

Research Paper: Effect of Extracorporeal Shockwave Therapy Versus Stretching in the Treatment of Athletes With Chronic Plantar Fasciitis



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ABSTRACT

Purpose: Extracorporeal Shockwave Therapy (ESWT) is a relatively new method in the treatment of musculoskeletal disorders such as plantar fasciitis. This study aimed to compare two methods of treatment with extracorporeal shockwave and stretching in athletes with chronic plantar fasciitis.

Methods: The study was a randomized clinical trial. A total of 30 male athletes with chronic plantar fasciitis voluntarily participated in this study. The subjects were randomly divided into two groups; ESWT (n=15) and stretching exercises (n=15). Both treatment methods were applied once a week for five weeks. Pain, the Range of Motion (ROM) of the ankle joint, and the strength of the plantar flexors of the ankle were assessed, using Visual Analog Scale (VAS), goniometer, and dynamometer before and after the interventions.

Results: VAS scores significantly decreased in both groups after the treatment ($P < 0.001$). Furthermore, after the treatment, the ROM and the strength of plantar flexors increased dramatically in both groups ($P < 0.001$). There were no significant between-group differences at any time ($P > 0.05$).

Conclusion: This study suggests that both methods of stretching and ESWT are suitable methods for improving the symptoms in chronic plantar fasciitis. There was no significant difference in the effect of both types of treatment. According to the results, stretching is easier, non-invasive, and less costly method. So, it seems to be a preferable method for ESWT. However, more studies are required because of the limitations of this research.

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Highlights

- Stretching is useful and less costly method for improving the symptoms in chronic plantar Fasciitis.
- Extra Corporal Shockwave Therapy (ESWT) is suitable new method for improving the symptoms in chronic plantar Fasciitis.

Plain Language Summary

Plantar Fasciitis is a musculoskeletal disorder in the lower extremities that affects the plantar fascia. Patients typically suffer from a sharp pain in the medial heel of Calcaneus. Pain is often more severe when standing or in the first steps after waking up or after long periods of sitting. The treatment of chronic plantar Fasciitis is mainly conservative. In the present study, we used two methods of stretching and Extra Corporal Shockwave Therapy (ESWT) to treat this injury. Both methods effectively improved the symptoms of the disease. Therefore, we propose both methods for the treatment of plantar Fasciitis, although the stretching is less costly treatment.

1. Introduction

Plantar fasciitis is a musculoskeletal disorder in the lower extremities that affects the plantar fascia [1, 2]. In the past, Plantar Fasciitis (PF) was known as a chronic inflammatory disease, but today, it is considered a degenerative pathological condition like tendinopathy [3]. Plantar fasciitis occurs at the site of the attachment of the plantar fascia to the medial tubercle of calcaneus [4]. PF rapidly is converted from acute to chronic, a symptom of which is the reduction of pain and the progression of the degenerative process [5]. It has been reported in many athletes, especially soccer players and runners [3].

This damage occurs both in recreational and professional sports, and female athletes suffer from this injury slightly more than male athletes [6, 7]. In addition to the external factors such as inappropriate shoes and prolonged walking on rugged surfaces, the practical factors in the occurrence of plantar fasciitis are a number of internal factors such as obesity, flat foot, pes cavus, the difference in the size of the two limbs, the increase in external rotation of tibia, and increased femoral anteversion [8]. The patients typically suffer from a sharp pain in the medial heel of the calcaneus. Pain is often more severe when standing or in the first steps after waking up or after long periods of sitting. Severe cases limit the ability to move a patient during daily activities and climb stairs [9].

Pediatrics, orthopedic surgeons, physiotherapists, and chiropractors are involved in the treatment of this injury [3]. In 2007, the cost of PF in the United States was es-

timated between 192 and 376 million dollars [10]. The treatment of chronic plantar fasciitis is mainly conservative (90%), including the use of non-steroidal anti-inflammatory drugs, topical steroid injections, orthotic devices, Stretching Exercises (STCH), as well as electrotherapies such as laser therapy, ultrasound, iontophoresis, and Extracorporeal Shockwave Therapy (ESWT) [3, 11-14].

ESWT is a relatively new method in the treatment of musculoskeletal disorders, which attracts a lot of attention and is rapidly expanding [15]. Shockwave means transferring a great deal of energy over brief periods at a rate exceeding the speed of sound. Thus, shockwave therapy uses the characteristics of these waves. Since the source of such high energy is human production, and this energy is transmitted from the outside of the body to the target tissue, the term ESWT is used for this therapeutic approach [16]. Radial shockwave therapy is a type of low-to-moderate ESWT produced pneumatically [17]. The success rate of this method for plantar fasciitis in various studies is 50%-80% [18].

Compared to ESWT, which is a relatively expensive treatment, the stretching of soft tissues is one of the very low-cost methods used to treat plantar fasciitis. Some studies suggest that Achilles tendon and plantar fascia stretching can reduce the symptoms of PF [19]. Some investigators believe that stretching is one of the easiest and most effective treatments for plantar fasciitis [20-25]. Regarding the relative effect of both types of treatment of ESWT and stretching on chronic PF and because of the significant difference in terms of the cost of treatment, the high prevalence of this injury in athletes, and the lack of research in this area, we aimed to

compare the effect of these two therapies in the treatment of chronic PF in athletes.

2. Materials and Methods

The setting, participants, and randomization

This study was designed as a randomized clinical trial. Of the 61 consecutive male athletes with chronic PF, who attended the Nikan physiotherapy clinic in Tabriz, Iran, 35 patients were eligible to participate in the study. Five of these participants refused to participate in the

project, and the rest were randomly assigned into two groups of ESWT (n=15) and STCH (n=15) (Figure 1).

Before starting the treatment program, the patients were invited to participate in a briefing session for the treatment process. They were willing to participate in the research, and they were asked to sign a consent form. The inclusion criteria included regular participation in a field of sports for at least two years, age over 18 years, heel pain for at least four weeks, which did not respond to conservative treatments (non-steroid anti-inflammatory drug and ice therapies), no evidence in favor of the collapse of calcaneus in

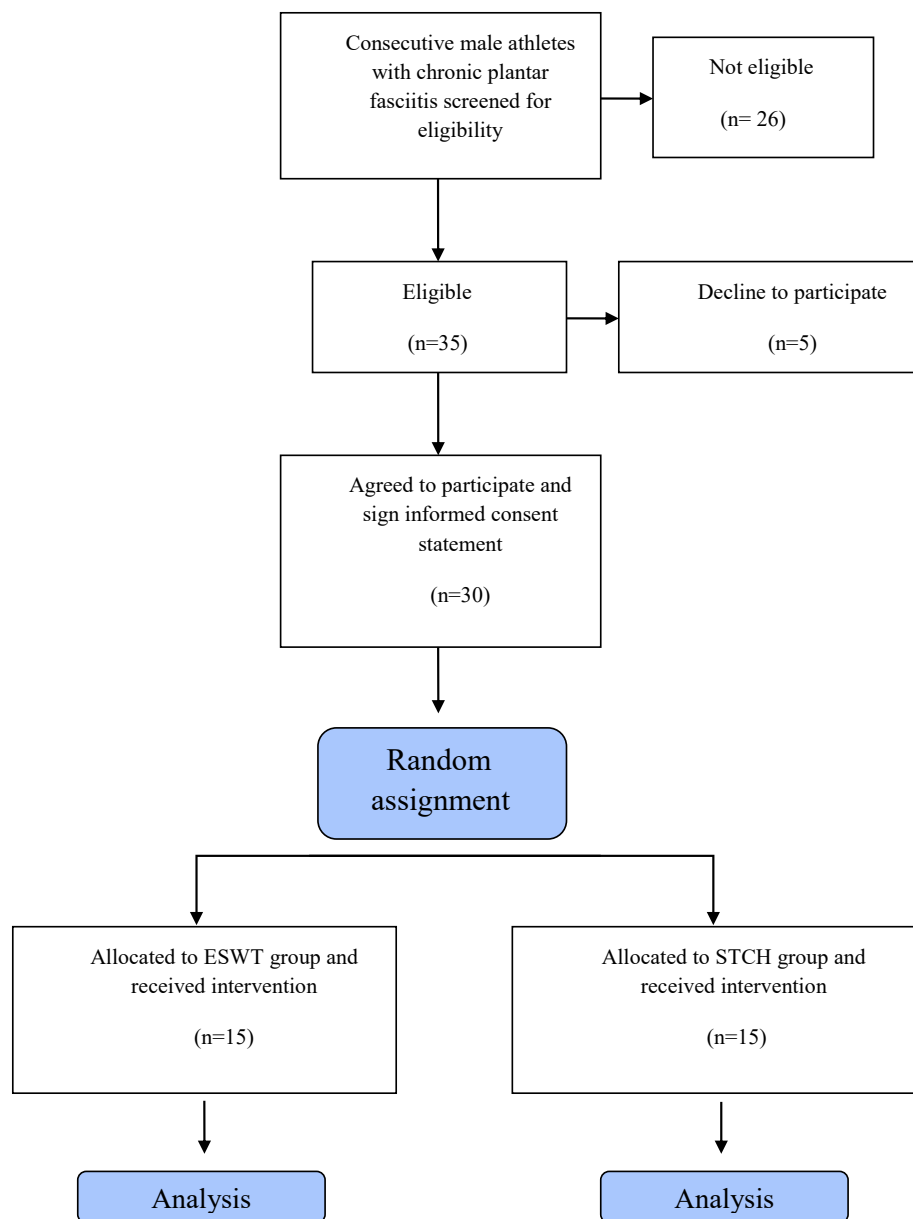


Figure 1. Recruitment and retention of participants with chronic plantar fasciitis for extra corporal shockwave and stretching

the radiography, pain intensity greater than 2 based on the Visual Analog Scale (VAS), and tenderness at the site of plantar fascia attachment to calcaneus.

The exclusion criteria included heel surgery, Achilles nerve or tendon injury, rheumatoid arthritis, both types of diabetes mellitus, local or systemic infection, peripheral vascular disorders, gout, coagulation disorders, and corticosteroid injection in the last six months or non-steroid anti-inflammatory drug use in the previous seven days. VAS was used to evaluate pain. On this scale, the patient rates his status from zero (without disturbance) to ten (completely disturbed). Goniometer (Yagamy: Japan) was used to measure the active flexion-extension Range of Movement (ROM) of the ankle. A dynamometer (Tiger R-372: Germany) was also used to measure the strength of the plantar flexors of ankle muscles.

Interventions

The ESWT (enPlusPro Zimmer: Germany) device was set on 12 Hz to 15 Hz frequency and 2500 pulses at 2 to 3 bar. The therapy (ESWT) was performed once a week for five weeks [26]. During the ESWT sessions, the patients were in a prone position with their feet extending beyond the examination table, and their knee and hip joints in a neutral position. Using ultrasound gel as a

coupling medium, the head of the ESWT device was applied to the inferior aspect of the calcaneus. The region of maximum tenderness in the medial calcaneus was the target area. No local anesthetic was applied. All patients were allowed for weight-bearing [27].

In the STCH group, the stretching of the plantar fascia, Achilles tendon, and calf muscles were performed three times a day for five weeks. Each time, ten stretches (each taking 20 seconds) were performed to each area.

Data analysis

The data were analyzed, using paired and independent t-tests for within- and between-groups differences in SPSS V. 22. A tow-way repeated measures Analysis of Variance (ANOVA) was performed to estimate the differences between (group effect) and within (time and time × group effects) treatment groups for each studied outcome.

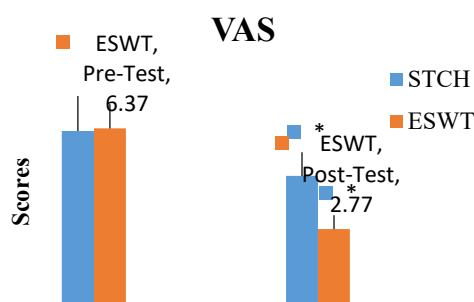
3. Results

Table 1 presents the demographic characteristics of the subjects of both groups. The Shapiro-Wilk test was used to check the normality of the data. There were no significant differences in terms of these variables between the two

Table 1. Demographic characteristics of both groups

Groups	Mean±SD			
	Age (y)	Height (cm)	Weight (kg)	BMI (kg/m ²)
STCH group (n=15)	24.87±4.72	175.47±3.34	72.40±4.45	22.93±1.39
ESWT group (n=15)	26.10±4.56	177.00±3.21	72.67±5.33	22.47±0.58

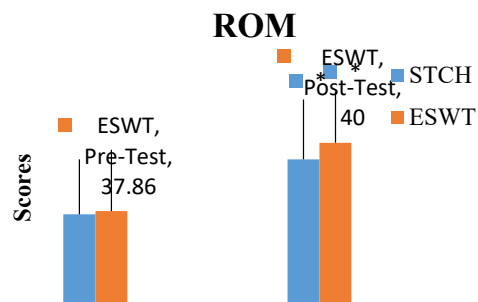
PHYSICAL TREATMENTS



PHYSICAL TREATMENTS

Figure 2. Visual analog scale scores before and after the treatment (Mean±SD)

* Indicates within-groups differences (P>0.05)



PHYSICAL TREATMENTS

Figure 3. Range of motion scores before and after the treatment (Mean±SD)

* Indicates within-group differences (P>0.05)

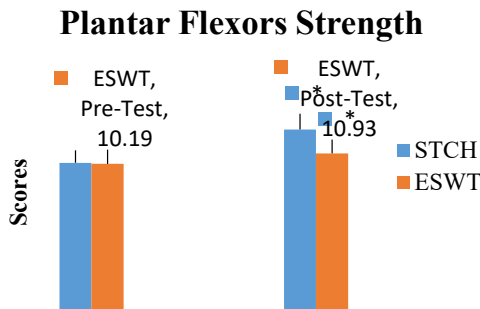


Figure 4. Mean±SD Strength scores of before and after the treatment

* Indicates within-group differences (P>0.05)

groups (P>0.05). Figures 2, 3, and 4 show the results of the VAS, ROM of the ankle, and the strength of plantar flexors. According to Figures 2, VAS scores significantly decreased after the treatment in both groups (P<0.001). The VAS scores showed no significant between-group differences at any time (P>0.05). Moreover, as seen in Figures 2, in both groups after the treatment, the ROM of ankle significantly increased (P<0.001). There were no significant between-groups differences at any time (P>0.05). Finally, as observed in Figures 3, after the treatment, the strength of plantar flexors in both groups significantly increased (P<0.001). There was no significant difference between the two groups before and after the treatment (P>0.05).

4. Discussion

The results of this research showed that ESWT and STCH reduced the ankle pain, increased the ROM of ankle joint, and improved the strength of the plantar flexors in the athletes with chronic PF. However, there were no significant differences between the two groups in any variable (P>0.05).

Regarding the pain, the results of this study are consistent with the studies of Akinoglu et al. Maffulli et al. Ordahan et al. and Lizis et al. [14, 27-29]. ESWT is a treatment, in which waves are produced by electromagnetic, piezoelectric, and electrohydrolysis techniques. According to studies, shockwaves cause an inflammatory-like response in the damaged tissue and cause the body to respond to this condition that as a result, blood flow and damaged tissue metabolism increase [30, 31]. Two mechanisms have been proposed for the effectiveness of ESWT. Firstly, transmitted waves are thought to affect the physiology of nociceptors. Secondly, the transmitted waves are responsible for tissue regenera-

tion through micro-trauma, the release of growth factors, and molecular factors [9, 31]. Increasing the ROM of the ankle joint in both groups is a remarkable result of this study. Improvement in the ROM in the ESWT group seems to result from a decrease of pain than other factors. Probably reducing pain has made it easier for the ankle joint to move. Moreover, there is a consensus among the researchers on the positive effects of STCH on increasing the ROM of joints [32].

Finally, increasing the strength of plantar flexors affecting feet in both the STCH and ESWT groups can also be as a result of pain relief. Pain relief seems to have made plantar flexor muscles work better. According to the results, both short-term methods have been effective in reducing chronic PF pain in athletes. Studies have shown that stretching is a therapeutic approach that is more effective in the short term. Stretching is also an easy and inexpensive method that can be applied by the patient. The effect of this method on improving the ROM and the strength of plantar flexor muscles are also well documented in this study. On the other hand, ESWT is a relatively expensive method, which causes pain and discomfort of the patient during the treatment. The use of costly methods in sports medicine is often applied for the faster conclusion and quicker return of athletes to sports fields.

Since the stretching method is cheaper and non-invasive, and since there is no significant difference in the effectiveness of the two methods in the short term, according to our data, using aggressive ESWT method in athletes is not much recommended. However, there are doubts about the long-term effects of STCH, and some researchers believe that the effect of STCH is temporary [20]. Therefore, more studies are required to achieve more accurate results. Of course, the limitations of this research should also be considered. The number of subjects in this research is low, and the probability of changing the results is likely with the increase in the number of subjects for both methods.

This study suggests that both methods of stretching and ESWT are suitable methods for improving the symptoms in chronic PF. There was no significant difference in the effect of both types of treatments. According to the results, stretching is easier, non-invasive, and less costly method. Thus, so, stretching seems to be preferable method to ESWT. However, more studies are required because of the limitations of this research.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles were considered in this article. The participants were informed about the aim of the research and its procedure. They were also assured about the confidentiality of their information. Also, they were allowed to leave the study whenever they wish, and if desired, the results of the research would be available to them.

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Authors' contributions

All authors contributed to designing, running, and writing all parts of the research.

Conflict of interest

The authors declared no conflict of interest.

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