Bulletin of the *Transilvania* University of Braşov
Series IX: Sciences of Human Kinetics • Vol. 13(62) No. 2 – 2020
https://doi.org/10.31926/but.shk.2020.13.62.25

THE EFFICIENCY OF MANUAL THERAPY WITH COMBINED CRYOULTRASOUND TECHNOLOGY IN THE FUNCTIONAL REHABILITATION OF CHRONIC PLANTAR FASCIITIS

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Abstract: *Plantar fasciitis (PF) is an inflammatory process of the plantar fascia, commonly encountered among runners. The purpose of this study is to evaluate whether the manual therapy (MT) alternated with the use of cryoultrasound in the treatment of PF is an effective option in reducing the symptomatology. The test was performed on 10 subjects (two groups), having the following rehabilitation protocol: Group A – MT and cryoultrasound; Group B – MT and cryotherapy. Both treatments proved to be effective, the difference in pain intensity on the VAS scale between the two groups measured at E3 being 10.48% in favor of group A.*

Key words: *marathon, plantar fasciitis, cryoultrasound, manual therapy*

1. Introduction

In the last few years the popularity of marathon events for amateur runners has grown immensely, people of different ages developing such a passion for the desire to improve their physical shape and effort capacity.

As in any other sport activity, the risk of injury is active. There are several studies carried out in order to check the incidence of injuries encountered in runners. Videbaek et al. (2015) found that at every 1000 hours of running there were between 7.7 and 17.8 injuries in recreational and amateur runners [14].

About 37-56% of runners have at least one injury in a year, most of them (70-80%) involving the knee and foot [6], [14].

In a top that includes the most frequent injuries, the plantar fasciitis occupies the 5th place, contributing to 6.7% of the injuries of the runners. Other authors have identified similar statistics, the cases

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of plantar fasciitis accounting for 10% of the total injuries to athletes whose lower limbs are highly requested (basketball, football, rugby, etc.) [3] [6].

Plantar fasciitis (PF) is an inflammatory process located in the plantar fascia, commonly encountered among runners. The plantar fascia is a fibrous, dense membrane that extends along the entire length of the foot, originating on the medial calcaneal tubercle and the terminal insertion on the proximal phalanges. It plays an important role in sustaining the plantar arch and is subjected to major and constant pressure which, over time, favors a series of repetitive microtraumas [13]. At the same time, PF is considered a degenerative disorder caused by the partial rupture of the plantar fascia associated with chronic inflammation, which is manifested by a painful symptomatology that affects walking. The pain appears on the plantar face of the foot, near the medial calcaneal tubercle, the insertion area of the plantar aponeurosis [11], [12].

The critical pain point is encountered in the morning, in the first steps, also the intensity of the painful signs is increasing in prolonged or running periods [4].

In the case of amateur runners, the onset of plantar fascia shows a number of intrinsic and extrinsic risk factors such as: overloading, insufficient preparation, improper or overused footwear, [9] anatomical and biomechanical predispositions (flat foot, short Achilles tendon) limited dorsiflexion, poorly developed leg musculature), age.

Informing patients about the risk factors of PF should be the first step in creating treatment and prevention strategies.

It is recommended to interrupt the participation in any type of competition or training until the physiotherapeutic treatment indicates a significant decrease of the pain in rest and walking [7], [8].

1.1. Treatment of plantar fasciitis

Treatment of plantar fasciitis may include the use of several physiokinotherapeutic means, such as: electrotherapy (TENS), TECAR, taping, manual therapy (mobilizations, deep tissue / trigger point massage techniques, stretching, manipulations), laser therapy, cryotherapy, ultrasound, magnetotherapy, orthoses, shockwave therapy [4], [7].

Conservative treatment is most often used in the approach of plantar fasciitis, most studies presenting a successful management in 85-90% of cases [10].

Manual therapy includes a set of maneuvers frequently used by physiotherapists, the main objectives being to increase mobility and reduce pain. [1] Biomechanical disorders of the ankle-foot complex are favored by the existence of soft tissues with limited elasticity or low joint mobility, with manual therapy (MT) being a very effective solution in their treatment [2], [15], [16].

The use of manual therapy by physiotherapists in the treatment of patients with plantar fasciitis has increased significantly in recent years due to its beneficial effects (mechanical, neurophysiological and psycho-emotional). [6] Another therapeutic option with beneficial effects in the treatment of FP is ultrasound, due to the analgesic and anti-inflammatory effect. In recent years the cryoultrasound therapy

has been tested and then implemented to treat musculoskeletal and musculoskeletal disorders (Figure 1).

This innovative therapy combines ultrasound and cryotherapy and improves the mechanical, thermal and biological effects of ultrasound, which makes the treatment more efficient:

- mechanical effect: muscle tissue cells are stimulated by mechanical stress, producing more collagen, fiber and proteoglycans;
- thermal effect: the superficial erythema means an increase of the superficial circulation and a decrease of the deep one;
- biological effect: the temperature difference between the dermis and the deep muscles causes an increased circulatory effect by increasing the metabolism [5] .

Fig. 1*. Cryoultrasound equipement*

The cryoultrasound head is not placed directly on the skin, and it is necessary to apply a cream / gel on the affected area. Initially a local vasoconstriction is followed by a strong superficial vasodilation with decreased circulation at the muscular level.

The duration of the individual treatment is 10-30 minutes depending on the area of application and trauma, the power varies from 0 to 3 Watt / cm² and the temperature from 3 to -5°C. Contraindications for the use of cryoultrasound therapy are: osteoporosis, hemorrhage, presence of osteosynthetic materials, varicose veins, thrombo-phlebitis, obliterating arteriopathy, pace-maker, tumor, pregnancy, Raynaud's syndrome, growth cartilage.

2. Objectives

The purpose of this study is to evaluate whether manual therapy (MT) alternating with the use of cryoultrasound in the treatment of patients with plantar fasciitis (PF) represents an effective option in reducing the symptomatology.

So far, we have identified a series of studies that have followed the main therapeutic means in the rehabilitation of plantar fasciitis, the opinions of the specialists being divided.

The objective of this study is to highlight the effectiveness of the treatment protocol that combines MT with the use of an innovative device (cryoultrasound).

3. Material and Methods

The test was performed on 10 subjects who showed clinical signs of plantar fasciitis and had not received physiotherapeutic treatment in the previous weeks.

The other criteria for the selection of patients were: the plantar fasciitis that appeared at least 6 months ago, the pain intensity score on the Visual Analog scale minimum 5, the participation in at least one marathon event for amateurs in the last 2 years.

The 10 subjects (between the ages of 29 and 45) were structured into two equal groups, specifying that their testing was performed in different periods (Group A in December 2019-February 2020, Group B in August-November 2019).

Both groups benefited from a rehabilitation protocol for 3 months and included 3 sessions per week, as follows: Group A - treatment comprising MT (40 minutes) and cryoultrasound (10-12 minutes, temperature -2°C, power 0.8-1 Watt / cm²) (Figure 2);

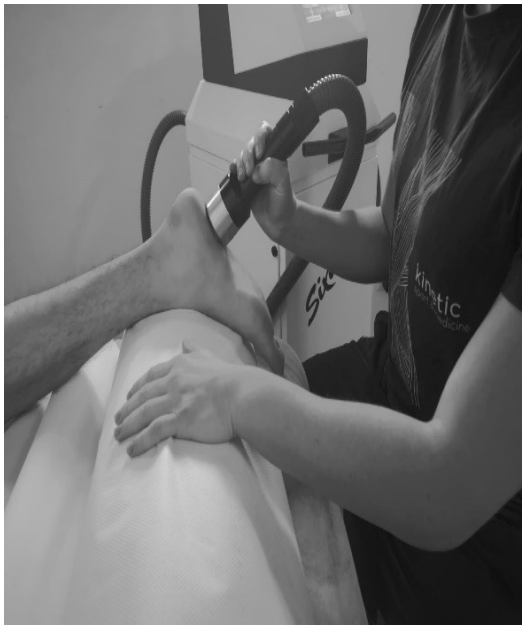

Fig. 2. *The use of cryoultrasound therapy in the rehabilitation of plantar fasciitis*

Both groups benefited from a rehabilitation protocol for 3 months and included 3 sessions per week, as follows: Group A - treatment comprising MT (40 minutes) and cryoultrasound (10-12 minutes, temperature -2°C, power 0.8-1 Watt / cm²) (Figure 2); Group B - treatment based on TM (40 minutes) and cryotherapy (10-12minutes).

Each patient underwent an evaluation (every 4 weeks): initial (E1), intermediate (E2) and final (E3) using the Visual Analog Pain Scale (VAS), which ranged from 0 (lack of pain) to at 10 (unbearable pain).

The coefficient of effectiveness was calculated between the initial and final evaluation, according to the following calculation sequence: VAS in E1 - VAS in E3 / VAS in E1 x 100. Statistical data were processed using SPSS.

3. Results and Discussions

Table 1

The evolution of the VAS score – group

Group A Evaluation	Number of subjects	Mean	Std. Deviation	Std. Error Mean
E1 - initial	5	7.00	.707	.316
E3 - final	5	2.20	.837	.374

Table 2

The evolution of the VAS score – group B

Group B Evaluation	Number of subjects	Mean	Std. Deviation	Std. Error Mean
E1 - initial	5	7.20	.837	.374
E3 - final	5	3.00	.707	.316

Table 3

Statistical analysis of the t test

Group A Evaluation	Lavene's Test		t-test Equality of Means			
	F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	.590	.464	9.798	.000	4.800	.490
Equal variances not assumed			9.798	.000	4.800	.490

Table 4

Statistical analysis of the t test

Group B Evaluation	Lavene's Test		t-test Equality of Means			
	F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	.590	.464	8.573	.000	4.200	.490
Equal variances not assumed			8.573	.000	4.200	.490

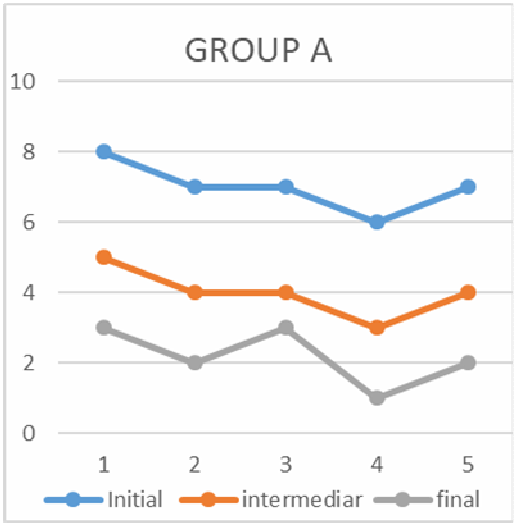

Fig. 3

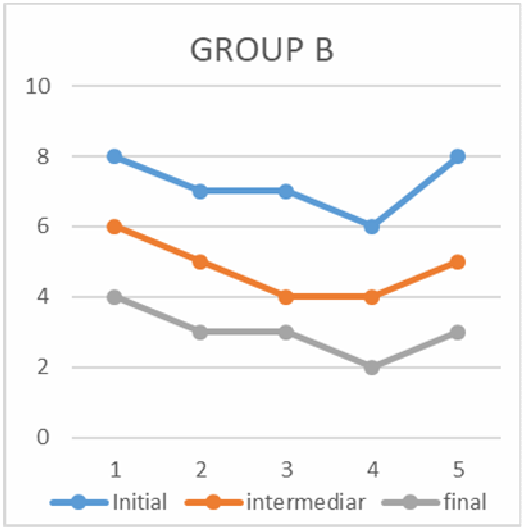

Fig. 4

The evolution of the VAS score (in E1,E2,E3)

As we can see from the tables above, *the Sig value* associated with *the t test* is 0.000 <α = 0.05 (5% risk assumed). Therefore, we can say that the treatment was effective for the subjects in group A (since there are significant differences between the initial and final evaluations, the evolution confirmed also by Figure 3.

Table 5

The average values for the coefficient of effectiveness

Group Name	Number of subjects	Mean	Std. Deviation	Std. Error Mean
Group A	5	69.1400	9.99715	4.47086
Group B	5	58.6600	6.27798	2.80760

Table 6

The average values for the coefficient of effectiveness

Effectiveness	Lavene's Test		t-test Equality of Means			
	F	Sig.	t	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Equal variances assumed	.911	.368	1.985	.082	10.48000	5.27932
Equal variances not assumed			1.985	.089	10.48000	5.27932

From the above output we can notice that *the Sig value* associated with *the t test* is 0.082. This value is higher than the risk assumed by 0.05, which means that there are no significant differences between the average effectiveness of groups A and B.

Table 7

Descriptive statistics – effectiveness

Number of subjects	**10**
Mean	63.9000
Std. Deviation	9.61480
Minimum	50.00
Maximum	83.30

From the total of 10 subjects, the average effectiveness was 63.9. Individuals deviate from the average by 9.61 (units). The maximum value of the effectiveness was 83.3 and the minimum 50.

5. Conclusions

Both treatments proved to be effective, the difference in pain intensity on the VAS scale between the two groups at E3 being 10.48 in favor of group A.

This study presents some evidence for the importance of approaching rehabilitation strategies using both manual therapy and physiotherapy devices without excluding each other.

The protocol that combines manual therapy and cryoultrasound technology can be an effective treatment option for plantar fasciitis with the possibility of being used on a long-term recovery strategy.

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