Current Aspects of Physiotherapy in the Treatment of Plantar Pain

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Abstract

Prolonged mechanical demands during daily activities or during physical exercices frequently generate significant pain at the plantar level, with a negative impact on the individual's quality of life.

In this study 37 patients with plantar pain were included, who were diagnosed by musculoskeletal imaging with plantar fasciitis.

The treatment performed consisted in the use of physiotherapy procedures such as shock-wave and Super Inductive System.

The therapeutic protocol was also adapted according to the associated plantar pathologies.

Following the physiotherapy treatment, a significant decrease in pain and inflammation at the level of plantar fascia was found, also a reduced number of intense pain episodes.

The research conducted demonstrates that physiotherapy procedures such as schock-wave and super inductive system have an increased efficiency in the treatment of plantar pain.

Keywords*: shock wave, inflammation, recovery, super inductive system, plantar fasciitis.*

1. Introduction

The plantar aponeurosis is made up of connective tissue and is located from calcaneus to the toes, forming together with the calcaneonavicular

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ligament and the long plantar ligament, the passive tension structure of the plantar arch.

The most common cause of plantar pain is represented by plantar fasciitis, which consists in the presence of inflammatory process located at the level of the plantar fascia.

The specific symptomatology consists in pain which is present at the level of the heel or towards the medial area of the plantar arch, especially in the morning when taking the first steps after a night's rest, or after a period of inactivity (Guttec et al., 2019).

Plantar fasciitis is more common in individuals aged 45-60 years, other studies showing that the prevalence is higher among runners (Lopes et al., 2012).

This condition has multifactorial origin being reaction to repeated mechanical overload mechanisms that produce micro-lesions over time, which can represent risk factors for musculotendinous retractions of the calf, overloading of the opposite limb, sedentary lifestyle, deformities of the foot (Van Leeuwen et al., 2016).

A high percentage of patients with plantar pain experience shortening of the calf muscles, which leads to a decrease in the amplitude of the dorsiflexion of the leg, which will lead to an increase in tension in the plantar fascia (Bolgla et al., 2004).

Frequently, plantar pain is associated with the presence of calcaneal spurs that lead to inflammation of the plantar aponeurosis through the pressure exerted by the osteophyte on the soft tissues (Ahmad et al., 2016; Kirkpatrick et al., 2017; Nishimura et al., 2017) .

The anamnesis together with palpation of the plantar fascia and mobilization in dorsiflexion of the fingers lead to the development of the clinical diagnosis, which will be completed by paraclinical investigations such as radiography (Schneider et al., 2018) and soft tissues ultrasound or magnetic resonance imaging (Ehrmann et al., 2014).

Conservative treatment in the acute stage consists in the administration of non-steroidal anti-inflammatory drugs (Donley et al., 2007), and weight loss in the case of overweight people can help reduce pain (Lee et al., 2009).

In order to relieve pain, electrotherapy procedures such as low-intensity currents, ultrasound (Ulusoy et al., 2017) and high-intensity laser are also used, which can lead to superior results when associated with stretching of the calf muscles and plantar aponeurosis (Katzap et al., 2018).

Studies highlight the fact that extracorporeal shock wave treatment has a significant role in relieving plantar pain (Gutteck et al., 2019) and can lead to increased rehabilitation performance by combining it with physiotheraputic means.

Extracorporeal shock wave therapy is used to promote neovascularization that helps to heal the degenerated tissue of the plantar fascia, the literature underlining the fact that this form of therapy represents a viable option in case of chronic plantar pain, being a non-invasive way of therapy that can enhance the healing process (Goff & Crawford., 2011).

Side effects of shock wave therapy are reversible and manifest in the form of ecchymosis, local edema or temporary hypoesthesia (Rompe et al., 2007).

In severe cases, when conservative treatment is no longer helpful, surgery may be a solution. Partial or total fasciotomy reduces the tension of the plantar aponeurosis at the level of its insertion, this procedure can lead to the improvement of painful symptoms (Othman et al., 2010).

2. Material and method

The study was conducted on a group of 37 subjects with unilateral plantar pain that was not caused by local trauma.

The inclusion criteria were: the presence of pain at the level of the plantar fascia, imaging confirmation of plantar fasciitis by musculoskeletal ultrasound.

The exclusion criteria were: the presence of foot trauma, plantar static disorders (platfus), peripheral vascular diseases and peripheral neuropathies.

The present paper started from the hypothesis that the use of extracorporeal shock wave therapy in association with the use of high intensity magnetic waves can lead to a significant improvement of the

painful syndrome and inflammation located at the level of the plantar aponeurosis.

The therapeutic intervention consisted in applying extracorporeal shock waves to the plantar fascia using shock wave therapy. The parameters used took into account both the intensity of the pain and the degree of inflammation revealed by the musculoskeletal ultrasound, as well as the presence and location of the calcaneal exostosis.

A number of 3000 shocks were applied per session, at a frequency of 10 Hz and an intensity between 1.5 and 3 bars. In the first 2 sessions, the intensity of the shock started from 1.5 bar for the first 500 shocks, increasing progressively up to 2.5 bar, every 500 shocks, after which the application intensity decreased to 2 bar for the last 500 shocks. Depending on the evolution of the pain, the intensity for the next 2 sessions was set on the same principle from 2 bar to the maximum intensity of 3 bar, maintaining the same dosage from 500 to 500 shocks.

In the case of patients who have performed 6 treatment sessions, the intensity of the shock remains constant at 2.5 bar throughout the duration of the session.

The application technique and the approach to the inflamed tissue was carried out from the outside of the painful perimeter progressively towards the epicenter of the pain, with the oblique positioning of the applicator in the periphery of the painful area and perpendicular to the painful point.

The treatment sessions were completed by the application of high-intensity magnetic waves with the BTL-6000 Super Inductive System device. They were performed immediately after the shock wave therapy, having an equal number of sessions. The applications were made by positioning the magnetic induction device at the level of the plantar fascia, without direct contact with it.

A preset program generated by the device was used for the diagnosis of plantar fasciitis with modular parameters on 7 sections between 5 Hz and 50 Hz, their intensity and frequency not changing manually during the treatment session. The application duration was for 10 minutes.

The methodology of applying the procedures consisted of performing the shock as the first therapeutic intervention followed by high-intensity

electromagnetic waves, taking into account the analgesic effect obtained by BTL-6000 Super Inductive System device.

3. Results and discussions

In order to highlight the results obtained as a result of the research, the statistical analysis was carried out with IBM SPSS Statistics 20 program, in order to highlight the level of significance.

The evolution of loading pain, from the initial evaluation to final evaluation, after 4 sessions of therapy, is represented in table no.1.

Table 1. Pain level evaluation after 4 treatment sessions

		Mean	Std. Deviation	Std. Error Mean	p
Pair 1	Weight bearing pain Initial evaluation	6,33	1,113	,287	0,000*
	Morning gait pain Initial evaluation	7,93	,594	,153	
Pair 2	Weight bearing pain Final evaluation	,73	,961	,248	0,334
	Morning gait pain Final evaluation	,47	,516	,133	

Regarding the results obtained by the subjects in the assessment of initial loading pain and the final assessment of loading pain, there are statistically significant differences between the two tests, after 4 applications of extracorporeal shock wave and super inductive system treatment.

This evolution is related to an initial average pain of 6.33 on the visual analog scale which represents a moderate pain that may suggest chronic plantar fascia damage, for which the final score of 0.73 indicates significant pain relief and the need for a small number of therapy sessions.

In the case of morning pain at gait initiation, it is also observed that there is a positive, statistically significant evolution between the initial and the final assessment when starting to walk with a final value of the pain level of 0.74 on the visual analogue scale.

For the patients who benefited from 4 treatment sessions, it is noted that at the final evaluation, there are no statistically significant differences between the 2 types of pain (during weight bearing and in the morning when the patients initiate the gait). This aspect highlights the fact that the number of sessions required for significant pain relief in the 2 cases is effective, reducing the pain to a minimum regardless of the type of stress on the plantar aponeurosis.

Other studies highlight the positive effects of shock-wave therapy also in the case of chronic pain caused by inflammation of the plantar fascia (Sun et al., 2017).

Table 2. Pain level evaluation after 6 treatment sessions

		Mean	Std. Deviation	Std. Error Mean	p
Pair 1	Weight bearing pain Initial evaluation	7,95	,950	,203	0,002*
	Morning gait pain Initial evaluation	8,82	,395	,084	
Pair 2	Weight bearing pain Final evaluation	1,59	1,098	,234	0,000*
	Morning gait pain Final evaluation	,73	,767	,164	

Patients who received 6 treatment sessions had a higher mean initial pain for loading pain (7.95 on the VAS scale) but also for morning pain when starting to walk (with a mean VAS scale of 8.82) . This increased pain may suggest more intense damage, with a greater degree of inflammation at the level of the plantar fascia, inflammation also determined and maintained by the presence of calcaneal exostoses at the level of insertion of the plantar aponeurosis.

A statistically significant positive evolution is observed both for the evolution of loading pain and especially for the morning pain when the patients initiate the gait.

According to clinical studies, shock wave therapy is a non-invasive method, with long-lasting analgesic and anti-inflammatory effects (Aquil et al., 2013).

Figure 1 shows the evolution of pain from the initial assessment to the final assessment, depending on the number of shock wave and super inductive system sessions used.

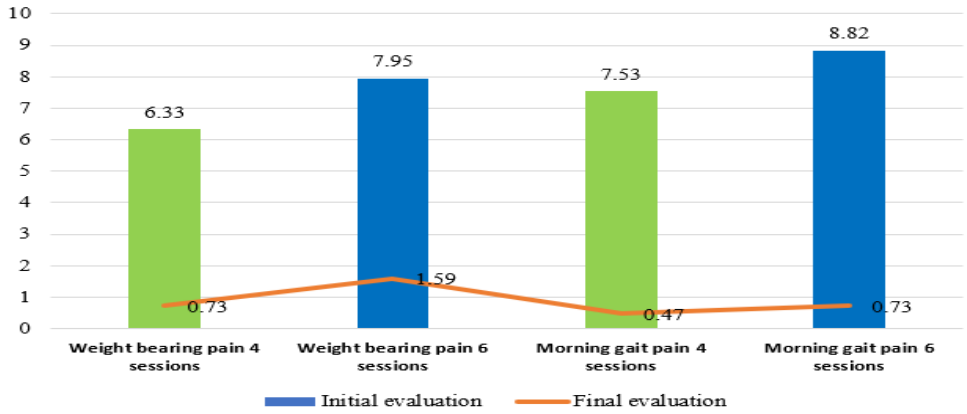

Figure 1. Evolution of pain according to the number of therapy sessions

According to the figure above, a positive evolution can be observed in the 37 subjects regardless of the number of sessions that were applied (4 or 6), progress that depended specifically on the cause of the pain. Thus it is observed that patients who presented a higher initial pain score also had associated calcaneal exostoses and needed a greater number of sessions to obtain benefits similar to those of subjects who benefited from only 4 shock wave sessions and high intensity magnetic induction.

Low-intensity magnetic wave therapy has low effectiveness in the treatment of pain syndrome (Cao et al., 2012) compared to high-intensity electromagnetic field therapy.

The differences between the two groups of subjects are not statistically significant for the two types of pain (weight bearing pain and morning gait pain), an aspect that highlights the fact that the effectiveness of the applied treatment is related to the triggering factor of the pain and the correlated sessions number.

4. Conclusions

Extracorporeal shock wave therapy is an effective mean of decreasing and ameliorating pain and inflammation in the plantar fascia, which has been studied and applied in current medical recovery programs due to its analgesic effects.

An important role in combating inflammation, pain and increasing tissue regeneration potential is played by high-intensity electromagnetic wave therapy applied to the area of the affected tissue.

For increased efficiency in the relief of plantar pain syndrome, it is recommended to combine therapy with extracorporeal shock waves and successive high-intensity magnetic induction, in a variable number of sessions related to the clinical-functional complexity of the patient.

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