantar fasciitis, acupuncture, pain management

INTRODUCTION

Plantar fasciitis is a common orthopaedic condition that causes pain in the heel of the foot.[1-6] It is estimated that 10% of the American population will develop plantar fasciitis in their lifetime, which results in approximately 1 million office visits and $192-376 million in healthcare costs.[5-7] This condition is important to address in the facet of primary care, as it has been found that primary care providers are responsible for the care of two-thirds of all patients with plantar fasciitis.[4,5] Plantar fasciitis is typically a chronic condition, diagnosed by history, physical exam, and high clinical suspicion alone.[1] It is most commonly seen in the athletic population, particularly in young males.[1,6] However, obesity, which is present in up to 70% of patients with plantar fasciitis, also plays a significant role in the pathogenesis of this condition.[1] Of the non-athletic and sedentary population, plantar fasciitis is present most commonly in middle-aged obese females.[1] There is a higher prevalence seen in patients with rheumatic conditions such as ankylosing spondylitis or Reiter's Syndrome, which typically presents between the third and fifth decades.[6] Other predisposing intrinsic factors include pes planus, pes cavus, repetitive ankle dorsiflexion, leg length discrepancy, inferior calcaneal exostoses (heel spurs), and advanced age (due to atrophy of the adipose tissue of the heel).[1,3,4,6,8] Some extrinsic factors include excessive running, prolonged weight-bearing activity, and improper shoeware.[1,3,4,6]

The classic presentation of plantar fasciitis is a sharp, stabbing pain over the anterior aspect of the medial calcaneal tubercle that can be reproduced with palpation.[1-5] Patients typically state that this pain is worse with the first few steps in the morning or after prolonged periods of sitting.[1-4,6] This is due to the equinos position of the fascia, which promotes contraction and tightening of the fascial tissues.[2] Initially, the pain is relieved with ambulation,

but symptoms regress again with repetitive activity throughout the day.[1-4] The plantar aponeurosis is a triangular shaped fibrous pad that attaches at the medical calcaneal tubercle, composed of central, lateral and medial bands.[5] It then extends distally, fanning into 5 separate bands at the mid-metatarsal level and attaching to the plantar aspect of the proximal phalanges.[1,5] This high-tension fibrous pad serves as both a static support and shock absorber along the medial longitudinal arch.[1,2,5] Although the exact pathophysiology of plantar fasciitis is unknown, it is suspected to be a multifactorial process. The progressive degeneration of the plantar fascia is likely due to successive microtears and microtrauma, which suggest a more degenerative pathology (fasciosis) rather than an inflammatory pathology (fasciitis) and has been supported by findings on histological examination of the tissue.[1,3,6,9]

Currently, there is a wide spectrum of treatments used for plantar fasciitis, but no one panacea. There are several treatment interventions including use of non-steroidal inflammatory agents (NSAIDs), ice therapy, rest and activity modification, physical therapy, corticosteroid injections, botulinum toxin type A, extracorporeal shock wave therapy, splints, orthotics, and surgery, if intractable with other therapies.[1,3,6] However, many of these treatments are either ineffective or have negative side effects. For example, 10% of patients with plantar fasciitis who received a corticosteroid injection had plantar fascia rupture, of which 50% were found to have long-term complications as a result.[6] Those who have used NSAIDs have shown only short-term relief of symptoms associated with plantar fasciitis.[4] If conservative treatments fail, providers and patients are left to consider surgical intervention. It has been reported that only 50-60% of people have satisfactory results from surgery which is often accompanied by residual complications.[1-3] Although many interventional therapies have been proposed, there is not enough research to support any one effective treatment for plantar fasciitis. Acupuncture is a

new, alternative treatment method that is being proposed that has been known to be effective in the treatment of pain syndromes and other musculoskeletal disorders and should be considered in the treatment of plantar fasciitis.[11, 12]

OBJECTIVE

The objective of this systematic review is to determine whether or not acupuncture, including electro-acupuncture, is effective in treating pain in plantar fasciitis.

METHODS

The studies discussed in this selective evidence based review include three randomized controlled trials (RCTs). The population includes males and females between the ages of 32.9-61.8 years old that presented with pain and tenderness over the medial aspect of the calcaneal tuberosity prior to participating in the study. The interventions used were acupuncture alone or in combination with conventional therapy. The first RCT compared the effectiveness of conventional therapy (ice, NSAIDs, and physical therapy) plus 16 sessions of acupuncture to group that received conventional therapy alone.[10] The second RCT compared 10 sessions of acupuncture at needlepoint Daling (PC7, located between the first and second metacarpal bones), an acupoint proposed to have specific analgesic effects for heel pain, to a control group that received 10 sessions of acupuncture at needlepoint Hegu (LI 4, located on the palmar side of the forearm at the midpoint of the wrist crease), known to have general analgesic properties.[11] Both needling points were applied to the contralateral side of the heel pain. The final RCT compared 10 sessions of acupuncture plus conventional therapy (NSAIDs, shoe modification, and physical therapy) to a control group who received conventional therapy only.[12] The tools used to measure

the effectiveness of treating pain included: Plantar Fasciitis Pain Scale (PFPS), Visual Analog Scale (VAS), and Function Foot Index (FFI).

The keywords used in the searches for the articles addressed in this selective EBM review included the following: plantar fasciitis, pain management, and acupuncture. All three randomized controlled trials were published in English in peer-reviewed journals, found on PubMed and EBSCOhost databases. The author of this selective EBM review chose the articles based on relevance to the proposed clinical question and if they addressed outcomes that would be significant to patients (Patient Oriented Evidence that Matters: 'POEM').

Articles included in this study were those that were published in 2011 or later. Populations addressed were patients diagnosed with plantar fasciitis. The participants included patients who had previous untreated plantar fasciitis for approximately 15 days,[10] patients who had a history of plantar fasciitis for greater than three months prior to the study,[11] or patients who had a history of plantar fasciitis for at least 6 months and had failed 6 weeks of conventional therapy.[12] Those who had any history or major orthopedic or medical conditions were excluded. The following are examples of orthopaedic and/or medical conditions that prevented admittance to the studies: peripheral neuropathy, tarsal tunnel syndrome, calcaneal cyst or fracture, arthritis or infection of the foot or ankle, rheumatoid arthritis, neurogenic claudication, previous foot surgery, history of local steroid injection within previous 6 months, pregnancy, severe systemic disease (diabetes mellitus, cardiovascular disease, etc), needle phobia, or communication difficulties. The summary of statistics used in the studies included analysis of variance (ANOVA), Chi-square test, independent t-tests, paired t-tests, and covariance with Bonforroni correction and regression analysis. Specific demographics and characteristics pertaining to each of the studies addressed in this review are detailed in Table 1 below.

Table 1. Demographics and characteristics of included studies

Study	Type	#pts	Age (yrs)	Inclusion	Exclusion	W/D	Interventions
Karagounis et al [10]	RCT	38	Intervention grp: 36.8±3.9 Comparison grp: 37.4±4.3	38 males experiencing heel pain with no previous treatment for PF	Pts w/ hx of major orthopaedic or medical conditions	0	Conventional therapy plus 16 sessions of acupuncture over 8 weeks
Zhang et al[11]	RCT	53	Intervention grp: 47±2.2 Comparison grp: 50±2.2	≥ 18 years old; Heel pain > 3 months preceding the study; Dx with PF if pain was localized the medial tubercle of the calcaneum	Hx of fracture or dysfunction of the ankle or knee; Arthritis or signs of nerve injury; Severe systemic diseases (RA, DM, or cardiovascular disorders); Unlikely to attend all tx sessions Needle phobia, pregnant, or breast feeding	2	Acupuncture needling at acupoint Daling (PC7), 10 daily sessions over 2 weeks
Kumnerddee and Pattapong[12]	RCT	30	Intervention grp: 52.4±10.5 Comparison grp: 53.8±8	Hx of PF for a minimum of six months and had failed at least six weeks of adequate conservative treatments	Pts w/ any of the following: peripheral neuropathy, tarsal tunnel syndrome, calcaneal cyst or fracture, arthritis of the foot or ankle, rheumatoid arthritis, neurogenic claudication, previous foot surgery, hx of local steroid injection for < 6 months, infection of the foot or ankle, pregnancy, or communication problems	6	Conventional therapy plus 10 sessions of electro-acupuncture over 5 weeks

OUTCOMES MEASURED

The outcome measured is improvement in pain upon completion of treatments. Karagounis et al[10] looked at pain description and mobility function before the start of treatment and at 1 month and 2 months post treatment.[10] Outcomes were measured using the Plantar Fasciitis Pain Scale (PFPS) questionnaire, which includes both identifying symptomatic questions in relation to plantar fasciitis as well as control questions. It is then scored on a 0-100

scale.[10] Zhang et al[11] measured morning pain at the beginning of treatment and at 1 month, 3 months, and 6 months post treatment.[11] Patients were asked to scale their pain 0-100 on the Visual Analog Scale (VAS), 0 representing no pain and 100 representing maximal pain. Kumnerddee and Pattapong[12] measured pain during the day at the completion of treatment and at 6 weeks post treatment. Patients were asked to complete the VAS and the Foot Function Index (FFI), a 23 item questionnaire divided into three categories: pain, disability, and activity limitation, each on a scale from 0 to 10.[12] The success rate for improvement in pain was defined by a 50% reduction in the VAS and overall FFI score between the start of treatment and follow ups.[12] The tools used to measure and analyze improvement in pain following treatment included: analysis of variance (ANOVA), Chi-square test, independent t-tests, paired t-tests, and covariance with Bonforroni correction and regression analysis.

RESULTS

All three RCTs assessed the efficacy of acupuncture in pain management of patients diagnosed with plantar fasciitis. Two studies[10,12] compared acupuncture therapy to conventional therapies, unlike Zhang et al[11], which compared acupuncture therapy at Daling (an acupoint implicated in heel pain) to acupuncture therapy at Hegu (an acupoint known to have analgesic properties). The assignment of patients to treatments was randomized and concealed from those enrolling in the study. All patients, clinicians and researchers were kept blind to treatment. The percentage of loss to follow up was none, 4%, and 20% in each study respectively. Kumnerddee and Pattapong[12] presented the outcomes of the study as dichotomous data. The other RCTs were continuous and could not be converted to dichotomous format.

Karagounis and associates[10] had a total of 38 participants, randomized into a control group (group 1, n=19) and an interventional group (group 2, n=19). The control group received 8 weeks of conventional therapy (ice, NSAIDs, and physical therapy) while the interventional group received conventional therapy plus 16 sessions of acupuncture. No statistical difference in the participants was reported at baseline and all participants had not received previous treatment for plantar fasciitis. A 1-way analysis of variance (ANOVA) was used to calculate statistical differences of the PFPS questionnaire scores within the group (between baseline and follow up) and between the two groups. Pain was significantly decreased from baseline ($p < 0.5$) in group 1 and group 2 at both the 4 week and 8 week measurement. At the 4 week measurement, no significant difference was found in the mean total scores between the two groups ($p > 0.5$). In contrast, a significant difference in mean total scores between the two groups was found at the 8 week measurement ($p < 0.5$). Three participants (16%) of the interventional group reported headaches and dizziness and 1 participant (5%) reported decreased strength and edema at the site of needling. There were no reports of negative side effects or symptoms associated with chronic use of NSAIDs. See Table 2 for detailed results of this study.

Table 2. Mean total score values of PFPS questionnaire and statistical significance at baseline, 4 week and 8 week measurement

	Baseline	4 Week Measurement	8 Week Measurement
Group 1 (comparison grp)	62.6±11.2	55.1±10.7*	46.2±10.3*
Group 2 (interventional grp)	64.8±11.4	54.2±10.9*	34.3±10.8*
Statistical significance (improvement of pain between the 2 groups)	n/a	p-value > 0.5	p-value < 0.5

*Significantly different from *baseline* $p < 0.5$

Zhang et al[11] admitted a total of 53 participants who were randomized into two groups. The comparison group (n=25) received acupuncture treatment at acupoint Hegu while the interventional group (n=28) received acupuncture treatment at acupoint Daling. Both groups received a total of 10 treatment sessions. There was no statistical difference between the two

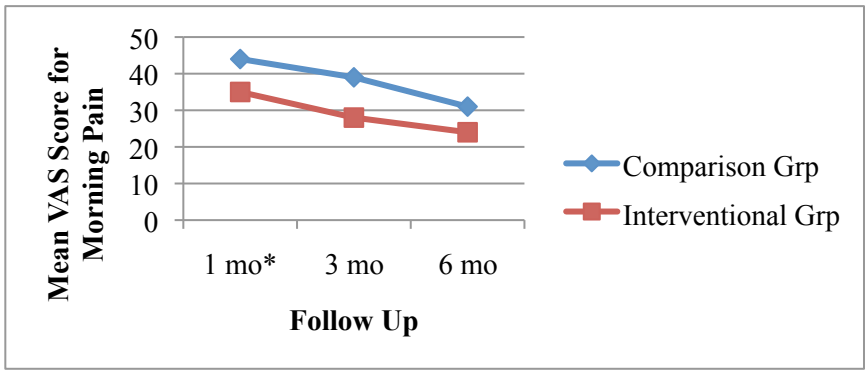
groups at baseline ($p > 0.5$) and most participants were receiving some form of treatment prior to the start of the study. To determine statistical significance of changes in pain from baseline and between groups, data was analyzed using *t*-test, Chi-square test, ANOVA, and covariance with Bonforroni correction and regression analysis. At 1 month, morning pain was significantly decreased from baseline ($p < 0.001$) within the interventional group (Table 3). No significant decrease in morning pain from baseline was observed in the comparison group at the 1 month follow up ($p > 0.5$). There was a significant decrease ($p = 0.044$) in morning pain observed between the comparison group and the interventional group at the 1 month measurement only (see Table 3 and 4). One patient in the comparison group discontinued treatment after the first session due to discomfort associated with needling. Following the third treatment session, 1 patient from the same group discontinued treatment due to lack of improvement in heel pain, leaving a total of 23 participants in the control group. Eight participants (28.6%) of the interventional group and 10 participants (40%) of the comparison group reported mild adverse effects other than pain (local edema, bruising, and distressed sensation), as reported in Table 5. This data demonstrated a relative risk reduction of 0.285% and an absolute risk reduction of 0.144% (Table 5). For every 8 patients who receive acupuncture therapy within the intervention group, 1 patient would experience an adverse event who would have otherwise not been harmed had the patient been assigned to the comparison group (Table 5).

Table 3. Statistical significance of changes in VAS scores at 1 month

	p-value
Baseline to 1 mo (within comparison group)	$p > 0.5$
Baseline to 1 mo (within interventional group)	$p < 0.001$
At 1 mo (between comparison and interventional groups)	$p = 0.044$

*$p < 0.5$ indicates statistical significance

Table 4. Mean morning pain VAS scores at 1 mo, 3 mo, and 6 mo follow up



*p < 0.5 indicates statistical significance

Table 5. Adverse effects and efficacy of Zhang et. al (2011) study

% of participants who experienced adverse effects within comparison group	% of participants who experienced adverse effects within interventional group	Relative Risk Increase (RRI)	Absolute Risk Increase (ARI)	Numbers Needed to Harm (NNH)
28.6%	40%	-0.285%	-0.144%	- 8

A total of 30 patients were admitted to Kumnerddee and Pattapong's[12] study. The participants were randomly allocated into two groups: a comparison group (n=15), who received 5 weeks of conventional treatments including NSAIDs, shoe modification and physical therapy, and an interventional group (n=15), who received 10 sessions of electro-acupuncture twice a week in addition to the same conventional therapies as the control group. There was no statistically significant difference found between the two groups at baseline ($p > 0.05$). The participants in this study included patients who had failed at least 6 weeks of conservative treatments (medication, heel cushions, and plantar stretching exercises). Paired *t*-tests were used to compare within-group changes from baseline and independent *t*-tests were used for between-group comparisons at baseline and follow up. Average FFI and VAS scores for pain during the day were significantly reduced ($p < 0.05$) between baseline and the end of treatment and between baseline and follow up (6 weeks) in the interventional group, but not in the comparison group. The average VAS score for pain during the day was more significantly decreased in the

interventional group than the comparison group at both the end of treatment ($p < 0.001$) and follow up ($p = 0.02$), as demonstrated in Table 6. Similarly, as reported in Table 7, the average FFI score was significantly reduced in the interventional group ($p < 0.001$) when in comparison to the control group at both the end of treatment and follow up ($p = 0.04$). Six participants from the comparison group requested acupuncture following the end of treatment measurement. Therefore, only 9 participants from the comparison group were assessed at the 6 week follow up. This data reflects a relative benefit increase of 10.94% of and an absolute benefit increase of 0.733% (Table 8). This data also demonstrated that 2 patients need to be treated with acupuncture therapy and conventional therapy in order for 1 additional patient to benefit from treatment. This applies for both the end of treatment and at follow up (Table 8). No adverse events were reported.

Table 6. VAS Score Success Rate between Comparison and Interventional Groups

	95% CI of Difference	*p* value
End of Treatment	74.8 (51.4 to 98.2)	< 0.001*
Follow up (6 weeks)	53.4 (18.1 to 88.7)	0.02*

*Significantly different between groups $p < 0.05$

Table 7. Overall FFI Score Comparison between Comparison and Interventional Groups

	95% CI of Difference	*p* value
End of Treatment	3.35 (1.99 to 4.71)	< 0.001*
Follow up (6 weeks)	1.32 (0.11 to 2.54)	0.03*

*Significantly different between groups $p < 0.05$

Table 8. Numbers Needed to Treat at End of Treatment and 6 Week Follow Up

	End of Treatment	Follow Up (6 weeks)
Relative Benefit Increase (RBI)	10.94%	1.064%
Absolute Benefit Increase (ABI)	0.733%	0.534%
Numbers Needed to Treat (NNT)	2	2

DISCUSSION

Plantar fasciitis is a common condition seen in a wide spectrum of patient populations (various ages, occupations, and activity level). Although typically self-limiting, the condition

can become chronic. Therefore, an effective treatment for plantar fasciitis should be determined to prevent the need for recurrent or long term treatment.

Each of the studies discussed in this systematic review are not without limitations. The study population in Karagounis et al[10] was limited to physically active male patients with predominantly normal body mass index and therefore lacked consideration of obese and non-athletic populations. The patients participating in both Zhang et al[11] and Kumnerddee and Pattapong[12] had received previous treatment for plantar fasciitis, so it is difficult to differentiate whether it is the cumulative effect of multiple treatments or the intervention of acupuncture that is responsible for improvements in pain. All three RCTs had a relatively small number of participants, with populations that were unisex or predominantly one sex more than the other. When comparing the three studies, the following factors must be considered: varying number of acupuncture treatment sessions, differing number and location of acupoint sites, the length of treatment, and the time period between completing treatment and the follow up measurement.

CONCLUSION

All three RCTs demonstrated that acupuncture treatment is an effective alternative to treating and reducing pain in patients diagnosed with plantar fasciitis. However, the studies are inconclusive regarding how soon following completion of treatment patients are able to attain improvements in pain. Further studies should be conducted to address the number of acupuncture treatments needed to be effective in reducing pain and if acupuncture is capable of providing long term relief and resolution of symptoms associated with plantar fasciitis. In addition, further research should address whether or not acupuncture alone (without conventional therapies) is an effective treatment in itself.

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