

# Cryoultrasound therapy and tendonitis in athletes: a comparative evaluation versus laser CO<sub>2</sub> and t.e.ca.r.therapy

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**Abstract.** Aim of this study is to compare the different kinds of tendonitis in athletes using cryoultrasound therapy, lasertherapy CO<sub>2</sub> and t.e.ca.r. therapy ( transfert energetic capacitive and resistive ). Forty five athletes were selected; they were all affected by severe insertional tendonitis of the Achilles tendon (15 of them), of the patellar tendon (15 of them) and of the epicondylar region (15 of them) during the last two months. They were divided into three groups. The first group underwent a treatment of 12 lasertherapy CO<sub>2</sub> sessions, the second group 12 cryoultrasound therapy sessions and the last group 12 t.e.ca.r. therapy sessions. Each patient was registered by an independent observer according to the pain before (initial V.A.S.) and after treatment (final V.A.S.) using the analogic visual range from 0 (lack of pain) to 10 (unbearable pain) and the indicator of efficacy (difference between initial V.A.S. and final V.A.S. / initial V.A.S.x 100). The obtained results were expressed as a difference between the two V.A.S. values and as a parameter of effectiveness (value ranging from 0 to 100) in order to correlate the initial condition of the patients with the performed physiotherapeutic treatment. The obtained V.A.S. score was submitted to statistic evaluation by analysis of variance through repeated measures, taking into consideration a value of  $p < 0,05$ . Possible differences among the group of patients were shown by analysis of variance through one single way by comparison among groups. Every patient benefited from the treatment. Analyzing the initial and final V.A.S. values in the three groups, statistically significant variations emerged ( $p < 0,05$ ). A meaningful difference resulted among the different kinds of treatment; a marked difference was noticed between laser CO<sub>2</sub> and cryoultrasound therapy ( $p < 0,01$ ). No statistically significant differences were observed between t.e.ca.r. and laser CO<sub>2</sub> therapy or between t.e.ca.r. and cryoultrasound therapy. It must be admitted that the mean difference between initial and final V.A.S. is higher in the Cryoultrasound group (7,40), than in the Laser group (6,33) compared to t.e.ca.r. group (6,74). This result would explain a higher range of effectiveness in the Cryoultrasound group (85) compared to the laser CO<sub>2</sub> (71,9) and t.e.ca.r. group (77,3). It can be asserted that cryoultrasound is a useful instrument for the physician working in the sports field. It offers advantages in comparison with laser CO<sub>2</sub>. It does not show significant differences with t.e.ca.r. therapy, although it shows a better mean range of effectiveness.

**Key words:** Cryoultrasound, tendonitis, laserCO<sub>2</sub> therapy, t.e.ca.r.therapy, athletes

## Introduction

Tendon syndrome is a characterized by local pain or diffused tumefaction and functional limitation of the tendon (1).

Pain is the main symptom in many patients af-

ected by tendinous pathology and painful reduction of the articular movement causes limitation in everyday life activities.

The main cause of tendon syndrome is of mechanical origin due to ipersollicitation following a non physiological strength lines, repeated overloading of

the tissues, and to the phenomenon of resonance which particular grounds or sportive or working equipments may provoke on tendons (2).

Since very little vascularized functional overloading may reduce the possibilities of recovery, physical therapy is able to resolve the inflammatory process and restore elasticity to tendinous tissue.

Cryoultrasound allows the treatment of different pathologies of the motor apparatus e.g.

- Severe inflammatory pathologies
- Pain intensification in chronic degenerative pathologies
- Severe phases in traumatology (interruption of pain-spasm-immobilization, improvement in recovery restore process and a quicker recovery.

Cryoultrasound therapy (Fig. 1) exploits the action of two different therapeutic techniques: cryotherapy and ultrasound therapy, thus improving the ordinary mechanical therapeutic, thermic and biological effects which ultrasound therapy offers.



Figure 1. Cryoultrasound equipment (mixed therapy between cryo and ultrasound therapy)

**Mechanical effect:**

Connectives and muscle tissue cells are stimulated by mechanical stress and produce more collagen fibers and proteoglycans.

**Thermic effect:**

The superficial localized erythema in the area of treatment causes an increase in superficial circulation while decreasing circulation at muscular level.

**Biological effect:**

The difference in temperature between the dermis and the underlying muscle causes a better circulatory effect by increasing metabolism (3).

The cryotherapeutic effect is obtained thanks to the pressure and controlled evaporation of gas (Freon) inside a refrigeration system.

The cryotherapeutic effects may happen on a superficial medium or deep level according to the duration of application, these include a decrease in pain in anti-inflammatory agent, in edema and in a miorelaxing effect.

The head of the ultrasound system placed on the interested area, provokes an initial vasoconstriction followed by a strong superficial vasodilation with a decrease in circulation at muscular level.

A decrease in temperature in the deep tissue creates an increase in density in the tissue itself, increases the mechanical effect, and notably reduces the thermic effect of the ultrasound.

The duration of this treatment may vary from 10 to 30 minutes, the power varies from 0 to 3 watt/cm<sup>2</sup> and temperature varies from 3 to -5° centigrade degrees.

The indication of the therapy may occur as follow:

- Continuous
- Pulsed at 50 Hz (P1) and at 100 Hz frequency (P2)

The contradictions to the treatment by cryoultrasound are: osteoporosis with high turnover, haemorrhage, presence of pieces of metal, varicose veins, thrombophlebitis, pace-maker, obliterous arteriopathy, tumor, pregnancy, fertilis epiphysis, raynaud syndrome (3).

Aim of this study is to compare the different kinds of tendonitis treatment in athletes using cryoultrasound therapy, endogenous thermotherapy like lasertherapy CO<sub>2</sub> (transfert of energy by projection) and esogenous thermotherapy like t.e.c.a.r.the-

rapy (currents of charge movement inside biological tissues).

## Materials and methods

Forty five athletes were selected (24 footballers, 13 volleyballers, 8 basketball players), 32 males and 13 females, with a mean age of 33 years, all affected by severe insertional tendonitis during the last two months.

The tendonitis was localized at Achilles tendon (15 of them), at patellar tendon (15 of them) and in epicondylar region (15 of them).

They were divided into three groups. Each group consisted of 5 cases of Achilles, 5 cases of patellar and 5 cases of epicondylar tendonitis.

The first group underwent a treatment of 12 lasertherapy CO<sub>2</sub> sessions, the second group 12 cryoultrasound therapy sessions and the last group 12 t.e.ca.r. therapy sessions.

Each group was submitted to the therapy mentioned above as follows:

**Laser group:** twelve sessions of 15 minutes period, continuous method, 12 watt of power.

**T.e.ca.r. group:** 12 sessions of 30 minutes period divided into 15 minutes with capacitive method, 15 minutes with resistive method; continuous method and medium power.

**Cryoultrasound group:** 12 sessions of 20 minutes period, continuous method, temperature of - 2 °C and power of 1,8 watt/cm<sup>2</sup> (Fig. 2)

Each patient was registered by an independent observer according to the pain before (initial V.A.S.) and after treatment (final V.A.S.) using the analogic visual range from 0 (lack of pain) to 10 (unbearable pain) and the indicator of efficacy (difference between initial V.A.S. and final V.A.S. initial/V.A.S. x 100) (Table 1).

The patients satisfaction was arbitrarily classified as follows: unsatisfied, slightly satisfied, satisfied, very satisfied.

The obtained results were expressed as a difference between the two V.A.S. values and as a parameter of effectiveness (value ranging from 0 to 100) in order to correlate the initial condition of the patients with the performed physiotherapeutic treatment.



Figure 2. Treatment by cryoultrasound in elbow's epicondylar tendonitis

According to the efficacy indicators the obtained results were classified as follows:

- slightly improved (score from 1 to 30);
- well improved (from 31 to 55);
- very well improved (from 56 to 80)
- recovered (from 81 to 100).

The obtained V.A.S. score was submitted to statistic evaluation by analysis of variance through repeated measures, taking into consideration a value of  $p < 0,05$ .

Possible differences among the groups of patients were shown by analysis of variance through one single way by comparison among groups.

## Results

Every patient benefited from the treatment.

The V.A.S. score for each group being respectively: Cryoultrasound: 8,73 +/- 0,77 (initial), 1,33 +/-

Table 1. V.A.S. score

|       | Laser CO <sub>2</sub>      |       |      | T.e.ca.r.therapy |       |      | Cryoultrasound |       |      |
|-------|----------------------------|-------|------|------------------|-------|------|----------------|-------|------|
|       | V.A.S. tendinitis rotulea  |       |      |                  |       |      |                |       |      |
|       | Inizial                    | Final | %    | Inizial          | Final | %    | Inizial        | Final | %    |
|       | 10                         | 2     | 80   | 9                | 1     | 89   | 8              | 0     | 100  |
|       | 8                          | 3     | 62,5 | 10               | 2     | 80   | 8              | 1     | 87,5 |
|       | 8                          | 2     | 75   | 8                | 2     | 75   | 8              | 0     | 100  |
|       | 9                          | 3     | 67   | 8                | 3     | 62,5 | 10             | 2     | 80   |
|       | 8                          | 3     | 62,5 | 7                | 2     | 71,5 | 9              | 1     | 89   |
| Media | 8,6                        | 2,6   | 69,4 | 8,4              | 2     | 75,6 | 8,6            | 0,8   | 91   |
|       | V.A.S. tendinitis achillea |       |      |                  |       |      |                |       |      |
|       | 9                          | 3     | 67   | 9                | 2     | 78   | 10             | 2     | 80   |
|       | 9                          | 3     | 67   | 10               | 2     | 80   | 9              | 1     | 89   |
|       | 9                          | 2     | 78   | 9                | 2     | 78   | 9              | 2     | 78   |
|       | 10                         | 3     | 70   | 8                | 2     | 75   | 9              | 2     | 78   |
|       | 8                          | 3     | 62,5 | 9                | 2     | 78   | 8              | 2     | 75   |
| Media | 9                          | 2,8   | 68,9 | 9                | 2     | 77,8 | 9              | 1,8   | 80   |
|       | V.A.S. epicondilitis       |       |      |                  |       |      |                |       |      |
|       | 9                          | 2     | 78   | 9                | 1     | 89   | 10             | 2     | 80   |
|       | 8                          | 2     | 75   | 8                | 2     | 75   | 8              | 1     | 87,5 |
|       | 10                         | 2     | 80   | 10               | 2     | 80   | 8              | 0     | 100  |
|       | 8                          | 1     | 87,5 | 8                | 2     | 75   | 9              | 2     | 78   |
|       | 9                          | 3     | 67   | 8                | 2     | 75   | 8              | 2     | 75   |
|       | 8,8                        | 2     | 77,5 | 8,6              | 1,8   | 78,8 | 8,6            | 1,4   | 84,1 |

0,82 (final), T.e.ca.r.therapy: 8,67 +/- 0,90 (initial), 1,93 +/-0,46 (final), Lasertherapy: 8,80 +/- 0,77 (initial), 2,47 +/- 0,64 (final).

Analyzing the initial and final V.A.S. values in the three groups, statistically significant variations emerged ( $p < 0,05$ ). A meaningful difference resulted among the different kinds of treatment; a marked difference was noticed between Laser CO<sub>2</sub> and Cryoultrasound therapy ( $p < 0,01$ ).

No statistically significant differences were observed between t.e.ca.r. and laser CO<sub>2</sub> therapy or between t.e.ca.r. and cryoultrasound therapy.

It must be admitted that the mean difference between initial and final V.A.S. is higher in the cryoultrasound group (7,40), than in the laser group (6,33) compare to t.e.ca.r. group (6,74).

This result would explain a higher range of effectiveness in the cryoultrasound group (85) compared to the CO<sub>2</sub> laser (71,9) and t.e.ca.r. groups (77,4).

The result obtained by cryoultrasound in the list used to evaluate the efficacy of treatment is classified as recovered; whereas in the other two therapies: well improved.

However the patient's satisfaction must be taken into account: (another thing to take into account is the patient).

Out of all treated patients, 19 patients (42%) declared to be satisfied) and 26 patients (58%) very satisfied. Among these treated patients by cryoultrasound only one declared to be satisfied and 14 were very satisfied.

Among the patients treated by laser CO<sub>2</sub>, 11 were satisfied and 4 very satisfied. Out of those treated by t.e.ca.r. therapy, 7 were satisfied and 8 very satisfied (Table 2).

After 8 months from the treatment a follow-up was carried out and a better condition of the patients treated by cryoultrasound emerged compared to those treated by t.e.ca.r. and laser CO<sub>2</sub> therapy.

In the group treated by cryoultrasound, no relapse was observed.

In the laser CO<sub>2</sub> group, 3 patients complained of sharper pain, 2 of them at rotular tendon and 1 in the epicondilar area.

In the t.e.ca.r. group, 2 patients with epicondilitis still presented pain.

**Table 2.** Patient's satisfaction

| Laser CO <sub>2</sub> group |   | Cryoultrasound group |    | T.e.ca.r. group    |   |
|-----------------------------|---|----------------------|----|--------------------|---|
| Unsatisfied                 |   | Unsatisfied          |    | Unsatisfied        |   |
| Slightly satisfied          |   | Slightly satisfied   |    | Slightly satisfied |   |
| Satisfied                   | 7 | Satisfied            | 1  | Satisfied          | 7 |
| Very satisfied              | 8 | Very satisfied       | 14 | Very satisfied     | 8 |

## Discussion

In the treatment of tendonitis many electromedical equipments may be utilized with different therapeutical effects. (4-7)

Therapeutic ultrasound (US) is one of the most commonly physical instrument used in the treatment of musculoskeletal injuries (8).

Previously published studies have demonstrated that pulsed low-dose US is most effective for facilitating tissue healing (9-11).

A study done by Ebenbichler et al (12) is an excellent example of how a specific setting of pulsed US, can demonstrate positive clinical results for management of calcific shoulder tendonitis in a randomized controlled trial.

Despite the fact is still in discussion the efficacy of ultrasound therapy (13-16), this research has shown that Cryoultrasound offers many advantages compared to laser CO<sub>2</sub> because of its effectiveness on pain, longer lasting results and patient's satisfaction.

It represents, compared to t.e.ca.r.therapy, a better range of effectiveness, a higher patient's satisfaction and a longer lasting of the obtained results.

Following these results, it can be asserted that among the proposed therapies, Cryoultrasound is a new and effective means for tendinous pathology treatment.

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