



6. It may be noted that in terms of postural balance of the subjects there are differentiated characteristics between the 2 tests (initial and final testing), so that an increase in the average values from 15.37 to 30.90 for units can be observed.

7. The programs used for functional recovery had significant results in terms of improving the balance at these patients and thus confirms the hypothesis.

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## THE EFFECTS OF EXTRACORPOREAL SHOCKWAVE THERAPY (ESWT) FOR THE PLANTAR FASCIITIS IN PROFESSIONAL ATHLETES

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### Abstract

*Aim.* This paper aims to highlight the effects of ESWT on plantar fasciitis in professional athletes who followed a conventional treatment, unsuccessfully.

Plantar fasciitis is a very frequent disorder that, unfortunately, affects a large and diverse number of professional athletes and ordinary people. The treatment of this disorder is very diverse, many times being aggressive to the patient, such as cortisone infiltrations, or surgery. Even so, the return of this disorder is quite frequent, many patients, in general, and athletes in particular, do not have a favorable response, not even after 3 or 6 months of conventional treatment. These aspects make the appearance of this disorder in professional athletes to be a real problem, because, in many cases, it comes back after the treatments, or does not even respond to treatments, the afflicted athlete missing entire competition seasons.

*Methods.* The experiment was conducted on a group of 17 professional athletes, diagnosed for at least 3 months with plantar fasciitis, men and women who came from various sports branches. Out of the total 17 athletes included in the study, 6 were track and field athletes, 5 female volleyball players, 3 badminton players, 2 male handball players, and one male soccer player. The study was conducted over a period of 3 months. The ESWT treatment was applied for 4 weeks, with a frequency of 2 sessions per week.

*Results.* The assessment of the studied subjects was performed by observing and recording the intensity of the pain felt by the subjects during walking, and the thickness of the plantar fasciitis that was measured by ultrasonography, at the beginning and at the end of the study.

The final results showed a significant decrease in the pain felt by the athletes, and in the dimension of the plantar

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aponeurosis.

**Conclusions.** After the application of the ESWT treatment, the patients felt much better, the positive results remaining two months after the treatment ended. Thus, one can say that positive results were obtained, and the ESWT treatment had an effect on the athletes with plantar fasciitis who did not respond to a conventional treatment.

**Key words:** shockwave, fasciitis, athletes.

## Introduction

Plantar fasciitis is one of the frequent causes producing the so-called "policeman's heel," and conventionally it is believed that this disorder is caused by an inflammatory process in the plantar fascia. Currently, its cause is thought to be the degeneration of the collagen fibers in the fascia. This disorder affects approximately 2 million people every year - data for the USA, 10% of its population developing it over the course of their lifetime. (Lemont, Ammirati, Usen, 2003). From a biomechanical point of view, the plantar fascia represents one of the resistance structures of the foot, supporting the longitudinal medial arch on the bottom of the foot. This formation is extended when the foot arch is flat, absorbing the force of the impact when the heel contacts the ground. Anatomically and structurally, the plantar fascia is not flexible, and that is why, after repeated overuse, small lesions or even ruptures can appear. (Carlson, Fleming, Hutton, 2000). The favoring and starting factors of the plantar fasciitis are multiple, the most common being:

- ❖ A flat foot, or, on the contrary, a foot with a too high arch - rigid foot;
- ❖ An orientation towards inside of the foot during walking;
- ❖ The excessive pronation of the foot;
- ❖ Unsuitable shoes - heels that are too high; shoes that do not support the plantar arch; going suddenly from heels shoes to no heels;
- ❖ Running on tiptoes (especially when athletes are concerned);
- ❖ Repeated jumps (as is the case with volleyball, handball players, or track & field athletes);
- ❖ Standing for a long period of time, plantar fasciitis being also called the "policeman's heel";
- ❖ Running or walking on your heels, or on soft surfaces (sand);
- ❖ Rheumatoid polyarthritis, ankylosing spondylitis, lupus, reactive arthritis, psoriatic arthritis, etc.);
- ❖ Hereditary factors. (Riddle, Pulisic, Pidcoe, Johnson, 2003)

As incidence is concerned, this disorder is more frequent in women than men, being directly influenced by the type of physical effort that was performed, by standing, by weight. In the case of professional athletes, the most frequent cases of plantar fasciitis can be encountered in long distance runners, volleyball, handball, basketball players, dancers, tennis players, etc. (Buchbinder, 2004). From a symptomatic point of

view, the dominant symptom in plantar fasciitis is pain. This appears on the medial plantar side of the calcaneus, on the lateral side of the ankle, or the dorsolateral side of the foot, when the injured foot is used, disappearing when resting. It is more intense in the morning, during the first steps, or whenever the person starts walking or standing after resting. In the case of professional athletes, because of intense pains felt in the arch and heel, the clinical picture also comprises pains in the knee of the affected lower limb. (McPoil, Martin, Cornwall, Wukich, Irrgang, Godges, 2008). The diagnostic of plantar fasciitis is done most of the times based on inspection, touching, clinical signs, analysis of the foot during standing and during walking. According to the intensity of the pain, and of the resistance to treatment of plantar fasciitis, the physician can recommend supplementary imaging investigations, such as X-rays, soft tissue ultrasonography, tomography (CT scan), or Magnetic Resonance Imaging (MRI). In the case of professional athletes, the doctors usually recommend an ultrasonography for the tissues of the arch of the injured foot, and an X-ray of that foot, in order to see whether there is a calcaneal osteophyte, which most of the times accompanies the plantar fasciitis. (Cole, Gazewood, 2005). The treatment of plantar fasciitis, in the case of both professional athletes and normal individuals, is complex and time consuming. In the case of professional athletes, the resistance to treatment of plantar fasciitis can mean, most of the times, missing the competitions from an entire season. The conventional treatment recommended in most cases of plantar fasciitis is:

- ❖ Rest, in regards to physical effort, in the case of professional athletes;
- ❖ Drug treatment - nonsteroidal anti-inflammatory drugs (NSAIDs) for 2-5 weeks. Local injection of corticosteroids can be an alternative when pain does not respond to usual NSAIDs administration. Frequent injections are not, however, recommended, because they can weaken and break the plantar fascia. (Tsai, Wen-Chung, Chih-Chin, Carl, Max, Tung-Yang, Ying-Jen 2006)
- ❖ Physical therapy that can include massage, electrotherapy (dynamic currents, ultrasound, laser), cryotherapy. (Osborne, Allison 2006, Genc, Hakan, Meryem, Bans, Hatice, Mahmut 2005)
- ❖ If conventional therapy does not give the expected results, the surgical intervention can be used only as a last resort, because the risk

of complications is relatively high. Most patients report an improvement of the pain symptoms in the first 3 months, with complete remission within a year, in 90% of the cases. (Lynch, Goforth, Martin, Odom, Preece, Kottor 1998).

The Extracorporeal Shockwave Therapy (ESWT) is treatment still newly used in treating plantar fasciitis, and still in its beginnings. (Rompe, Furia, Weil, Maffulli 2007). This treatment is nothing else but high energy pressure waves, generated outside the body, and focused on a certain point inside it. They are used in medicine since the eighties, in treating biliary, reno-urinary, salivary lithiasis, since the nineties for consolidating fractures, pseudarthroses, and currently for various musculoskeletal disorders. (Thomson, Crawford, Murray, 2005).

## Method

This paper aims to highlight the effects of ESWT on plantar fasciitis in professional athletes who followed a classical treatment, unsuccessfully.

The experiment was conducted on a group of 17 professional athletes, diagnosed for at least 3 months with plantar fasciitis, men and women who came from various sports branches.

Out of the total 17 athletes included in the study, 6 were track and field athletes (4 males and 2 females - one 60m and 100m runner, 2 middle distance runner, and one long jumper), 5 female volleyball players, 3 badminton players (2 males and one female), 2 male handball players, and one male soccer player.

**Table 1.** Repartition of the studied subjects on sex and sport

Practiced sport	Females	Males	Total
Track & field	2	4	6
Volleyball	5	0	5
Badminton	1	2	3
Handball	0	2	2
Soccer	0	1	1

The study was prospective, randomized, single blind.

The criteria in choosing the subjects were:

- Plantar fasciitis, diagnosed at least 3 months before the beginning of the study;
- The athlete has unsuccessfully tried a conventional treatment;
- The lack of ruptures in the plantar aponeurosis, an aspect shown through an ultrasound of each athlete's injured plantar aponeurosis;

The research was conducted at a Medical Rehabilitation Clinic, in Bacau.

The assessment of the subjects was done by observing and recording the following:

- The intensity of the pain felt by the subjects during walking. This aspect was done by

using the Visual Analogue Scale (VAS) for pain - 1=no pain, 10=very severe pain. This parameter was recorded at the beginning and at the end of the study.

- The thickness of the plantar fascia was measured by ultrasound, also at the beginning and at the end of the study. The condition for being included in the study was to have at least 4 cm thickness, hypoechogenicity, and alteration of the fibrillar pattern.

The study was conducted over a period of 3 months. Throughout the whole study, none of the athletes had any kind of treatment. The ESWT treatment was applied for 4 weeks, 2 sessions per week, every Monday and Thursday, cumulating a total of 8 sessions.

**Table 2.** The ESWT content

The moment of application of the ESWT	Number of applied shocks	Area on which the shocks were applied
Monday	4000	Calcaneal plantar side, aponeurosis insertion, plantar aponeurosis
Thursday	4000	Calcaneal plantar side, aponeurosis insertion, plantar aponeurosis

## Results

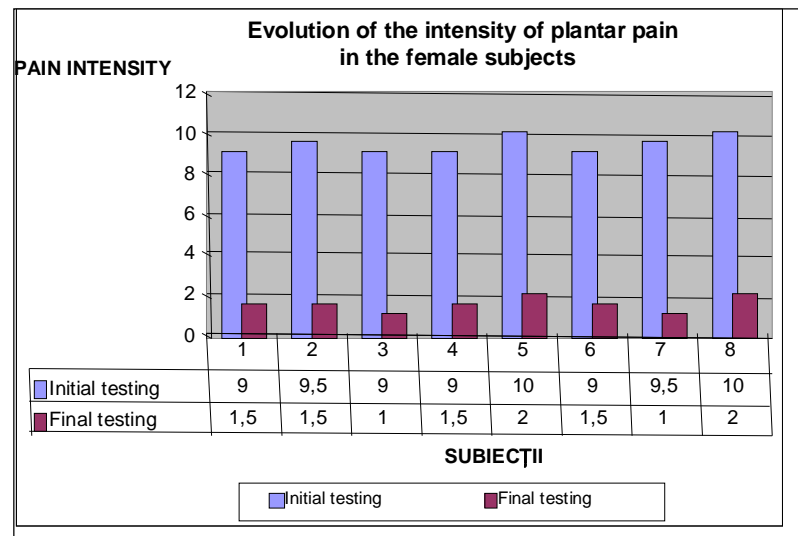
The final results showed a significant decrease in the pain felt by the athletes, and in the dimension of the plantar aponeurosis.

Thus, one can see from the analysis of Figures 1 and 2, that both the female and the male subjects recorded an

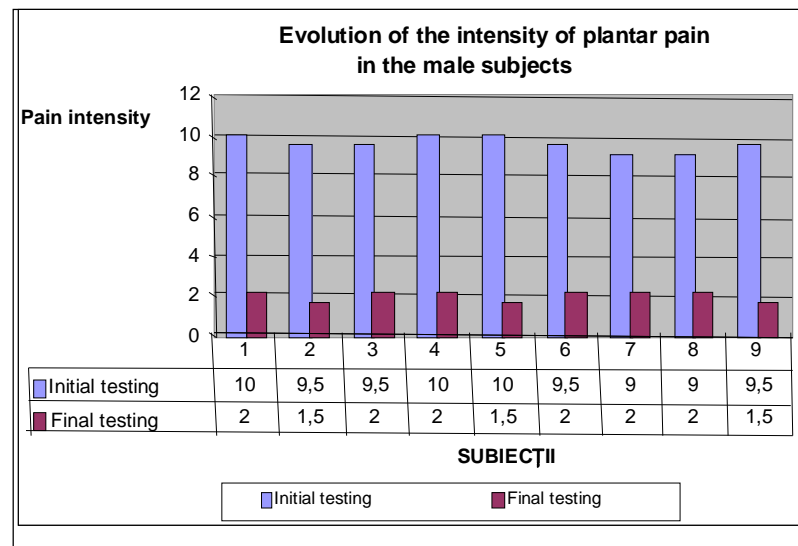
almost identical evolution of the pain intensity, no matter their sports branch. If the initial pain intensity average value was 9.38 for females, and 9.56 for males, at the end of the study, the average pain values were 1.50 for the females, and 1.83 for the male subjects. (Table 3)

**Table 3.** The subjects' average pain value, on gender

Time of test	Females (n=8)	Males (n=9)
Initial testing	9.38	9.56
Final testing	1.50	1.83



**Figure 1.** The evolution of the intensity of plantar pain in the female subjects



**Figure 2.** The evolution of the intensity of plantar pain in the male subjects

In regards to the evolution of the thickness of the plantar aponeurosis, both the male and the female subjects recorded a similar development over the course of the study. Thus, the initial values were, in average, of 5.84 cm in the female athletes, and of 5.87 cm in the male athletes. In the final testing, after the three months of monitoring, the ultrasound values of

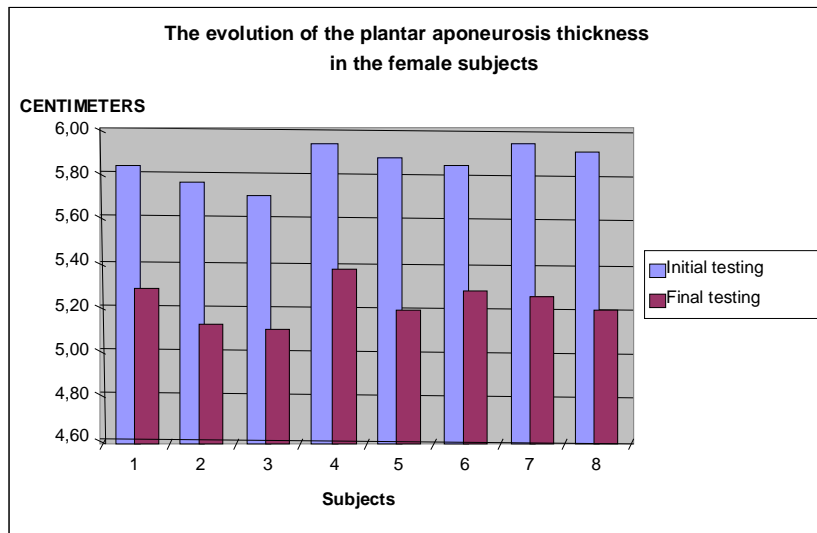
the plantar aponeuroses recorded a positive development, in the sense that they decreased, both in the female and the male subjects. Thus, in the final assessment, the average thickness of the plantar aponeurosis was of 5.21 in the females, and of 5.14 in the male subjects. (Table 4)

**Table 4.** The average thickness of the plantar aponeurosis, on genders

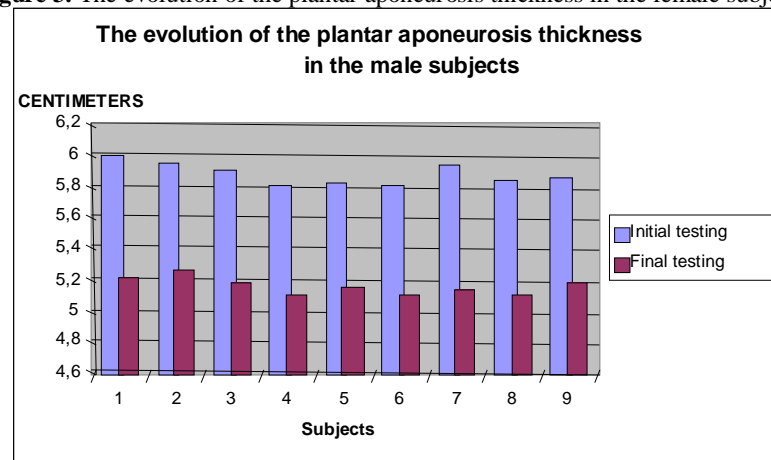
Time of test	Females (n=8)	Males (n=9)
Initial testing	5.84	5.87
Final testing	5.21	5.14

By analyzing Figures 3 and 4, one can observe the descending trend regarding the thickness of the plantar aponeurosis, between the initial and the final testing, both for the female and the male subjects, no matter

their sports branch, the differences recorded after the plantar aponeurosis ultrasounds being considered to be very good.

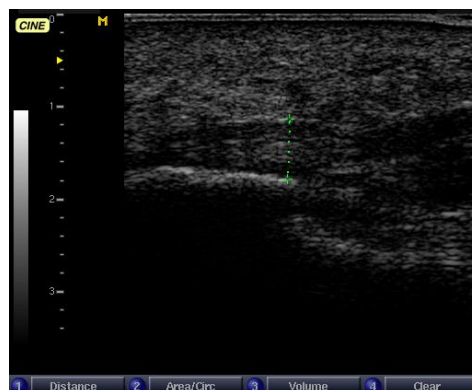


**Figure 3.** The evolution of the plantar aponeurosis thickness in the female subjects

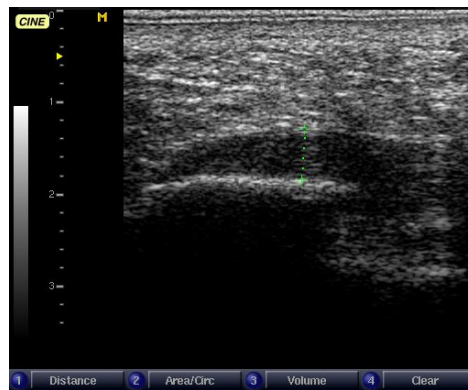


**Figure 4.** The evolution of the plantar aponeurosis thickness in the male subjects

To further support the statements above, the initial and final ultrasounds recorded for one athlete are presented below.



**Figure 5.** The initial thickness of the plantar aponeurosis for one athlete



**Figure 6.** The final thickness of the plantar aponeurosis for one athlete (3 months after the initial ultrasound)

## Discussions

After the application of the Extracorporeal Shockwave Therapy (ESWT), all athletes, no matter their sports branches, and no matter their sex, recorded a very good development in regards to their clinical charts, both over the course of the four weeks of the shockwave treatment, and 3 months after the beginning of the study (2 months after the ESWT treatment was over). (Rompe, 2003; Thomson, Crawford, Murray, 2005)

Thus, one must see that, as these cases are concerned, the shockwave treatment was very effective in treating the plantar fasciitis, the athletes being able to resume their professional activity 2 months after the end of the treatment. (Lynch, Goforth, Martin, Odom, Preece, Kottor, 1998)

The value of this form of treatment is even higher, as the athletes have gone through all the forms of conventional treatment (except for surgery) indicated for plantar fasciitis, before beginning the shockwave treatment. (Tsai, Wen-Chung, Chih-Chin, Carl, Max, Tung-Yang, Ying-Jen 2006; Genc, Hakan, Meryem, Bans, Hatice, Mahmut, 2005)

## Conclusions

The Extracorporeal Shockwave Therapy for athletes with plantar fasciitis presents the advantage of effectiveness, safety, and non-invasiveness.

After conducting this study, one can say that the positive effects produced by the ESWT treatment have maintained both on short term, and on medium term, unlike the drug and rehabilitation treatments, which had an effect only throughout the time they were applied.

Another conclusion is that the ESWT treatment is effective in treating the plantar fasciitis in athletes who went through conventional treatment without any result.

All these aspects allows us to say that this form of treatment is clearly superior to other treatments for plantar fasciitis, being a very good alternative for surgery, with clear superior benefits to the latter (lack of post-surgery infections, low treatment costs; large

post-surgery convalescence period - several months, compared to the shockwave therapy, which takes very little time).

Another advantage of this form of treatment is that throughout the whole ESWT treatment period, the athlete can perform various types of effort that would keep him/her physically fit for sports, the only counter-indication being not to overwork the injured foot.

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