CLINICAL RESULTS IN THE TREATMENT OF ANKLE AND KNEE DISTORTION PATHOLOGIES WITH MLS THERAPY

Corti L.[1], Rosa E.[2], Norbiato V.[2], Pedrini L.[1]
[1] *Radiotherapy I.O.V.-I.R.C.C.S.*
[2] *Physiotherapy Service*

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ABSTRACT

The aim of this study is to evaluate the effectiveness of MLS (Multiwave Locked System) Therapy on osteo-musculotendinous pathologies previously not considered, such as trauma to the knee and ankle. The knee is a complex joint, extremely exposed to trauma and degenerative lesions; while the ankle bears the body weight and is thus very vulnerable and subject to sprains.
Of the 28 patients included in this study, 11 had knee trauma, 18 had ankle trauma. A 10-day treatment with the M6 system (ASA, Arcugnano, Vicenza) was scheduled, making automatic execution of the therapy possible. The VAS scores before MLS Therapy, those before therapy but after palpation, and those right after treatment are compared through t-test.
The results confirm the effectiveness of MLS Therapy in the remission of painful symptoms and in recovery of functionality in a short time, so as to allow, in many cases, for the suspension of therapy before completing the 10 sessions foreseen by protocol.

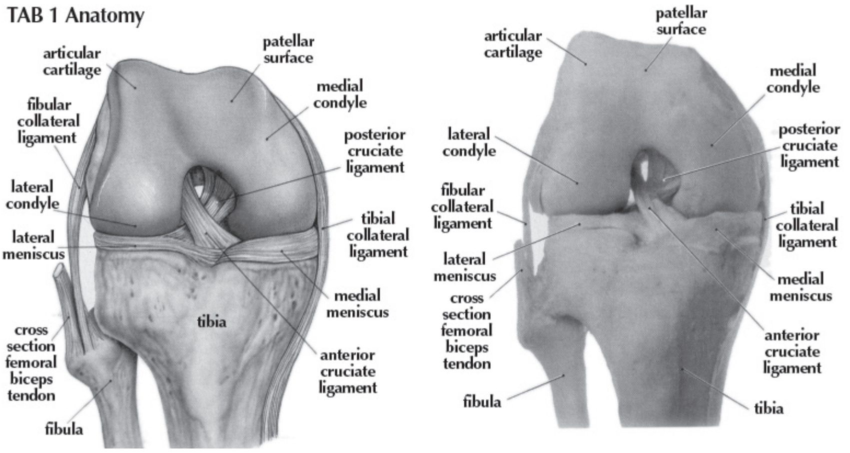
INTRODUCTION

It has been known for some time that laser therapy successfully treats numerous musculoarticular pathologies (Bjordal JM. et al. [1]; Hakguder A. et al. [2] playing an important role in the physical therapy used in daily medical practice (England S. et al. [8]; Ernst E. et al. [9]; Gam A. et al. [10]; Tuner J. et al. [3]).
In particular, it has been observed that continuous emission has an

anti-inflammatory effect and pulsated emission has a prevalently analgesic effect (Tuner J. [3]); while, in a previous study on treatment of post-traumatic cervicalgia, it has been shown that the combination of the two types of emission represents an effective way of obtaining the overlapping of both therapeutic effects (Corti L., et al. [4]). Thanks to the control system that generates the MLS impulse, MLS therapy takes another step ahead: through synchronization of continuous and pulsated emission, the analgesic, anti-inflammatory and anti-edema effects are strengthened synergically with each other. These results are in line with previous cell culture and laboratory animal studies, where we can see how particular types of laser impulses are able to exercise greater therapeutic effects (Squizzato F. et al. [5]; Gigo-Benato D. et al. [6]; Fortuna D. et al. [7]). The aim of our research was to expand the case histories relative to MLS Therapy, evaluating its effectiveness on osteo-musculotendinous pathologies as of yet not taken into consideration, such as knee and ankle trauma.

The knee joint extends from between the distal end of the femur and the proximal end of the tibia and is protected in front by the knee-cap, which eases the muscles' job during flexion and extension movements. The bony surfaces are covered by a layer of cartilage which eases their reciprocal sliding. The knee has two menisci, medial and lateral
The menisci are cartilaginous structures serving both for increasing stability and for absorbing blows and loads, acting like proper shock

TAB 1 Anatomy



absorbers. Finally, the ligaments are fibrous structures connecting the joint ends: the anterior cruciate ligament with the posterior cruciate ligament forms the central pivot of the knee, essential for the knee's stability as it prevents anterior translation of the tibia in respect to the femur.
Thanks to the help of the articular capsule, which contains the synovial fluid, and the muscles, the ligaments allow movement.

We have specifically emphasized the effectiveness in terms of pain remission, confirming the validity of this therapeutic approach in reduced treatment time.

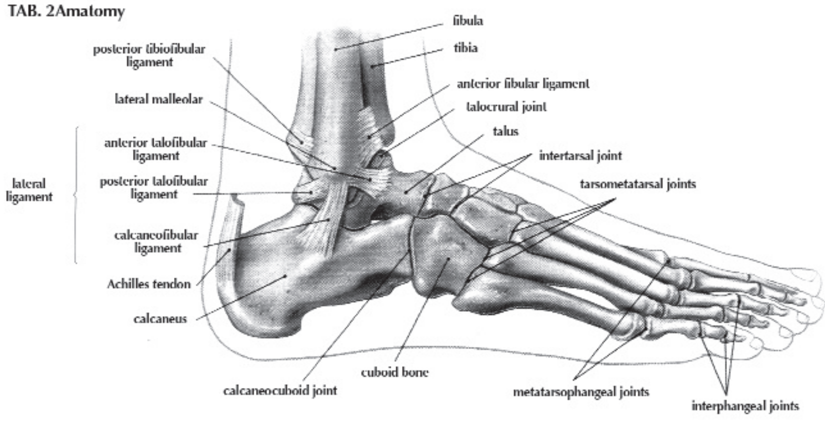
The knee

Because of its anatomy, the knee joint is the most exposed to trauma and degenerative lesions.
It is a complex joint which subjects the bone, capsule, meniscus, ligament and myotendinous structures to considerable stress; an incorrect movement while practicing sports, a sudden functional overload of the knee, a contrast with the foot set on the ground can produce acute lesions.

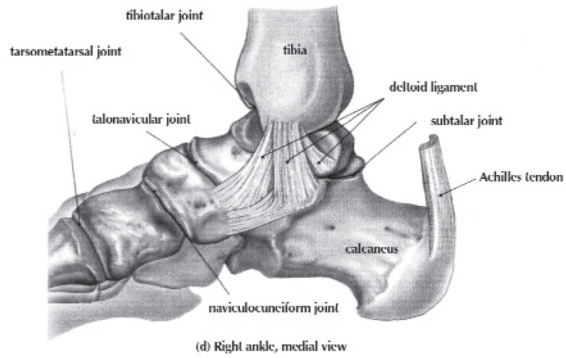
The most common traumas are due to sudden rotation of the tibial plate with the foot set on the ground.
They provoke lesions in the menisci, the cruciate ligaments, the collateral ligaments or sprains. In our study we present the most frequent cases regarding gonalgia from knee sprains, the diagnoses range also to contusions, meniscal alterations, tendonitis, lesions to the ligaments, apophysitis.
Sprain is due to a "closed" lesion, or one without tearing of the skin, of a joint that is rotated violently beyond the normal limits of its mobility. This abrupt movement leads to an incomplete and temporary dislocation of the bone heads involved.
The speed of the movement and return to its normal position, even if it doesn't generally provoke bone lesions, does not prevent, however, a serious sprain or even the breaking of the ligaments that stabilize the joint itself.
The symptoms of pain and fast developing local swelling are due to this mechanism of straining and laceration.

The foot is a sophisticated structure made of 26 bones, joined by 33 joints reinforced by more than 100 ligaments. The weight of the body passes to it through the ankle or talocrural joint, formed by the articulations between the tibia, fibula and talus. The articular capsule of the ankle joint extends between the distal surfaces of the tibia, the medial malleolar, the lateral malleolar, and the talus. The ligaments extend between all these bones, strong fibrous cords whose rupture, following more serious sprains, implies a greater articular play with subsequent instability.
The main ligaments are the medial deltoid ligament and the three lateral ligaments. The malleolars, supported by these ligaments and held together by the tibiofibular ligaments prevent the ankle joint from slipping sideways.

TAB. 2Amatomy



Ankle and foot joints. Side view (Martini FH et al. [11])



Ankle and foot joints. Medial view (Martini FH et al. [11])

The ankles are very vulnerable and thus subject to sprains. A sprained ankle comes about because of heavy stress involving the ligaments. The most common sprain mechanism is an internal rotation movement of the ankle. When this unusual movement is faster and stronger than can be contrasted by the muscles, the ligaments will be subject to an excessive traction leading to damage to the ligaments. This damage can be more or less complex depending on the number of ligaments involved and the extent and

seriousness are quantified in three degrees: first degree sprains consist of a sprain of the ligaments without breaking; second-grade sprains include a partial break of the ligaments, nevertheless leaving joint stability intact; finally, third-degree sprains are the most serious and means there is complete breaking of the ligaments, leading to instability.
Also in the case of the ankle the traumas examined in our study have different etiologies: tibiotarsal sprain with lesions of the ligaments, contusions of the malleolars, plantar fascitis of the calcaneus insertion of the foot, metatarsal fracture, tendonitis, partial lacerations of the ligaments, tenosynovitis, capsulitis.

Just as for the shoulder and elbow joints, individual tendons can develop degenerative pathological processes linked to functional overload. One of the most common kinds of tendonitis, found in some cases of this clinical study, is tendonitis of the Achilles tendon. The Achilles tendon originating from the muscles of the posterior leg space, inserts in the calcaneus; its task is to transmit the force originating in these muscles to the skeleton and it is constantly involved during walking, running and jumping.
The main symptom is pain along the length of the tendon sometimes felt in the calcaneus region, initially tied to physical effort, but after a while also at rest.

MATERIALS AND METHODS

Admitted to the study were patients coming for physiotherapy and rehabilitation for the consequences of trauma to the knee or ankle.
28 patients participated, 17 with ankle trauma, 11 with knee trauma. The patients were treated daily, on weekdays, for a total of 10 sessions altogether. During the first 5 sessions MLS Therapy was applied as monotherapy. In the following 5 sessions MLS Therapy was accompanied by electrostimulation in order to favour muscle recovery, with an identical protocol for all the patients.
The MLS Therapy equipment used for this study is the M6 system

(ASA, Arcugnano, Vicenza). M6 makes automatic execution of MLS Therapy in Multitarget form possible. Thanks to its robotized head, illumination is performed by automatic shift on the treatment zone of a target area illuminated simultaneously.
The applicator is positioned above the area to be treated (100cmÇ), at a distance of approximately 20 cm, trying to guarantee as far as possible that the patient does not move his leg during treatment.

The applicator is positioned above the area to be treated (100cmÇ), at a distance of approximately 20 cm (measurable with the ultrasound sensor with which the equipment is supplied).
In this study treatment with MLS Therapy was performed at a constant frequency of 700 Hz per 10 minutes at an intensity of 50%. The total energy emitted was 481.5 J, which corresponds to a dose of 4.8 J/cmÇ.

Assessment of the outcome was made by VAS (Visual Analogue Scale) at three different moments of each session: the value of spontaneous pain was evaluated before the start of MLS Therapy (T1), pain after palpation before the onset of therapy (T2) and pain at the end of therapy (T3).

In some cases the articular functionality before the onset of therapy and at the end of the entire 10-session cycle was evaluated. In particular, the extent of articular excursion of the knee was studied: with the patient lying down and the knee flexed the distance between heel and buttocks was measured (normal extension corresponds to about 5°).

The VAS data at T1 (before MLS Therapy), Ts (before MLS Therapy after palpation), T3 (right after MLS Therapy) were compared through t-test. The minimum level of significance was set at 0.05. The data were analyzed with Origin software (Microcal), version 7.0.

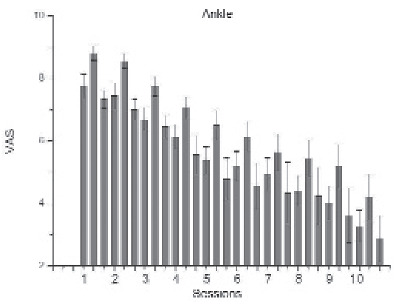


Fig. 1 Average VAS score before MLS Therapy (T1), before MLS Therapy after palpation (T2), right after MLS Therapy (T3).

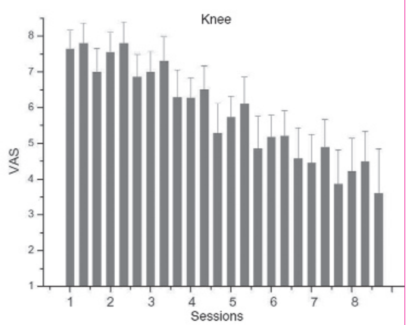


Fig. 2 Average VAS score before MLS Therapy (T1), before MLS Therapy and after palpation (T2), right after MLS Therapy (T3).

RESULTS

At the end of treatment MLS Therapy for all 28 patients the results for the VAS score show a clear improvement in passing from the first to the tenth session. In the case of the ankle the results relative to the VAS show a clear and constant improvement from session to session. In passing from T1 to T2 of each session we notice a worsening of the VAS, due to palpation of the painful area. As we can see from the graph in figure 1 (Session 1, VAS (T1) = 7.75 ± 0.37, N =16; session 10, VAS (T3) = 2.850 ± 0.41, N =7) the difference between the average VAS value at time T1 at the first session and the average VAS value at time T3 at the tenth sitting is statistically significant ($p<0.00001$). At time T2 of each session (VAS evaluation after palpation) we observe a slight worsening of the painful symptoms due to palpation of the painful area; a value which, in any case, diminishes at every session in a statistically significant way (Session 1 VAS(T2) = 8.81 ± 0.25, N =16; session 10, VAS (T2) = 4.20 ± 0.74, N = 10; p = 3.05E-7).

From figure 1 we can see that the error of the average VAS value grows with the number of sessions; the increase in errors is due to the fact that many patients ended the treatment before the ten applications. To demonstrate this, the statistical analysis of the data is significant ($p<0.0001$) comparing the averages at the first and the fifth sessions, calculated on the VAS values of 16 patients: at session 1, VAS (T1) = 7.75 ± 0.37, N =16; at session 5, VAS (T1) = 5.37 ± 0.44, N =16.

In the case of the knee, remission of pain obtained in patients with MLS Therapy is less significant. Nevertheless, to show the effectiveness of MLS Therapy in relatively short times, only two of the eleven patients treated completed the ten sessions.
For this reason statistical analysis is made between the VAS values obtained in the first eight sessions (Fig. 2) obtaining significant results with the comparison of the averages at time T1of the first

session and at time T3 of the eighth session (pz0.01): S1, T1, VAS = 7.63 ± 0.53, N = 11; S8, T3, VAS = 3.6 ± 1.2. If, instead, the t-test is made between the VAS at session 1 and the VAS at session 5, all the patients are included: S1, T1, VAS = 7.63 ± 0.53, N =11; S5, T1, VAS = 5.72 +/- 0.58, N =11 (p<0.01).

DISCUSSION

The results of this study broaden the therapeutic confines of MLS Therapy demonstrating its effectiveness in the remission of painful symptoms and in the recovery of functionality, both in patients with ankle trauma and those with knee trauma

The remission of pain is in fact statistically significant in both cases, considering also the fact that most of the patients start with an elevated VAS score (20% patients, VAS = 10). In patients with ankle trauma the result corresponds to five 'stars', on the basis of the decimals separating the p-value from 1 (p<0.00001); the patients with knee trauma show more modest but statistically significant results (p-value<0.01).

In the last four sessions, in both cases, VAS error increases; this is due to the fact that many patients terminated their treatment cycle after the fifth session. Suspension of treatment before ten sessions signifies that the therapy is effective in times which are even briefer than those foreseen.

For some patients articular functionality has also been evaluated at the end of the ten sessions by measuring the degrees of the extent of articular excursion of the knee: in 75% of the cases recovery of functionality results at 60%.

This study has demonstrated that the new MLS Therapy represents a valid instrument even for the effectiveness in short treatment.

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