MLS THERAPY TREATMENT OF ACUTE SHOULDER PAIN IN INFLAMMATORY PROCESSES OF THE ROTATOR CUFF

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ABSTRACT

Shoulder pain is a complex pathology due to pathological processes involving the glenohumeral joint, the acromioclavicular joint, the ligaments or the supporting tendons. In this paper we illustrate the efficacy of MLS (Multiwave Locked System) Therapy in the treatment of acute shoulder pain in inflammatory processes involving the rotator cuff. Twenty patients underwent monotherapy treatment with MLS Therapy using the MIX5 system (ASA, Arcugnano, Vicenza). After an initial clinical-anamnestic examination, subjective and objective evaluations of the pain symptomatology are made right before treatment, after 10 days of application and after 30 days. At the end of MLS Therapy treatment the data are compared with each other using t-test: the results relative to the VAS ($p<0.0001$) and to the SRQ and SSRS parameters show a statistically significant improvement and, as already demonstrated previously, confirm MLS Therapy as one of the best solutions for rapidly reducing pain symptoms in many muscle-tendon diseases, guaranteeing long-lasting benefits from the results.

INTRODUCTION

Shoulder pain is a complex pathology with a multiple etiology. Felt at the inner shoulder, this pain is due to pathological processes involving the genohumeral and acromioclavicular joints, the ligaments or the supporting tendons. The complex movement of the shoulder is the result of the movement of four joints: the scapulohumeral, the acromioclavicular, the sternoclavicular and the

scapulothoracic. In order for the shoulder to function well, all four of these joints must move simultaneously and in synchrony.

There are about 30 muscles surrounding the shoulder, allowing its movement; in particular, the muscles making up the "rotator cuff" are responsible for the external and internal rotation of the shoulder: the supraspinatus (abductor), subscapular (internal rotator), infraspinatus and teres minor (external rotators).

These structures, together with the long head of the brachial biceps and the subacromion-deltoid bursa, fall between the humeral head and an arc above it consisting of: acromion (a postero-anterior projection of the scapula), the coracoid process (an anterior projection of the scapula), and the coracoacromial ligament, which joins the two protuberances. Inflammation of these structures causes "degenerative syndrome of the rotator cuff".

subacromial bursa
acromion
supraspinatus
acromioclavicular joint
coracoacromial ligament
infraspinatus
coracoid process
long head of biceps
teres minor
subscapularis

Tab. 1 – The scapulohumeral joint *is the most mobile of the human body: it has three degrees of movement which allow the upper limb to be oriented in relation to the three planes of space (sagittal, frontal, horizontal). Nevertheless, we must remember that the scapular glenoid does not completely contain the head of the humerus; stability is guaranteed by the glenoid labrum which increases its surface and covers it. The rotator cuff muscles, together with the superior, middle, and inferior glenohumeral ligaments and the tendon of the biceps long head, contribute to maintaining the humeral head inside its joint cavity; if this did not happen the head of the humerus would dislocate at every movement.*

Pathologies involving the rotator cuff derive typically from excessive use of the shoulder and can arise following physical activity. In the case of "throwing" sports (such as volley ball), they originate from an inflammation of the tendons due to harmful mechanisms of overload

caused by movements that are repeated excessively (microtraumas) or performed too intensely. The causing factors are extrinsic or intrinsic, such as defects in the length or angle of the limbs, postural imbalance. The problem originates from a bad relationship of force between the elevator/depressor muscles and the internal/external muscles that during movement generate a conflict between the tendon and the bony wall above them; this perpetuates damage to the tendon, making it degenerate until there is a partial or complete break. The use of laser as a therapeutic instrument is quite widespread and has been used successfully for some time in treating numerous muscle-joint pathologies (Bjordal JM, et al. [1]; Hakguder A, et al. [2]) as it is able to stimulate the different cell processes at the tissue level, which translates into remission of pain, diminution of edema, inhibition of the inflammatory process (Tuner J, et al. [3]; England S, et al. [5]; Ernst E, et al. [6]; Gam A, et al. [7]).

Furthermore, it has been known for some time that continuous laser emissions act quickly on inflammation while the pulsations have a practically immediate effect on pain (Tuner J. [3]). Recent studies show that the combination of the two types of emission results in an overlapping of the therapeutic effects (Corti L. et al. [4]).
MLS Therapy further enhances these therapeutic effects by achieving a linked and synchronized emission of different continuous and pulsated laser emissions with different infrared wavelengths.

The aim of the study presented in this report is to evaluate the efficacy of MLS Therapy in the treatment of acute shoulder pain in inflammatory processes involving the rotator cuff, avoiding, in this case, concomitant pharmacological therapy.

As already demonstrated in recent studies, MLS Therapy has shown its effectiveness in the treatment of many muscle-tendon diseases and represents one of the best solutions for reducing pain in the shortest time possible, guaranteeing long-lasting benefits.

MATERIALS AND METHODS

Population

This study includes 20 patients, 7 males and 13 females, with a mean age of 59 (range: 45-78 years), suffering from painful shoulder due to inflammatory processes involving the rotator cuff.
The inclusion criteria for the study call for the presence of pain in the shoulder, with or without functional limitations, in the absence of complete lesions of the rotator cuff (shown by ultrasound or NMR), fractural or degenerative pathologies, and a history of recurring dislocations. The patients begin monotherapy treatment with MLS Therapy in the absence of concomitant or recent oral or infiltrative NSAIDS or corticosteroids.

Equipment

The equipment used for this study is the MIX5 D system (ASA, Arcugnano, Vicenza), equipped with a multidiode applicator with a fixed sight and 5 continuous and pulsated laser heads guided by the MLS system. The MLS emission of the applicator covers a Target Area of 5 cm in diameter, capable of optimizing the homogeneous and simultaneous activation of several photoreceptors and of a broad tissue volume. Homogenous coverage of the zone to be treated is important for minimizing energy loss through scattering, guaranteeing that all the tissue responds promptly to the therapy.

Methodology

One session per day is effected, for 10 days (5 days a week for two weeks) on the target area corresponding to the site of the diagnosed lesion. The evaluation methods call for an initial clinical-anamnestic examination, followed by the subjective and objective evaluations of the painful symptoms through the use of the VAS (Visual Analogue Scale), of the SSRS (Subjective Shoulder Rating Scale) test and the SRQ (Shoulder Rating Questionnaire) test in three phases: prior to the beginning of the entire MLS Therapy cycle, at the end of the cycle and 30 days after the end of therapy.

The VAS, for the evaluation of painful symptoms, is a straight line of 10 cm with the two ends corresponding to “no pain” – equal to 0 – and with the maximum pain possible, or the maximum experienced – equal to 10 -.

The SRSS (Bonaiuti D. [8]) represents the patient’s appraisal of the condition of his own shoulder. The SRSS, in contrast to most specific measurement scales for the shoulder, also includes evaluation of instability. It attributes the main importance to articularity (35 points), rather than to function (10+5) or to instability (15 points). Pain is not evaluated on the basis of intensity (as with the VAS scale) but in relation to frequency, length and the circumstances in which it is felt. The highest score for a shoulder with no problems is 100. The lowest score is 0.

Objective evaluation is effected through a clinical exam of flexion, abduction, internal rotation, external rotation and administration of the SRQ scale (Bonaiuti D. [8]). The latter is evaluated by a questionnaire for evaluating the severity of the correlated symptoms and the functional state of the shoulder.

It includes pain, everyday, sports, and free-time activity, satisfaction with the work, and the areas of improvement. The highest score for a shoulder with no problems is 100; the lowest is 0.

After the first evaluation (T1) follows MLS Therapy with a constant frequency of 700Hz per 5 minutes. All together 55.01 Joules are emitted, equal to a dose of 2.8 Joule/cm2 with an intensity of 50%.

The second evaluation (T2) is effected immediately at the end of the 10-session cycle, using the same evaluative instruments.
Finally,the third evaluation (T3) is obtained with a new administration of the evaluation tests 30 days from the end of the last MLS Therapy session.

Data analysis
The data from T1 (beginning of therapy), T2 (end of therapy), T3 (30 days after the end of therapy) are compared through t-test.
The lowest level of significance is set at 0.05. The data are analyzed with Origin software (Microcal), version 7.0.

T-test is an appropriate analysis every time we want to compare the averages (A) of two groups (a, b) and estimate if the averages of two groups are statistically different from each other.
T-test compares two averages keeping in mind how much the average found between the two groups differs from the real average (valid assumptions assuming that the distribution of the terms of the population follows a normal or Gaussian pattern); this evaluation is linked to the probability of error that we are willing to accept and depends on the standard deviation of our samples.

The parameter representing the analysis of the t-test is the p-value, or significance level, which is calculated in the following way: p-value = Ma – Mb/SE(Ma – Mb) The numerator is represented by the difference of the averages of the two groups; the denominator, instead, refers to the standard error of this difference.

The standard error depends in turn on the standard deviation that measures how much the single values differ from the mean.
In our case, group a, for example, is represented by the average of the VAS of the patients of the patients in time T1 and group b by the average of the VAS of the patients at time T2: p-value = VAS1-VAS2/SE(VAS1-VAS2).
To give another example, group a is represented by the average of the SRQ of the patients at time T2 and group b by the average of the SRQ of the patients at time T3: p-value = SRQ2-SRQ3/SE(SRQ2-SRQ3).The p-value represents the probability that the difference observed between the two averages is casual.
Typically, a value of p-value equal to 0.05 (or 5%) is used: a p-value

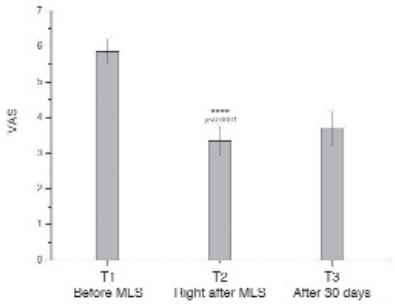

Fig. 1 Average VAS score before MLS treatment (T1), right after MLS treatment (T2), 30 days after treatment (T3).

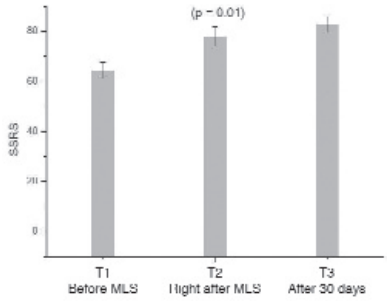

Fig. 2 Average SSRS score before MLS treatment (T1), right after MLS treatment (T2), 30 days after treatment (T3).

equal to 0.05 tells us we have a 5% possibility that the difference between the two averages is casual. Therefore, in our case, if in the comparison between VAS1 and VAS2 $p<0.05$, we can say that VAS1 and VAS2 are statistically different from each other, in other words VAS1 is significantly different from VAS2.

RESULTS

At the end of treatment with MLS Therapy the results relative to the VAS scale show a clear improvement in the passage from T1 to T2, as we can see in the graph in figure 1 (VAS1 = 5.85 ± 0.37, N=20; VAS2 = 3.35 ± 0.41, N=20): the difference between the two values is statistically significant (p = 5.48E-5).
Upon follow up after 30 days the result obtained at T2 remains stable in time (VAS3 = 3.7 ± 0.49, N=20): the mean VAS at T2, in fact, is not significantly different from that at T3 (p = 0.59), even if there is a slight worsening of the painful symptoms.

Regarding the SRSS test we notice a significant improvement from T1 to T2, as shown by the graph in figure 2 (SSRS1 = 64.4 ± 3.23, N=20; SSRS2 = 77.95 ± 3.95, N=20): the difference between the two values is statistically significant (p = 0.01).
At 30 days (SSRS3 = 82.8 ± 3.24, N=20) the result obtained remains stable: the value of SSRS2 is not significantly different from that of SSRS3 (p = 0.35), rather, it continues to increase, witness of a further improvement.

The results of the SRQ test show roughly the same pattern: there is a significant improvement from T1 to T2 as can be seen in figure 3 (SRQ1 = 44.25 ± 3.76, N=20; SRQ1 = 55.8 ± 3.47, N=20): the difference between the two values is statistically significant (p = 0.03). At 30 days the result obtained at T2 remains stable at T3 (SRQ3 = 60.05 ± 3.31, N=20): the value of SRQ2 is not significantly different from that of SRQ3 (p = 0.38) and here, too, there continues to be improvement.

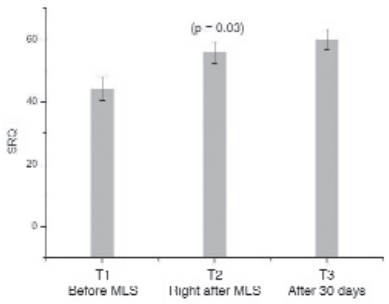

Fig. 3 Average SQR score before MLS treatment (T1), right after MLS treatment (T2), 30 days after treatment (T3).

DISCUSSION

The results of this research highlight the effectiveness of MLS Therapy in the treatment of pain of the shoulder and, in particular, of the inflammatory processes involving the rotator cuff.

At the end of treatment with MLS Therapy the results relative to the VAS and to the SRQ and SSRS parameters show a statistically significant improvement; the VAS bears witness to a considerable improvement: the result corresponds to four 'stars' based on the decimals separating the p-value from 1 ($p<0.0001$).
The analysis made at 30 days after the end of treatment show a slight worsening of the VAS, not – however – statistically significant. Nevertheless, the VAS at a month after treatment is not comparable with the data found before treatment: the worsening may represent an almost functional process due to the resumption of motor activity of the shoulder and arm involved, without recording the true quality of the pain. To demonstrate this, the results of the SSRS and SRQ scales are significant; at 30 days from the end of treatment there is a slight improvement indicative of the persistence of the benefits of this therapy.

In this study we wanted to examine the path of the painful symptomatology through subjective as well as objective measure. VAS is a one-dimensional instrument that quantifies what the patient subjectively perceives as pain or as relief in the whole of their physical, psychological and spiritual variables without, however, distinguishing which of these components has the greater role. SRSS and SRQ are specific tests for pathologies involving the shoulder, known internationally, which extend the evaluation of the pain to multiple determining factors.

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