

Research Article

Acupuncture Techniques in the Treatment of Plantar Fasciitis

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Abstract

This literature review will explore a variety of acupuncture techniques to treat plantar fasciitis. A total of five scholarly articles were selected for this literature review using the search engine, Pub Med. In reviewing the articles there are many ways in which plantar fasciitis is treated, but for this review the use of acupuncture alone or in combination with traditional methods will be explored. The methods of acupuncture implemented to treat plantar fasciitis in this literature review are Mini Scalpel-Needle (MSN), dry needling, acupuncture, and the use of Electrode-Acupuncture. The researcher will seek to define the most effective, statistically supported, acupuncture method to treat plantar fasciitis.

Introduction

Plantar fasciitis pain is a common and expensive disease or condition. It affects approximately 10% of the population [1]. Between the years of 1995 and 2000 in the United States, it was estimated that approximately 1 million patient visits to physician's office and hospital out patient's departments per year for plantar fasciitis heel pain [2] at a projected cost of between \$192 million and \$376 million third-party payers [3]. Due to the lack of standard protocols the amount of funds spent to third-party payers should give acupuncturists an incentive to establish a standard protocol. The acupuncturist would then be the front line of defense in the treatment of plantar fasciitis.

The demographics of plantar fasciitis affect about two million Americans each year, causing mild discomfort to debilitating pain. Plantar fasciitis is common among athletes participating in high-impact sports and physical exercises in which excessive force is brought onto the heel and attached tissue. Some high stress activities include ballet dancing, dance aerobics, volleyball, basketball, and long-distance running. These activities result in repetitive stress to the plantar fascia by over pronation of the foot. Over pronation causes excess talar pronation, talar adduction and talarplantar flexion, all of which pulls and strains the plantar fascia causing micro tears to the tissue of the plantar fascia and creating plantar fasciitis. The biomechanics of pronation occurs around the

subtler joint, thus during flat foot stance of gait the talus adducts and plantar flexes (Figure 1) [4]. The plantar fascia of the foot provides the primary support of the medial longitudinal arch. The fascia consists of an extensive series of thick, very strong, longitudinal and transverse bands of collagen-rich tissue. The plantar fascia covers the sole and sides of the foot and is organized into superficial and deep layers. The superficial fibers are attached primarily to the thick dermis, and they function to reduce shear forces and provide shock absorption. The more extensive deep plantar fascia attaches posterior to the medial process of the calcaneal tuberosity [5]. From this origin, lateral, medial and central sets of fibers course inferiorly, blending with and covering the first layer of the intrinsic muscles of the foot. The main, larger, central set of fibers extend inferiorly toward the metatarsal heads where they attach to the plantar plates(ligaments) that cover the metatarsophalangeal joints and fibrous sheath of the adjacent flexor tendons of the digits. The biomechanics of gait and the plantar fascia are very involved and complex and should be considered in any research study that involves the treatment of plantar fascia and acupuncture. In simple terms, plantar fasciitis is defined as an over pronation of the midfoot which causes excessive strain and force on the plantar fascia causing micro tears in the tissues. This then causes fibroblast to lay down collagen thus creating scar tissue to the area and restricting the movement and glide of the plantar fascia, resulting in pain and setting the individual up for plantar fasciitis. Often an

insert of an arch support or orthotic is made to support the arch and the talus from over pronating and decreases the micro tears to the plantar fascia.



Figure 1: Subtalar joint pronation causes the talus to adduct and plantarflex [4].

Other risk factors of plantar fasciitis may involve tight Achilles tendons, or high arches, or any factor which creates an abnormal pattern in the patient's gait. Such as people who work long hours on a job which requires them to stand or walk are especially prone to plantar fasciitis and people whom are overweight or obese. People between the ages of 40 and 70 years of age, women are more likely to get plantar fasciitis than men, primarily due to the array of shoe selection and pregnant women are more likely to get plantar fasciitis primarily due to the inflammation factor and excessive weight during pregnancy.

Symptoms of plantar fasciitis can occur gradual or suddenly, when they occur suddenly, there is usually intense heel pain on taking the first morning steps, referred to as first-step pain. This

heel pain will often subside as the person begins to walk around, but it may return in the later afternoon or evening from excessive walking causing irritation on the plantar fascia.

A heel spur is a pointed bony fragment that extends from the heel bone known as heel spurs. Heels spurs are frequently the cause of heel pain in humans and makes for a painful foot and more painful when walking. It has been reported that calcaneal spurs are of little diagnostic value due to the fact that there is a high prevalence of it in patients with plantar fasciitis [6].

The best way to diagnose plantar fasciitis is to categorize if the patient has classic symptoms of first-step pain. Inquire if their daily activities have changed or if they have intensified their exercise program. Conservative allopathic treatment for Plantar Fasciitis includes rest, balanced with stretching exercises to lengthen the heel cord and plantar fasciitis, ice massage to the bottom of the foot after activities that trigger heel pain, avoidance of walking barefoot or wearing slippers or sandals that provide little arch support, a temporary switch to swimming and/or bicycling instead of sports that involve running and jumping, shoes with soft heels and insoles, taping the bottom of the injured foot, Non-Steroidal Anti-Inflammatory Drugs(NSAIDS), such as ibuprofen(Advil, Motrin and other brand names), or acetaminophen(Tylenol) for pain, physical therapy using ultrasound, electrical stimulation with corticosteroids or massage techniques [7].

Allopathic treatment can include the above conservative treatment, as well as Shock Wave Therapy [8] and lastly if all conservative treatments fail, the patient and doctor may opt for a surgical procedure, which involves cutting part of the plantar fascia ligament to release tension and inflammation of the contracted plantar fascia (Table 1).

Study	Study cohort	Duration	Type of Study	PT/ NSAIDS, Stretching,	Location/methods	Outcome: VAS or other(results)
Li, et al. (2014) [6]	MSN-group (29) Steriod (25) Local treatment only	12months study	Random- ized Con- trolled Trial	Yes	Inserted .8mmx 50mm into most painful tender point over medical tubercle of calcaneus located by palpating the heel. Insert vertical and parallel to foot, up and down 3 to 5 time, no rotation. Steroid injection same palpation, one injection at the heel.	Yes, P values were .43 for VAS, overall pain, indicating MSN group valid for treatment versus Steroid group after 1 month, Patient which received MSN more favorable and sustained improvements in pain compared to those who received steroid injection at 1, 6, and 12 months follow ups.

Cotch- ett, et al. (2014) [10]	TP dry nee- dling & PF based on MF Trp, n =80	1 tx per week for 6 weeks,	Yes, parallel- group,	Yes + Orthosis	Used criteria for MTrPs in muscle and dry needling	Yes: VAS for pain & foot pain: FHSQ: subscale for Foot Health Status question- naire.
	Distal acu- points only	par- ticipants were fol- lowed for 12 weeks	partic- ipant- blinded, random- ized con- trol trial			Results: Significant effects favored real dry needling over sham dry needling for pain: VAS first step pain=-14.4mm, 95% confidence Interval=-23.5 to -5.2. FHSQ foot pain = 10 points, 95%, CI 1 to 19.1, although the between-group difference was lower than the minimal important difference. The number needed to treat at 6 weeks was 4(95% CI = 2 to 12, the frequency of minor transitory adverse events was significantly greater in the real dry needling group (70 real dry needling appointments (32%) compared with only 1 sham dry needling appoint- ment (<1%)
Kum- nerd- dee (2012) [11]	n=35 eligible, randomized n = 30, n =15 for acupuncture, n=15 control group Local electro-acu- puncture	6weeks	Yes, ran- domized control trial	Control group: Conserva- tive therapy (oral anal- gesics and stretching	Electroacupuncture at the plantar fascia	Significant Difference in reduction of VAS scores in favor of the intervention group. Intervention: 6.00 ± 1.69 vs 1.89 ± 1.59 , Control: 6.27 ± 2.34 vs 5.40 ± 2.26
Kara- gounis, et al. [12]	41 = n total participant were random- ized using computer- generated numbers into 2 tx groups 38 of 41 actu- ally partici- pated Group 1: n=19 Group 2: n = 19 Age range: 32-41 yrs Acupoints lo- cal and distal	16 ses- sion, 2 sessions per week for 8 weeks 4wk and 8wk	Yes, ran- domized control trial	Yes + ice therapy +strength- ening	Group 1: tx with ice, NSAID- diclofenac 75 mg, 2x for 15 days, a stretching program focusing on calf muscles, the Achilles tendon and plantar fascia itself and strengthening program for intrinsic foot muscles. Group 2 received the same ther- apeutic procedures as group 1, plus reinforced by acupuncture treatment- 16 sessions, 2 sessions per week. Points used in group 2 -acupuncture: BL 31, 54, 58, 60, 62 St 36, LI 4, PC7, SP5, K7,8, TW5, LV2,3, GB 30, 34, 37, 38	PFPS (includes VAS) Significant differences in reduction of PFPS score in favor of the intervention group at 8 wk. Comparison of PFPS after 4 wk: control group: 55.1 intervention group: 54.2 ($p>.05$), not effective. Comparison of PFPS after 8 wk: control group: 46.2 intervention group 34.3($p<.05$) the smaller the p value the more valid the study

Zhang, et al. [13]	N= 53, n= 25 for control group(LI4) and n=28 treatment group(PC7) Acupoints Distal only	5X per week for 2 weeks	Yes		Location: LI 4 for control group, PC7 for treatment group.	Significant difference in reduction in VAS scores in favor of the intervention group at 1 month. Morning pain: 22.6 ± 4.0 vs 12 ± 3.0 , Overall pain: 20.3 ± 3.7 vs 9.5 ± 3.6 , Pressure pain threshold: 145.5 ± 32.9 vs. -15.5 ± 39.4 . No significant difference found at 3 months and 6 months.
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Table1: The number of different types of Acupuncture used in this literature review includes Mini Scalpel- Needle (MSN), dry needling, acupuncture and the use of Electrode-Acupuncture in the treatment of plantar fasciitis.

Methods

Research for this literature review was conducted by utilizing the University of Bridgeport's Wahlstrom Library's on-line database. The researcher proceeded to search data bases by subject and selected acupuncture. The main database utilized was Pub Med using acupuncture and plantar fasciitis as search words. This search resulted in a total of seventeen articles. When the filters of full-text and published in the last 10 years were selected, the results were narrowed to six articles. The article, How Effective Is Acupuncture for reducing pain due to plantar fasciitis, was eliminated because it was a literature review with no data to determine significance. The Mini Scalpel-Needle versus Steroid Injection for Plantar Fasciitis. A Randomized Controlled Trial with a 12-Month Follow-Up, was cited in other articles three times and had 1,495 views to date. Two of the articles by Cotchett, et al. were preparation for a randomized controlled trial. The first article, Effectiveness of trigger point dry needling for plantar heel pain: study protocol for a randomized controlled trial, was cited by eight Pub Med Central publications. The second, Effectiveness of dry needling and injections of myofascial trigger points associated with plantar heel pain a systematic review was cited by ten Pub Med Central articles. Neither of these articles contained the actual randomized controlled study. After further review the actual study Effectiveness of Trigger Point Dry Needling for Plantar Heel Pain a Randomized Controlled Trial, was located, using the Aca-

demic Search Premiere Database, in the Physical Therapy Journal, Volume 94, Number 8. Another article Acupuncture Treatment for Plantar Fasciitis: A Randomized Controlled Trial with Six Months Follow-Up by Zhang SP, et al. was cited in Pub Med Central eight times. To obtain more studies the researcher referred back to the original search of acupuncture and plantar fasciitis and reviewed a study by Karagounis, P. entitled, Treatment of plantar fasciitis in recreational athlete's two different therapeutic protocols. This study was determined to be of value to review because it had a good control group of standard treatment compared to a control group of standard treatment plus acupuncture. The article, Efficacy of electro-acupuncture in chronic plantar fasciitis a randomized controlled trial by Kumnerddee W, was also selected based on the controlled trial and the use of another form of acupuncture, electro-acupuncture. Research to obtain other articles was done by changing search engines. Using the Cochran database with keywords acupuncture and plantar fasciitis resulted in six articles. Of the six articles, three articles were also in the Pub Med search results and the other findings did not have acupuncture in the title, thus were eliminated.

The Delphi list, (Table 2) is a criteria list for quality assessment of randomized clinical trials, which was used for the evaluation of the studies chosen. Items are given one point if it was 'Yes' and zero points for 'No' or 'Unknown'. If studies scores are $>75\%$ they are deemed to be good, 50-70% are fair, and $<50\%$ poor quality [9].

Study(yr)	Randomization	Allocation Concealment	Similar Baseline	Fulfilled eligibility criteria	Blinded outcome assessor	Blinded care provider	Blinded patient	Point estimate measure of variability	Intention to treat	Score (%)
Li, et al. [14]	Yes	Yes	Yes	Yes	NO	NO	NO	Yes	Yes	6/9=66.7%
Cotchett, et al. [3]	Yes	Yes	Yes	Yes	NO	NO	Yes	Yes	Yes	7/9=77.7%
Kumnerddee (2012) [11]	Yes	Yes	Yes	Yes	unknown	No	No	Yes	Yes	6/9=66.7%
Kargounisal (2011) [12]	Yes	Yes	Yes	Yes	Yes	No	No	Yes	unknown	6/9=66.7%
Zhang, et al. (2011) [13]	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	8/9=88.9%

Table 2: Delphi Criteria List for Papers.

Results

In the Li, et al. article patients were randomly assigned to two groups and followed up for 12 months, with 29 receiving MSN treatment and 25 receiving steroid injections. The results showed that the Visual Analog Scale (VAS) scores for morning pain, active pain and overall help pain were decreased significantly in the MSN group from 1 to 12 months after treatment. (Figure 2) [14] In contrast, treatment for the steroid injection group remained pain free for only one month. (Table 3) [14] Additionally, subjects in the MSN group achieved a more rapid relief of pain and sustained improvements than the steroid group according to VAS scale [14]. The inclusion criteria for this study was ages 18 to 70 who had plantar fasciitis and patients who did not respond to conservative treatments(physical therapy, NSAIDS, stretch exercise and heel cushion) for at least 6 months. The patients were allowed if the heel pain was localized to the medial tubercle of the calcaneus, which is the site of the insertion of the plantar fascia and intrinsic muscles. Exclusion of the group included prior surgeries, arthritis of the ankle, fracture, nerve injury or prior MSN treatment, or local steroid injections into the heel pain area. This is the first randomized study between MSN and steroid injections. The MSN technique is effective because it releases the plantar fascia adhesions by cutting and detaching the stiff and contracted plantar fasciitis, which decreases the high tension of plantar fasciitis which is what is causing the pain. While the asset of this study is that it is the first randomized, controlled study to evaluate the effectiveness of MSN and steroid injection for plantar fasciitis and prove a distinct result between MSN and steroid injections, it does have some weaknesses. Plantar fasciitis is described as a self-limiting condition that will eventually resolve with time. Since the study was so long 1, 6, and 12 months, there should have been a study done with a placebo group for each the MSN and the Steroid groups at the three interval time periods of 1, 6, 12 months. This was not established, except for the one-month criteria, and there were several studies which showed effectiveness of steroids for one month but not longer. Additionally, the study allowed use of prior conservative treatment (NSAIDS, stretching, physical therapy) which may have skewed the results, as well as two patients in the MSN group who dropped out and five patients in the steroid injection group dropped out because of persistent heel pain, this would lower the VAS scale for both groups. The issue of calcaneal spurs was also not factored in. The current study had 43 out of 61 patients had calcaneal spurs according to x-rays imaging results, which is in contrast to results of other studies analyzed. However, it has also been reported that calcaneal spurs are of little diagnostic value due to the fact that there is a high prevalence of it in patients with plantar fasciitis, so it would be very difficult to exclude this variable in all plantar fascia studies. Other weaknesses of this study included, again, the lack of a true control group which may have risked the confidence

of the results, second, the study could not keep patients blinded to the treatment type due to the nature of the treatments and third, only subjective measurement outcomes were used to evaluate the effectiveness of MSN release treatment for plantar fasciitis. The study would have been more effective if there were objective measurement outcomes.

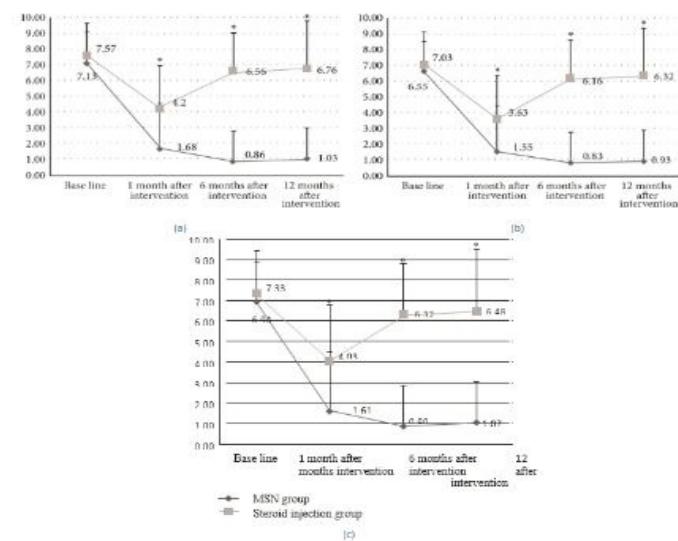


Figure 2: The effectiveness of MSN release treatment versus steroid injection for treating plantar fasciitis. (a) VAS scores for morning pain of MSN group decreased significantly compared to those of steroid injection group at 1-, 6-, and 12-month follow-up. (b) VAS scores for active pain of MSN group decreased significantly compared to those of steroid injection group at 1-, 6-, and 12-month follow-up. (c) VAS scores for overall pain of MSN group decreased significantly compared to those of steroid injection group at 1-, 6-, and 12-month follow-up. VAS: visual analog scale; MSN: miniscalpel-needle. * $P < 0.05$ [14].

Morning pain	MSN group	Steroid injection group	P value
Baseline	7.13 ± 1.82	7.57 ± 2.10	0.387
1-month follow-up	1.68 ± 2.10	4.20 ± 2.47	0.000
6-month follow-up	0.86 ± 1.30	6.56 ± 2.40	0.000
12-month follow-up	1.03 ± 1.40	6.76 ± 2.70	0.000

(a)

Active pain	MSN group	Steroid injection group	P value
Baseline	6.55 ± 1.75	7.03 ± 1.71	0.278
1-month follow-up	1.55 ± 1.95	3.63 ± 2.40	0.000
6-month follow-up	0.83 ± 1.63	6.16 ± 2.54	0.000
12-month follow-up	0.93 ± 1.70	6.32 ± 2.67	0.000

(b)

Overall pain	MSN group	Steroid injection group	P value
Baseline	6.94 ± 1.77	7.33 ± 2.09	0.425
1-month follow-up	1.61 ± 2.14	4.03 ± 2.37	0.000
6-month follow-up	0.90 ± 1.72	6.32 ± 2.64	0.000
12-month follow-up	1.07 ± 1.69	6.4 ± 2.70	0.000

Table 3: 12 months after intervention $P_{>0.05} > 0.05$; Figure 3(a) [14].

The Cotchett, et al. study used a parallel group participant and assessor blinded, randomized controlled trial. Participants, see (Table 4) [3] for details, were randomized to receive either real dry needling or sham dry needling intervention. Allocation to either the real or sham groups was achieved by computerized random number sequence. The Cotchett et al. study used Myofascial Trigger Points (MTrPs) within the plantar intrinsic foot musculature and muscles proximal to the foot. It has been long established that the use of trigger point therapy is effective in reducing the pain created by the trigger point into the muscle. In Janet Travel's book, Myofascial Pain and Dysfunction, The Trigger Point Manual, she states, "A focus of hyperirritability in a tissue that, when compressed, is locally tender and, if sufficiently hypersensitive, gives rise to referred pain and tenderness, and sometimes to referred autonomic phenomena and distortion of proprioception. Types include myofascial, cutaneous, fascial, ligamentous and periosteal trigger points [15]." The Cotchett, et al. study is important due to the fact it is the first published randomized controlled study in the treatment of MTrPs for plantar fasciitis. There had been other investigative studies by Tillu and Gupta which found significant improvement in plantar heel pain with the usage of MTrPs also supported by the study of Merez-Milan and Foster. The MTrPs diagnosis used a tender point within a taut band of skeletal muscle, a characteristic pattern of referred pain and patient recognition of pain on sustained compression over the tender point and a local twitch response on dry needling. A flat palpation or pincer technique was used to palpate an MTrPs depending on the muscle being assessed. The problem with this palpation techniques it is not interexaminer and not intraexaminer reliable not reproducible, this has been shown in many studies [8]. Additionally, this study did not just pick a set number of MTrPs and treat those points specifically on each patient. The study would have more credibility if the MTrPs were the same for each subject in both the real dry needling group as well as the sham dry needling group. Another issue with this study was the people in the sham group were treated with a needle in a non-penetrating but simulated technique which is great, but it is not possible for the patient to not know they are being needled. Most people know when an acupuncture needle goes into their skin, so this could have skewed the outcome result for this group and thus the comparison between the two groups and decrease the credibility of the study. Furthermore, there were too many variables of co-intervention to relieve plantar heel pain while conducting the study. This included NSAIDS, foot orthoses, night

splints, calf stretching, massage therapy, footwear medication, foot taping and foot injections. Although they tried to account for these co-intervention factors, there were too many variables which can affect the outcome of their measurement. Thus far, this seems to be a common theme in the papers, where the study allows for the continuation of these variables which really cannot be measured throughout the studies and can influence the outcome in a study. For example, if one patient took NSAIDS and the other patient did not but they are in the same study group either sham or real, the NSAIDS are going to affect the outcome measurement of pain.

Table 2.
Baseline Characteristics of Participants for Intervention Groups^a

Variable	Real Dry Needling Group (n=41)	Sham Dry Needling Group (n=43)
Age (y)	54.4 (12.4)	57.8 (12.0)
Sex (male), n (%)	17 (41.4)	27 (62.8)
Height (cm)	168.2 (10.7)	171.1 (8.8)
Weight (kg)	86.6 (22.6)	82.9 (13.2)
Body mass index (kg/m ²)	30.3 (5.7)	28.4 (4.4)
Foot Posture Index	3.1 (1.4)	2.8 (1.5)
Duration of symptoms (mo)	13.4 (14.1)	13.7 (17.3)
Medical conditions, ^b n (%)		
Heart disease	1 (2.6)	2 (4.3)
Hypertension	13 (28.9)	8 (21.7)
Hypercholesterolemia	13 (31.6)	10 (23.9)
Lung disease	4 (10.5)	0 (0.0)
Osteoarthritis	4 (10.5)	5 (10.9)
Thyroid disease	1 (2.6)	2 (4.3)
Depression	2 (5.3)	2 (4.3)
Anxiety	0 (0.0)	1 (2.2)
Education (y)	14.9 (2.8)	15.8 (3.2)
First-step pain (VAS ^c)	67.7 (20.9)	58.5 (19.5)
Pain (FHSQ ^d)	32.9 (22.1)	40.2 (19.7)
Foot function (FHSQ)	45.4 (26.0)	52.6 (22.1)
General foot health (FHSQ)	46.2 (31.8)	42.4 (29.0)
Health-related quality of life (SF-36 ^e physical component)	43.4 (9.0)	44.5 (8.7)
Health-related quality of life (SF-36 mental component)	49.3 (10.7)	49.9 (8.3)
Depression (DASS-21 ^f)	6.4 (7.9)	6.5 (7.0)
Anxiety (DASS-21)	3.8 (4.5)	3.8 (4.5)
Stress (DASS-21)	10.9 (10.0)	8.5 (8.0)
Level of activity in the previous week (PAR ^g)	290.5 (54.1)	303.9 (90.1)

^a Values are mean (SD) unless stated otherwise.

^b A comorbidity was defined as any medical condition reported by a participant for which he or she was taking medication.

^c VAS=visual analog scale (higher values indicate greater levels of heel pain when getting out of bed in the morning).

^d FHSQ=Foot Health Status Questionnaire (0="worst foot health," 100="best foot health").

^e SF-36=36-Item Short-Form Health Survey (0="worst quality of life," 100="best quality of life").

^f DASS-21= 21-item short-form Depression, Anxiety and Stress Scale (higher scores indicate more symptoms).

^g PAR=Physical Activity Recall Questionnaire (values correspond to total weekly energy expenditure in kcal/kg/wk).

Table 4: Baseline characteristics of participants for Intervention Groups.

The Kumnerddee, et al. did no manual manipulation of the needles, but used electro-acupuncture, which is the application of electrical current to acupuncture needles [11]. The Kumnerddee, et al. study was a randomized study of a sample size of n=30, and used outcome measures of VAS and Foot Function Index scores

for 5 weeks. The study compared conservative therapy (oral analgesics and stretching plus electro-acupuncture versus conservative therapy (oral analgesics and stretching). There was a significant difference in reduction in VAS scores in favor of the intervention group. This study used inclusion criteria which required participant who had failure at least six weeks of conservative therapy (such as medication, heel cushion and stretching exercises). Several theories have been proposed to explain the effects of electro-acupuncture. Plantar fasciitis causes myofascial pain due to the development of trigger points in the foot muscles. Researchers have suggested that these points could be deactivated by acupuncture, with electrical stimulation providing an “Additive” effect [16]. Deactivation of trigger points could also relieve the noxious stimulation, leading to central sensitization in the spinal cord and central nervous system. Since there is scientific evidence supporting a link between electrical stimulation of acupuncture points and the release of endorphins, this research theorized that electro-acupuncture could activate the body’s pain relief system, increasing the concentration of endorphins in the central nervous system and decreasing the amount of pain signals that arrive at the spinal cord level [10]. The primary issue with this study is that it was performed by a single author, which increases the possibility of bias in study selection and appraisal that could have impacted its results [17-20].

The Karagounis, et al. study helps guide the field of acupuncture on how long and how frequent the need for acupuncture is for plantar fasciitis. The results were significant for the pain & disability scale (PFPS) scores which favor the intervention group at eight weeks for acupuncture. The comparison of PFPS after four weeks showed control group: 55.1, intervention group: 54.2, with ($p>.05$) versus PFPS after eight weeks, control group 46.2, intervention group: 34.3($p<.05$). While the smaller the p value the more valid, thus eight weeks of treatment was required for successful treatment with acupuncture for plantar fasciitis. However, there were some limitations of this study, in the control groups; group 1, validity was never established. The control group treatments would have needed to establish a control for the effect of all of the conventional treatments received in group 1, which included treatment with ice, 75 mg diclofenac 2x/day for 15 days, plus a stretching program for intrinsic muscles. Basically, the study never proved group 1 protocols effectiveness. A key variable which may have skewed the results was changing the acupoints during the study to the symptoms and the final diagnosis [21,22].

A combination of up to 12 points was used out of a list of 20(BL 31, 54, 58, 60, 62, ST 36, LI 4, PC7, SP5, KD 7,8, TW 5, LV 2,3, GB 30, 34, 37, 38). The study used a first combination of acupoints for six consecutive sessions, if no improvement was reported; another clinical exam was performed to choose alternative points for the next 10 sessions. This was a flaw of the study. If you are trying to establish effectiveness of points then changing the points in the middle of the study is interfering with the outcome of the study. Additionally, they used recreational athletes of

an age population which generally has good healing ability, given the mean age for group 1 was $37.4+/-4.3$ and group 2 mean age was $36.8 +/- 3.9$, they used runners, basketball players and tennis players. This study did not include a control group because it is difficult to sustain patients without any medication and/or acupuncture treatment. Therefore, no assessment of the efficacy of the intended acupuncture treatment compared with placebo can be found [23,24].

In the Zhang et al. study, two groups were studied in a sample size of 53, with $n=25$ the control group (LI4) and $n=28$ treatment group (PC7). The points chosen were LI 4 is known to be an analgesic point and close to PC7 and PC7 is known to be a key point in treating heel pain. Both sites were needled distal and contra lateral to the area of plantar fasciitis. Patients were seen five times per week for two weeks. The VAS scores for this study were in favor of the intervention group at 1 month, but no significant difference was found for 3 months and 6 months period. The main problem with the Zhang et al study is that LI 4 is analgesic and PC 7 is for heel pain, so it would have been more effective to choose a control group which was not an analgesic for pain, which may have skewed the outcome of this study.

Discussion

Although, there are some flaws to the studies reviewed, according to the five studies compared, all treatments in the form of acupuncture type were successful in treating plantar fasciitis. These articles showed that acupuncture, or forms of acupuncture, significantly reduced pain levels in patients with plantar fasciitis, as measured on the Visual Analogue Scale (VAS). In the five studies viewed, two of the five used local points for treatment and two used distal points and one study used local and distal. In a recent study by Qing-Nan Fu et al. this study tested local point, distal points and combination of local and distal points for the treatment of shoulder pain. It was evidenced that local acupoints in combination with distal acupoints may be more effective than needling points separately to treat pain [14]. Additionally, this study chose the distal point on the opposite side of the involved shoulder, which adds not only local distal but also local and opposite. In the studies reviewed in this literature review, the Karagounis, et al. was the only study which used local distal.

For measurement outcomes, all studies used a Visual Analogue Scale (VAS). An important addition in the Karagounis, et al. study was the importance of the Plantar Fasciitis Pain/Disability Scale (PFPS) which allowed for differentiation of plantar fascia pain and other pathologies causing heel pain. The present study was limited, only two databases were used for literature searches and only studies published in English language were researched. However, the key notes to take from this literature review is research studies for acupuncture and plantar fasciitis should apply uniform and consistent methods of acupuncture application throughout the studies, sample size should be large, detailed information regard-

ing the qualifications and experience of the acupuncturist should be made available, duration of the studies should be a minimum of 6 months in order to study long-term effects of acupuncture, all studies should include VAS scores, all points study should include local and distal. Lastly, biomechanics and gait analysis of participant should be evaluated as a baseline for treatment.

Conclusion

While the studies provided show effectiveness of acupuncture for the treatment of plantar fasciitis, a new study should be proposed for the Li et al. study here in the United States. The Li et al. was the most effective study in this literature review establishing pain relief for 12 months post procedure versus the common use of steroid injections which last one month. This study was done successfully in China and it would be advantageous for the treatment of plantar fasciitis for researchers to duplicate the Li et al. study here in the United States. Recreating the Li et al. study in the United States would be a stepping-stone to establish the most effective treatment for plantar fasciitis.

References

1. Cotchett MP, Landorf KB, Munteanu SE, Raspovic A (2011) Effectiveness of trigger point dry needling for plantar heel pain: study protocol for a randomized controlled trial. *Journal of Foot and Ankle Research* 4: 5.
2. Cotchett MP, Landorf KB, Munteanu SE (2010) Effectiveness of dry needling and injections of myofascial trigger points associated with plantar heel pain a systematic review. *Journal of Foot and Ankle Research* 3: 18.
3. Cotchett MP, Landorf KB, Munteanu SE (2014) Effectiveness of Trigger Point Dry Needling for Plantar Heel PainA Randomized Controlled Trial. *Physical Therapy Journal* 94: 1083-1094.
4. DeMaio M, Paine R, Mangin RE, Drez Jr D (1993) Plantar Fasciitis. *Orthopedics* 16: 1153-1163.
5. Dunn, JE, Link CL, Felson DT, Crincoli MG, Keysor JJ, et al. (2004) Prevalence of foot and ankle conditions in a multiethnic community sample of older adults. *Am J Epidemiol* 159: 491-498.
6. Fu QN, Shi GX, Li QQ, Tian He, Bao-Zhen Liu, et al. (2014) Acupuncture at local and distal points for chronic shoulder pain: study protocol for a randomized controlled trial. *Trials* 15:130.
7. Gollwitzer H, Saxena A, DiDomenico L, Galli L, Bouche R, et al. (2015) Clinically Relevant Effectiveness of Focuses Extracorporeal Shock Wave Therapy in the Treatment of Chronic Plantar Fasciitis. *The Journal of Bone and Joint Surgery* 97: 701-708.
8. Haneline M, Young M (2009) A review of Intraexaminer and Interexaminer reliability of static spinal palpation literature synthesis. *Journal of Manipulative and Physiological Therapeutics* 32: 379-386.
9. Hill CI, Gill T, Menz HB, Taylo AW (2008) Prevalence and correlates of foot pain in a population-based study the NorthWest Adelaide Health Study. *J Foot Ankle Res* 1:2.
10. Hong CZ (2000) Myofascial trigger points pathophysiology and correlation with acupuncture points *Acupuncture Med* 18: 41-47.
11. Kumnerddee W, Pattapong N (2012) Efficacy of Electro-Acupuncture in Chronic Plantar Fasciitis: A Randomized Controlled Trial. *The American Journal of Chinese Medicine* 40: 1167-1176.
12. Karagounis P, Tsironi M, Prionas G, Tsiganos G, Baltopoulos P (2011) Treatment of plantar fasciitis in recreational athletes two different therapeutic protocols 4: 226-234.
13. Zhang, Yip TP, Li QS (2011) Acupuncture treatment for plantar fasciitis a randomized controlled trial with six months follow-up. *Evidence-Based Complementary and Alternative Medicine*.
14. Li S, Sheng T, Liang Y, Bai B (2014) Miniscalpel-Needle versus Steroid Injection for Plantar Fasciitis a Randomized Controlled Trial with a 12-Month Follow-Up. *Evidence Based Compl and Alter Med* 2014: 1-7.
15. Travell JG, Simons DG (1983) Myofascial Pain and Dysfunction the Trigger Point Manual. Volume 1. Baltimore Maryland Williams& Wilkins.
16. Perez-Millan R, Foster L (2001) Low frequency electroacupuncture in the management of refractory plantar fasciitis. *Medical Acupuncture* 13: 1-6.
17. Lewine (2013) Plantar fasciitis. In Harvard Medical School (Ed.), Harvard Medical School health topics A-Z. Boston MA Harvard Health Publications.
18. Menz HB, Tiedemann A, Kwan, Plumb K, Lord SR (2006) Foot pain in community-dwelling older people an evaluation of the Manchester Foot Pain and Disability Index. *Rheumatology (Oxford)* 45: 863-867
19. Michaud T (1997) Foot Orthoses and Other Forms of Conservative Foot Care. Massachusetts Thomas C Michaud
20. Neumann DA (2002) Kinesiology of the Musculoskeletal System. St Louis Missouri Mosby, Inc.
21. Riddle DL, Schappert SM (2004) Volume of ambulatory care visits and patterns of care for patients diagnosed with plantar fasciitis: a national study of medical doctors. *Foot Ankle Int* 25: 303-310.
22. Tillu A, Gupta S (1998) Effect of Acupuncture Treatment on heel pain due to plantar fasciitis. *Acupuncture Medicine* 16: 66-68.
23. Tong KB, Furia J (2010) Economic burden of plantar fasciitis treatment in the United States. *Am Journal Orthop*: 227-231
24. Verhagen AP, de Vet HC, de Bie RA, Kessels AG, Boers M (1998) The Delphi list a criteria list for quality assessment of randomized clinical trials for conducting systematic reviews developed by Delphi consensus. *J ClinEpidemiol* 51: 1235-1241.