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Original Research Article

Extra Corporeal Shock Wave Therapy Versus Local Corticosteroid Injection in the Treatment of Chronic Plantar Fasciitis, a Single Blinded Randomized Clinical Trial

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Abstract

Objectives. Plantar fasciitis is a self-limiting condition, but can be painful and disabling. Among the different treatments which exist, corticosteroid injections are effective and popular. Extracorporeal shock wave therapy (ESWT) is another treatment modality used for resistant conditions. In this study, the authors evaluated the efficacy of radial ESWT versus corticosteroid injections in the treatment of chronic plantar fasciitis.

Design. Randomized clinical trial.

Setting. Physical medicine and rehabilitation research center in a university hospital.

Subjects. Forty patients with plantar fasciitis who did not respond to conservative treatment.

Methods. Patients were allocated to radial ESWT with 2000 shock waves/session of 0.2 mJ/mm^2 (n = 20) or local methylprednisolone injections (n = 20). Pain in the morning and during the day based on a visual analog scale (VAS), functional abilities using the foot function index (FFI), and satisfaction were evaluated before treatment and at 4 and 8 weeks after treatment.

Results. Patients (average age: 42.1 ± 8.20) received five sessions of ESWT or single steroid injection. Changes in the VAS in morning and during the day and the FFI throughout the study period were significant in both groups ($P < 0.001$). ESWT group had a higher reduction in VAS in morning and better function in FFI, but these changes were insignificant statistically [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, $P = 0.072$)]. Good or excellent results in the opinions of patients were achieved in 55% of ESWT and 30% of corticosteroid injection groups ($P = 0.11$).

Conclusion. Both interventions caused improvement in pain and functional ability 2 months after treatment. Although inter-group differences were not significant, the FFI was improved more with ESWT and patients were more satisfied with ESWT, thus shockwave therapy seems a safe alternative for management of chronic plantar fasciitis.

Key Words. Plantar Fasciitis; Corticosteroid Injection; Extracorporeal Shockwave Therapy

Introduction

Plantar fasciitis is the most common cause of heel pain, and accounts for 11%–15% of all foot symptoms requiring professional care [1–3]. It has a bimodal distribution, afflicting both athletes and sedentary patients. Plantar fasciitis is characterized by pain and tenderness at the calcaneal origin of the plantar fascia upon weight-bearing after prolonged periods of rest [1–4]. It has been suggested that acute or chronic inflammatory changes occur in the calcaneus insertion, resulting from chronic overload from lifestyle or exercise [5,6]. Degenerative changes in the fascia, especially in chronic cases without an inflammatory condition, have also been reported [2,7].

Regardless of the treatment, plantar fasciitis is a self-limiting condition in which symptoms are resolved in the majority of the patients within 12 months [7,8]. However, plantar fasciitis can be painful and disabling and may worsen over time [9]. In such cases, treatment appears to be helpful.

Current treatments for plantar fasciitis are conservative and include rest, non-steroidal anti-inflammatory drugs (NSAIDs), stretching of the plantar fascia, physical therapy, foot padding, and orthotic devices, which can be used to suit patient needs [5–7]. Other treatments for plantar fasciitis include local steroid injections, platelet-rich plasma, and intralesional botulinum toxin A [5,7,10]. Corticosteroid injections are an effective and popular method to treat this condition [11]. Nevertheless, serious side effects following corticosteroid injections, such as subsequent plantar fascia rupture, have been reported [12,13].

Other treatments for plantar fasciitis, such as extracorporeal shock wave therapy (ESWT) and surgery, are recommended if patients do not respond to conservative treatments for at least 6 months [2,3]. Shock waves in medicine are pulsed acoustic waves characterized by a short duration of time (<10 microseconds), very high pressure amplitudes, and relatively low tensile wave components (approximately 10% of the maximum pressure). Shock waves are generated outside the human body in water and transmitted widely over a large skin area onto the target region, where the acoustic energy is concentrated to a focal area 2–8 mm in diameter [14,15].

It has been reported that ESWT is safe and efficacious in patients with chronic musculoskeletal disorders, such as tennis elbow, medial epicondylitis, tendinosis, and plantar fasciitis, who are resistant to conservative treatment [16–19].

Although local corticosteroid injections and ESWT are well-known treatments for plantar fasciitis, there are only two reports that have compared the efficacy of these treatments [20,21]; similar success rates or higher were shown for corticosteroid injections. On the other hand, experimental data in this area are somewhat controversial [22] and there is no general consensus about its appropriate application and standard protocol of ESWT in different musculoskeletal disorders. Indeed, there are few relevant studies and further researches are warranted.

In the current study we aimed to evaluate the efficacy of radial ESWT versus local corticosteroid injections on pain intensity, functional disability, and patients' satisfaction in the treatment of chronic plantar fasciitis.

Methods

Participants

In this randomized clinical trial, 40 patients with chronic plantar fasciitis seeking evaluation in the physical medicine and rehabilitation clinic of a university hospital were recruited between October 2013 and March 2015.

Patients of both genders between 18–65 years of age diagnosed with plantar fasciitis who failed to respond to conservative treatments, including physical therapy, NSAIDs, stretch exercise, and heel cushion for more than 2 months were included.

Plantar fasciitis was diagnosed based on the following criteria by an experienced physiatrist [23]: 1) tenderness to pressure at the origin of the plantar fascia on the medial tubercle of the calcaneus, 2) complaint of heel pain in the morning or after sitting for a long time, and 3) increasing foot pain with extended walking or standing for more than 15 minutes with pain intensity greater than or equal to 3 on a 1–10 visual analog scale (VAS).

Patients were excluded if they had previous local surgery, fracture of foot bones, systemic inflammatory disease (e.g., rheumatoid arthritis, gout, and lupus), diabetes mellitus, posterior heel pain due to Achilles tendon bursitis, or active S1 radiculopathy. Also, patients who had received a corticosteroid injection for plantar fasciitis within the previous 6 months or physiotherapy within the previous 3 months were excluded. Pregnant women were also excluded.

The trial was powered to detect an effect size of $d \geq 0.60$ as statistically significant in a two-tailed test with an $\alpha = 0.05$ and a power of 0.80 with $N = 17$ per condition. As there was a possibility that some patients would not complete the study, we included 20 patients in each group.

A study by Jensen et al. showed that a percentage decrease of 30–33% on a rating scale of 0 to 10 points was associated with much improvement for chronic pain patients [24]. However, to define patients who benefited from treatment or success rate, a similar study in this regard was considered [23], and 60% decrease

in VAS was defined as successful therapy in present study. Accordingly, a minimal reduction of 50% in the FFI score was also considered as clinically significant functional improvement perceived by patients [25].

Research Ethics

The study procedure was in accordance with the ethical standards of the local Committee on Human Experimentation of Tabriz University of Medical Sciences and approved by the Ethics Committee. The study protocol was also registered as a clinical trial in the Iranian Registry of Clinical Trials (www.irct.ir, Number IRCT201306163217N7). Before participating in the project, the aims of the study were explained to all of the patients and written informed consent was obtained from all study participants.

Interventions

Each participant was randomly assigned to the ESWT or the local corticosteroid injection group using the random number generation function in a commercially available software program (Excel; Microsoft, Redmond, WA, USA).

The first group received shock wave therapy using radial ESWT (DolorClast Classic Equipment, Switzerland). Treatment of the affected tissue region was achieved by a sequence of 2000 shock wave pulses fired with a repetition frequency of 2 pulses per second. Energy level or intensity was set at a tolerable level by patient ($0.2 mJ/mm^2$). The entire treatment lasted 15 min per session and was usually performed without local anesthetic drugs. All subjects received five sessions of ESWT at 3-day intervals.

The participants were instructed to refrain from using any other conservative treatment, including physical therapy during their participation in this study. Patients were also discouraged to use non-steroidal anti-inflammatory medications during the following 2 weeks because of their inhibitory effects on recovery process. Acetaminophen 500 mg was ordered for pain in this period.

In the second group, before the corticosteroid injection the skin was prepped and draped. Then, 40 mg of methylprednisolone plus 1 ml of 1% lidocaine was injected under sterile conditions with a 22-gauge needle into the most painful tender point (usually in the medial plantar or inferior calcaneal area). A single injection was administered by an expert physiatrist without the guidance of sonography. Patients were recommended to have relative rest for 24–48 hours after injections and limit weight-bearing over the injected area. During this period, they were recommended to apply cold therapy two times a day for 10 minutes each time.

After treatment, patients in both groups were observed for 30 min to record any adverse reactions. If the participants in any group exhibited bilateral plantar fasciitis, both feet were treated. All patients were asked to avoid full weight-bearing on the heel for 2 days. Heel pad and orthotic insoles were provided for both groups. All patients in both groups were also educated and advised to do stretching exercises of the gastrocnemius muscle, plantar fascia, and hamstrings in 3 sets of 10 repetitions; each time holding for 10 seconds and repeating 10 times, at home during the study period. None of the patients were lost to follow-up or excluded during the study period (Figure 1).

Outcome Measures

Pain intensity was quantified using a 10-cm VAS. Pain intensity was referred as 0–10, in which 0 = no pain at all and 10 = the worst pain possible. Patients were asked to mark the place on the VAS scale that corresponded to their level of pain. Patient satisfaction of the treatment was evaluated using a 4-point Likert scale (1 = excellent, 2 = good, 3 = adequate, and 4 = poor).

The modified FFI consists of 17 self-reported items divided into two sub-categories (pain and disability). The pain sub-category consists of five items and measures foot pain in different situations. The disability sub-category consists of 12 items and measures difficulty or limitation performing various functional activities due to foot problems. Scores range from 0 to10 on the VAS, with higher scores indicating worse pain. Both total and sub-category scores were calculated. The modified 17 item-FFI has been validated and determined to yield reliable data for people with musculoskeletal foot and ankle disorders [25].

The investigator who evaluated the clinical measurements was blinded to the allocated treatments. All evaluations were repeated at baseline and 1 and 2 months after treatment by the same investigator.

Statistical Analysis

Quantitative variables are presented as mean (SD). The U Mann Whitney was used to compare mean of quantitative variables (Age) between two groups. Categorical data are reported as frequencies (percentages) and were tested by Fisher's exact test. We used Mixed model ANOVA to investigate changes in mean score of dependent variables (VAS morning, VAS during the day, and FFI) over three time points (baseline, 4 weeks, and 8 weeks after intervention) between two groups (ESWT, corticosteroid injection).

Statistical analyses were performed using SPSS 16.0 software. *P* values less than 0.05 were considered statistically significant.

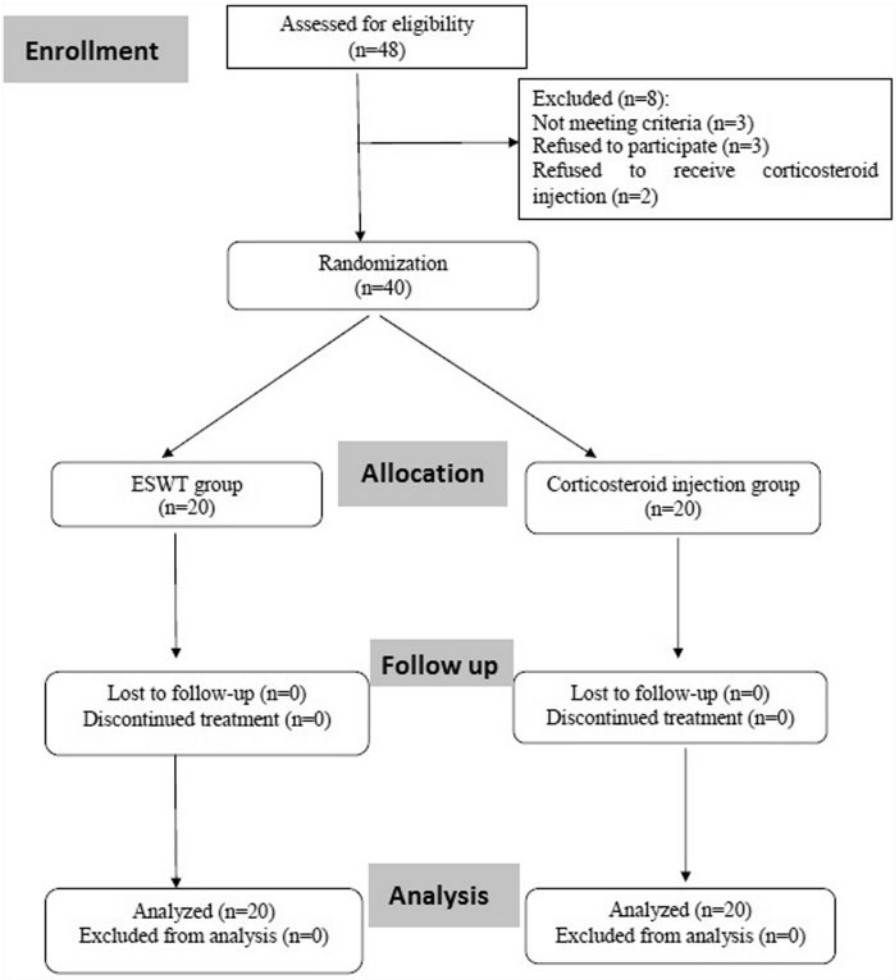

Figure 1 Flow diagram of the study protocol.

Results

Demographical Characteristics of Patients

Twenty patients received radial ESWT and 20 patients were treated with local corticosteroid injections. The ESWT group was comprised of two males (10%) and 18 females (90%). The corticosteroid injection group was comprised of five males (25%) and 15 females (75%), ($P = 0.14$). The mean age was not different between the ESWT and corticosteroid injection groups (41.45 ± 8.05 years versus 42.85 ± 8.62 years, $P = 0.59$).

Eleven patients in the ESWT group and eight patients in the corticosteroid injection group had both feet treated. Nine patients in the ESWT (six right feet and three left feet) and 12 patients in the corticosteroid injection group (seven right feet and five left feet) had one foot treated. So total volume of treated feet with ESWT was 31 and treated feet with injection was 28. But it should be mentioned that only one foot with more symptoms selected for analysis, thus total sample size for analysis of pain VAS, the FFI, as well as satisfaction level was 40, regardless of the number of injected or treated feet (analysis per person).

Heel spur was seen in calcaneal X-ray imaging of seven patients in ESWT and 10 patients in injection group. There was no significant differences between groups regarding presence of heel spur ($P = 0.33$). In addition, significant correlation between pain reduction and functional improvement with presence or absence of heel spur was not achieved among patients of both groups ($P = 0.88$, $P = 0.95$, respectively).

Baseline demographic and clinical characteristics of patients are shown in Table1.

The Effect of Treatments and Time Points Interactions on Parameters

A Mixed ANOVA with a Greenhouse-Geisser correction revealed that there was no significant difference

Table 1 Baseline participants' demographic and clinical characteristics

Variable	ESWT Group (n = 20)	Steroid Injection Group (n = 20)	*P* Value
Age, yr	41.45 ± 8.05	42.85 ± 8.62	0.59
Sex	18 (90%) female 2 (10%) male	15 (75%) female 5 (25%) male	0.14
Duration of foot pain, weeks	8.5 ± 4.53	10.4 ± 5.53	0.55
BMI*, kg/m^2 (%)			
< 25	3 (15%)	2 (10%)	0.45
26–30	14 (70%)	17 (85%)	
• 31	3 (15%)	1 (5%)	
Affected side			
Bilateral	11 (55%)	8 (40%)	0.35
Unilateral: Right/left	9:6/3	12:7/5	
Previous physiotherapy per person	8 (40%)	5 (25%)	0.80
Previous local injection per foot	6 (30%)	2 (10%)	0.15
FFI total score (0–170), point ± SD**	60.25 ± 8.37	60.25 ± 5.90	0.84
Morning VAS* (0–10), point ± SD**	9.10 ± 0.22	9.10 ± 0.52	0.98
Average VAS (0–10), point ± SD	7.35 ± 1.08	7.50 ± 1.10	0.69
Presence of heel spur in calcaneal X-ray	7 (35%)	10 (50%)	0.33

*BMI: body mass index.
**FFI: Foot Function Index.
***VAS: Visual analog scale.

between treatment groups with respect to the VAS in the morning and during the day and FFI at baseline, 4, and 8 weeks after treatment ($P = 0.191$, $=0.726$, and $P = 0.072$, respectively). Although ESWT group had a higher reduction in the morning VAS as well as the FFI, these changes were not significant statistically (Table 2, Figures 2 and 3).

The Effect of Radial ESWT and Corticosteroid Injections and Time Points Interactions on Parameters

Focusing on main effects determined that there was not a statistically significant difference within treatment groups with respect to the VAS in the morning and during the day and FFI ($P = 0.278$, $P = 0.508$, and $P = 0.131$, respectively) but all parameters had a continuous improvement trend in 2 evaluation sessions ($P < 0.001$, $P < 0.001$, and $P < 0.001$).

Post hoc tests using the Bonferroni correction revealed that there was a reduction in VAS in the morning from baseline to 1 month after treatment (9.10 ± 0.157 vs 5.10 ± 0.40, respectively) ($P < 0.001$). Also, VAS in the morning at week 8 significantly reduced to 4.025 ± 0.436 compared to baseline and week 4 ($P < 0.001$ and $P < 0.001$, respectively). VAS during the day at the baseline (7.42 ± 0.17) was significantly higher compared to week 4 and week 8 (3.85 ± 0.33 and 2.75 ± 0.43, respectively, $P < 0.001$ and $P < 0.001$) and also week 4 compared to week 8 ($P < 0.001$). Foot function index had a considerable reduction in week 4 (33.96 ± 2.96) and week 8 (25.57 ± 3.30) compared to baseline (60.25 ± 1.15) ($P < 0.001$ and $P < 0.001$). Also, There was statistically significant reduction in foot function index at week 8 compared to week 4 ($P < 0.001$).

Changes in VAS in the morning and during the day and the FFI at various study time points in ESWT and injection groups are shown in Table 2.

More than half of the participants (55–60%) in ESWT group achieved successful therapy response in VAS in the morning and FFI score at week 8, respectively. In contrast, 35–40% of participants in steroid injection group achieved success rate regarding VAS and FFI percentage decrease at the end of study, respectively.

Patient Satisfaction

Patient satisfaction with both treatments was also evaluated. Patients believed the treatment was good and excellent in 11 ESWT cases (55%) and six corticosteroid injection cases (30%) and poor to adequate in nine ESWT cases (45%) and 14 corticosteroid injection cases (70%), but the difference was not significant ($P = 0.11$). Some patients reported transient pain after ESWT at initial sessions or during injection procedure, which were resolved after therapy continuation. Apart from that, no side effects including infection, exacerbation of inflammation, or sustained pain related to ESWT or injection were seen at present study.

Discussion

In this randomized clinical trial, we evaluated and compared the effectiveness of radial ESWT and

Table 2 Changes of variables during the assessments points in ESWT and Corticosteroid injection groups

Study Groups Variables and Time Points	ESWT Group (N = 20)	Corticosteroid Injection Group (N = 20)	Total	Test Result Mixed ANOVA	Pairwise Comparisons	
Visual analog scale in morning					Groups	*P* Value
At baseline	9.10(0.22)	9.10(0.52)	9.10(0.157)	$F_{(time)}(1.583, 60.135) = 126.405$	baseline * week 4	< 0.001
week 4	4.75(0.56)	5.45(0.56)	5.10(0.400)	*P* value < 0.001	baseline * week 8	< 0.001
Week 8	3.40(0.62)	4.65(0.62)	4.025(0.436)		week 4 * week 8	< 0.001
Total	5.75(0.42)	6.40(0.42)				
Test Result	$F_{(group)}(1, 38) = 1.211$			$F_{(group * time)}(1.583, 60.135) = 1.734$		
Repeated Measure ANOVA	*P* value = 0.278			*P* value = 0.191		
Visual analog scale during the day					Groups	*P* Value
At baseline	7.35(0.24)	7.50(0.24)	7.42(0.17)	$F_{(time)}(1.416, 53.821) = 129.515$	baseline * week 4	< 0.001
week 4	3.65(0.46)	4.05(0.46)	3.85(0.33)	*P* value < 0.001	baseline * week 8	< 0.001
Week 8	2.45(0.60)	3.00(0.60)	2.75(0.43)		week 4 * week 8	<0.001
Total	4.48(0.39)	4.85(0.39)				
Test Result	$F_{(group)}(1, 38) = 0.447$			$F_{(group * time)}(1.416, 53.521) = 0.220$		
Repeated Measure ANOVA	*P* value = 0.508			*P* value = 0.726		
Foot function Index					Groups	*P* Value
At baseline	60.25(8.37)	60.25(5.90)	60.25(1.15)	$F_{(time)}(1.483, 56.341) = 102.976$	baseline * week 4	< 0.001
week 4	29.67(20.83)	38.25(16.27)	33.96(2.96)	*P* value < 0.001	baseline * week 8	< 0.001
Week 8	19.65(21.26)	31.50(20.53)	25.57(3.30)		week 4 * week 8	< 0.001
Total	36.52(3.12)	43.33(3.12)				
Test Result	$F_{(group)}(1, 38) = 2.379$			$F_{(group * time)}(1.483, 56.341) = 0.075$		
Repeated Measure ANOVA	*P* value = 0.131			*P* value = 0.072		

All values are mean (SE), *P* value < 0.05 is considered as significant.

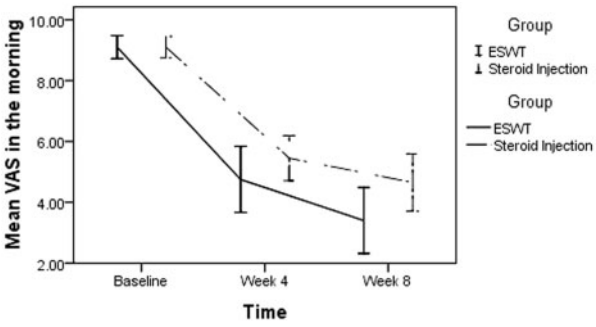

Figure 2 Serial changes in the VAS in morning over the course of the study period in each group.

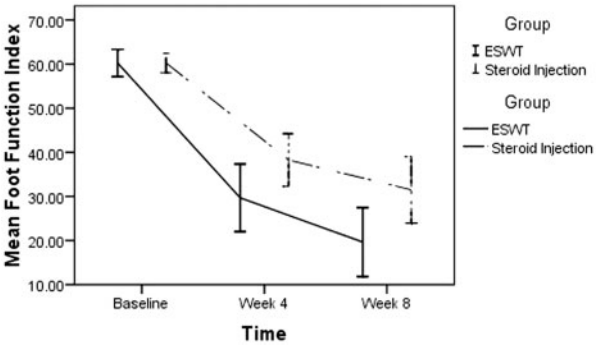

Figure 3 Serial changes in the FFI over the course of the study period in each group.

corticosteroid injections in patients with chronic plantar fasciitis. Both treatments resulted in considerable improvement of pain in the morning and during the day, as well as functional ability as measured by the FFI.

Although plantar fasciitis is considered to be self-limiting, chronic cases are recalcitrant and do not respond to routine conservative treatment [7,8]. Some previous studies have reported that corticosteroid injections have similar or better efficacy than other treatments in treating chronic plantar fasciitis [26–28]. Similarly, the efficacy of ESWT in the treatment of chronic plantar fasciitis has also been investigated recently and is usually recommended [15–17]. The optimal treatment, however, is still remains to be determined.

We observed mean improvement in pain in the morning (62.2% vs. 49.5%) and during the day (66.6% vs. 60%) and the functional disability (67.4% vs. 47.7%) following ESWT and corticosteroid injections at the end of week 8 compared to baseline, respectively.

This improvement exceeds the defined minimal clinical difference of 50% decrease in FFI as success rate. So that, ESWT group includes 60% successfully treated patients, superior to the injection group, with 40.5% successfully treated patients. Despite these results, this difference between groups did not achieve significance statistically. The main cause could be related to low sample size of each group which hinders to reach a meaningful difference.

We only evaluated the short-term results in the first 2 months after treatment. In this regard, it is reported that corticosteroid injections are effective in the short-term and results regarding the long-term outcomes are controversial [8,29,30].

Although previous studies have shown improved pain scores with the use of ESWT in the short-term, which was maintained for a long time (nearly 12 months) [15,17], the efficacy of ESWT in the long-term needs further studies.

ESWT, as was previously described, is defined as a sequence of single sonic pulses characterized by high-peak pressure (10–100 MPa, 100–1000 bar) and short duration (10 μs), and is conveyed by an appropriate generator onto the affected area with an energy density in the range of 0.003–0.89 mJ/mm^2 [15,31]. The mechanism of action of shock waves is not fully understood, but it has been suggested that ESWT may affect topical pain factors by inducing excessive excitement of the axon. Then, a reflexive analgesic effect is generated and pain is reduced by destroying unmyelinated sensory fibers. Several recent studies have suggested that nitric oxide (NO) production induced by ESWT plays a critical role in suppressing the inflammatory process [14]. Moreover, direct stimulation of healing and promotion of neovascularization has also been reported [15,32,33].

"Radial" shock waves can be delivered to the tissue without local or nerve block anesthesia, unlike "focused" shock waves, and no form of anesthesia was used in the aforementioned trials. In general, radial ESWT is better tolerated than focused SWT because radial shock waves have the point of highest pressure and highest energy flux density (EFD) at the tip of the applicator, and thus outside the tissue. In contrast, focused shock waves have the point of highest pressure and highest EFD at the center of the focus, which is positioned within the treated tissue [15]. We used radial ESWT in this research and it was a relatively comfortable procedure without any complications.

In fact, the main advantage of RSWT over first generation focused ESWT are the lack of need for any anesthesia during the treatment and the demonstrated long-term treatment success. Radial ESWT do not require patients to avoid weight bearing and allow patients to return to activities of daily life within 1 or 2 days and normal daily shoe wear [15].

It should be noted that low-intensity ESWT refers to shockwaves with a power output intensity < 0.2 mj/mm^2 and high intensity refers to shockwaves with a power

output intensity > 0.2 mj/mm^2 [14,15]. Thus, the intensity of ESWT in our study was in the moderate or borderline range; however, Yin and colleagues [34] reported that low-intensity ESWT were even more effective and safer than high intensity types.

Two previous studies have compared the efficacy of ESWT and corticosteroid injections in patients with plantar fasciitis. Porter and Shadbolt [20] observed better VAS scores for pain 3 and 12 months after treatment in the corticosteroid injection group compared to the ESWT group. Yucel and colleagues [21] also observed significant improvement in the VAS score for pain and heel tenderness index scores for both treatments, but without a significant difference between the groups; however, the authors preferred corticosteroid injections because of the low cost and availability.

Our results are in agreement with Yucel and colleagues [21], however, in contrast to two previous studies [20,21] that concluded corticosteroid injections had similar or somewhat higher efficacy and superiority of cost-effectiveness than ESWT. We observed better efficacy for ESWT, especially considering the higher satisfactory rate for ESWT compared to corticosteroid injections, regardless of the high cost. In support of our findings, there are a few points to be noted.

First, we assessed and followed patients at baseline and at weeks 4 and 8 after treatment. Since ESWT patients received five sessions of 3-day intervals and they were evaluated 15 days later that the single injection group, so it appears the self-limiting nature of plantar fasciitis and probably spontaneous recovery over time may help to exaggerate positive effects of ESWT. On the other hand, durability of both treatments should also be considered, so that long-term effects of each treatment may be attenuate over time and later follow up may be reveal this persistency of results, which is in favor of ESWT effects.

Second, corticosteroid injection requires a period of rest after administration, while radial ESWT has benefits of no immobilization and early return to work. Although pain occurs during the therapy session in both treatments, the pain during injection is greater than pain in radial ESWT.

Third, corticosteroid injection, and mainly multiple injections, may cause rare complications such as plantar fascia rupture, fat pad atrophy, medial plantar nerve injury secondary to injection, or calcaneal osteomyelitis [12,13].

Fourth, there is a high frequency of relapse and recurrence following treatment with corticosteroid [29]. In addition, some previous studies indicate better long-term efficacy for ESWT, but not for corticosteroid injection [15,17,30].

Finally, it is crucial that biomechanical correction with insole prescriptions and wearing proper footwear, avoidance of predisposing factors, and doing stretching therapeutic exercises should always be considered prior to any invasive or semi-invasive treatments in patients who have plantar fasciitis.

The limitations of the present study were that no control group was used to exclude placebo effects and the number of subjects was relatively small, with 20 patients in each group. The sample was mainly composed of females (82.5%) and it is difficult to know whether both genders would show the same behavior, and the differences between genders were not assessed because low sample size of males hinders this comparison.

Also, a short duration of follow-up limits definite conclusion on long-term efficacy. Future studies are warranted to overcome these limitations.

Conclusion

Both radial ESWT and local corticosteroid injection treatments improved pain and functional ability 2 months after treatment. Although inter-group differences were not significant statistically, the FFI was improved more with ESWT and patients were more satisfied with ESWT, thus shockwave therapy seems a safe alternative for management of chronic plantar fasciitis.

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