

Application of MLS laser on muscular contracture caused by functional overload in a young athlete - case report.

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ABSTRACT

Myalgic fatigue (or muscular contracture caused by functional overload) is clinically detected as an unpleasant feeling of one or more muscles, that appears within 24 hours after exercise and disappears in 5-7 days. In athletes, often the muscular contracture is not due to pathological alterations of muscle metabolism, but rather to a condition of lack of training, as typically happens at the beginning of the training season or after a period of enforced rest due to trauma or injury. Laser therapy has long been widely used to treat muscle pain and contracture, and recently it has also been proposed to prevent injuries from overwork in athletes. The aim of this study was to evaluate the efficacy of an advanced IR laser system, the MLS laser, in combination with the other components of standard therapy for the treatment of muscular contracture. MLS system is a laser device with special characteristics: it is equipped with synchronized combination of continuous

and pulsed emissions. The first one (that may emit also in pulsed mode) with $\lambda=808$ nm and maximum power of 1W, the other one with $\lambda=905$ nm and peak power of 25W. Here we report the case of a 16 years old athlete in good health state and with no previous muscle injury. The athlete reported a rectus femoris pain after a work of multiple running on 200 meters. After 3 days of MLS treatment, associated with mobilization of the muscle, stretching and eccentric contraction exercise, the athlete reported negative clinical examination for pain and muscle contracture and was available to work with the team. Studies are in progress to confirm our findings increasing the number of cases and also evaluating the efficacy of MLS laser therapy on different types of injury.

INTRODUCTION

Myalgic fatigue (or muscular contracture caused by functional overload) is clinically detected as an unpleasant feeling of one or more muscles, that appears within

24 hours after exercise and disappears in 5-7 days. The diffusely painful muscle is sensitive to palpation and inefficient during exercise. The symptoms are of varying severity and the quantification of exercise intolerance is difficult. The ensuing fatigue protects the muscle against further exercise which might be harmful.

In athletes, often the muscular contracture is not due to pathological alterations of muscle metabolism, but rather to a condition of lack of training, as typically happens at the beginning of the training season or after a period of enforced rest due to trauma or injury [1].

Muscular contracture begins as a result of a single concentrated physical exercise that exceeds the adaptation of muscle structure, or as a result of series of repeated physical exercises (for example during training at the beginning of a season). Therapy currently in use is composed of instrumental therapy (tecar and/or laser therapy) and a light mobilization of the muscle (cyclette with a low load or tapis roulant at low speed) both aimed at reducing inflammation and at increasing muscle vascularity, all associated with a physiotherapeutic protocol (stretching and eccentric contraction exercise). During the preseason of ACF Fiorentina young athletes, we used MLS laser therapy in combination with the other components of classical therapy for muscular contracture to assess the benefits of this kind of treatment on prognosis.

Laser therapy has long been widely used to treat muscle pain and contracture, and recently it has also been proposed to prevent injuries from overwork in athletes [2,3].

Although many studies have demonstrated the effectiveness of laser therapy in promoting vascularization through controlled vasodilation [4], reducing pain [5-7] and inflammation [8-10], the results reported in the literature do not allow to draw on clear indications on the therapeutic

efficacy and the appropriateness of application of the different treatment parameters. This variety of results and often conflicting indications is largely due to the equally wide variety of laser sources and treatment parameters used in the studies.

In fact the interaction between laser radiation and tissue is highly dependent on the optical properties of the treated tissue, the characteristics of the source (wavelength, power, continuous or pulsed mode emission) and the treatment parameters chosen (frequency of the pulses, fluence, exposure time). In this study we used as the laser source an MLS laser with near infrared (NIR) emissions and treatment parameters specifically setted for muscle contracture.

MATERIALS AND METHODS

16 years old athlete in good health state and with no previous muscle injury was included in our study. The athlete reported a rectus femoris pain after a work of multiple running on 200 meters in the morning; the muscle appeared painful and contracted in absence of lesions on ultrasound examination. Athlete was treated with a MLS laser device provided by ASA s.r.l. (Arcugnano, Vicenza, Italy). This instrument has special characteristics: it combines the laser emission of two diodes with different wavelengths, one ($\lambda = 808\text{nm}$) may emit in continuous and in pulsed mode, in the first case with a power $P = 1.1\text{W}$, in the second with an average power $P_a = 0.55\text{W}$ and a maximum frequency of 2000Hz . The other one ($\lambda = 905\text{nm}$) may emit only in pulsed mode with a maximum frequency of 2000Hz and an average power $P_a = 60\text{mW}$. In pulsed mode, pulse repetition frequencies of the two diodes are the same. For the treatment we used the following parameters (muscle contracture program): 700 Hz frequency, 2 min exposure, $39,67$

	FIRST DAY	SECOND DAY	THIRD DAY
Morning	Cyclette 15' Low resistance Mild tecar-therapy 20' Laser-therapy (muscle contracture program)	Ultrasound (contracture) Cyclette 20' Low-mild resistance Tecar-therapy with massage 20' Laser-therapy (muscle contracture program)	Tecar-therapy with massage 20' Laser-therapy (muscle contracture program) CPW mode Eccentric contraction exercise: quadriceps 4x10. Eccentric contraction exercise: rectus femoris 4x10. Stretching 30"x5 Run 10'x2 - changes of direction - technique with ball.
Afternoon		Cyclette 20' Mild resistance Tecar-therapy with massage 20' Laser-therapy (muscle contracture program) Stretching 30"x3 Eccentric contraction exercise: quadriceps 3x10. Eccentric contraction exercise: rectus femoris 3x10. Stretching of quadriceps and rectus femoris 30"x3	Laser-therapy (muscle contracture program) 700 Hz 2 minuti 50% intensità 39,67 J) CPW mode Training with team.

We added to the classical rehabilitation protocol the MLS laser therapy according to this model

J energy delivered by handpiece. The treatment protocol was always carried out under the threshold of pain reported by the athlete

RESULTS

The athlete was available to work with the team after 3 days of treatment. We joined the athlete to the team according to subjective symptoms and to the clinical examination negative for pain and muscle contracture.

DISCUSSION

The prognosis of a muscle contracture

is 5-7 days as usually found in clinical experience. The athlete treated according to the new protocol was cured in just 3 days of therapies with no recurrence or new muscle injury. We should note that the injury occurred during the preseason, so the athlete was subjected to treatment twice a day rather than once, as often happens during the season. However, the result is very encouraging. Studies are in progress to confirm our findings increasing the number of cases and also evaluating the efficacy of MLS laser therapy on different the types of injury.

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Physical treatment of post traumatic gonalgia by NIR laser therapy: a case report.

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ABSTRACT

In this paper we present a case report that refers to a female patient, aged 54, who suffered from post-traumatic knee pain. The clinical case described was part of a clinical trial whose purpose was to investigate the therapeutic effects of NIR laser therapy on knee pain.

The laser source was a Multiwave Locked System (M6 device) provided by ASA s.r.l. (Arcugnano, Vicenza, Italy). The instrument consisted of two assembled laser diodes with synchronized emissions at 808 and 905 nm, respectively. The patient was treated 3 times weekly, for a total of 10 treatments. The patient's pain, both before and after each session, was measured by using VAS scale, in order to evaluate the effect of the laser therapy. The data obtained show that, during the treatment, the patient had a progressive improvement in pain relief. At 60 days follow-up, it was observed that the effect of laser therapy persisted. The results we obtained in this study indicate that, with the chosen laser source (MLS) and treatment parameters, NIR laser therapy had beneficial effects on knee pain.

INTRODUCTION

Gonalgia, or knee pain, is a common problem, which requires medical examinations and treatments, both in sportsman and in non-sportsman [1]. It is a symptom that can be due to many different causes: it can occur in young persons hurting after a distortive trauma (with related joints or menisci lesions), in elderly persons suffering for knee arthrosis, in athletes with an inflamed rotular tendon (jumper knee), in teenagers feeling pain at the tibial apophysis (Osgood - Schlatter disease). More specifically, according to their etiology, the patellofemoral disorders are distinguished with the classification of Merchant [2].

Obviously symptoms can be more or less acute, depending on their gravity, on which structure of the knee has been affected, on the type of pathology which caused gonalgia. In general it is possible to distinguish between acute pain, usually as a consequence of a trauma, and chronic pain.

The difficulties in diagnostic classification of knee pain and subsequent treatment are related to the nonspecificity of subjective

and objective symptoms [3].

Since many years, laser therapy has been widely used to control pain in different musculoskeletal conditions. Despite its widespread use, the results of the experimental and clinical studies are conflicting. In particular, relatively few controlled clinical studies on laser therapy applied for the treatment of knee pathologies have been reported and the findings from these studies are also contradictory [4, 5]. The results obtained from the trial of Stelian et al. suggest that laser treatment may be useful in reducing the pain and disability associated with knee osteoarthritis [4]. In contrast, in a double blind, placebo controlled study on the efficacy of LLLT on knee pain, no difference between the actively and the placebo treated groups was detected [5]. Since the results following the application of laser therapy show a significant variability, also according to the laser source and the treatment parameters used, we evaluated the effect of the MLS laser on knee pain. Here, we report the particular case of a female patient, 54 years old, who suffered from severe post-traumatic knee pain.

MATERIALS E METHODS

The patient, a cook, aged 54 years, female, belonged to a group of several patients, males and females of different ages, that were recruited for the trial from our outpatients aid physiotherapy. Patients presented a generalized pain of the knee. Inclusion criteria was based on pathology, pain symptoms reported and treatability with laser therapy. Exclusion criteria were: other physical instrumental therapies, except for electrical stimulation for muscle reinforcement o strengthening of the district considered (ex. femoral quadriceps in pathologies of the knee), as this physical therapy has not analgesic and

biostimulation effect on joint tissues. The patient that we present in this case report turned to us following a post-traumatic knee pain.

Patient was treated with ASA M6 laser device provided by ASA s.r.l. (Arcugnano, Vicenza, Italy). The instrument consist of two assembled laser diodes, with synchronized emissions at 808 and 905 nm, respectively. The diode with $\lambda = 808\text{nm}$ may emit in continuous mode, with a power $P = 1.1\text{W}$, or pulsed mode with an average power $P_a = 0.55\text{W}$ and a maximum frequency of 2000Hz.

The diode $\lambda = 905\text{ nm}$ is characterized by a pulsed emission with a maximum frequency of 2000Hz and an average power $P_a = 60\text{mW}$.

Therefore, the MLS emission can occur in different modes, according to the operator's choice:

Continuous Mode (Continuous Mode Operation, CW): diode with $\lambda = 808\text{ nm}$, continuous emission and diode with $\lambda = 905\text{ nm}$, pulsed emission. Pulsed mode (Pulsed Mode operation): diode with $\lambda = 808\text{nm}$, pulsed emission with pulses repetition frequency f_{808} (Max value 2000Hz) and diode with $\lambda = 905\text{nm}$, pulsed emission with pulses repetition frequency $f_{905} = f_{808}$.

When frequency changes, the emission features allow the average power of the 905nm diode emission to change, while the average power of the 808nm diode emission does not change. In fact, when the frequency changes the 808nm diode emission duration changes in proportion, in this way the average power remains the same, while the temporal distribution of the released energy changes. With the same emission time (and spot sizes), the whole energy (808nm + 905nm) changes when the set frequency changes.

In the present case, the following treatment parameters have been applied: 2 min time exposure, 900 Hz frequency,

SCALA VAS										
Session	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°
Pre-therapy pain	4	4	4	4	3	3	2	2	1	0
Post-therapy pain	4	4	4	3	3	3	2	1	0	0

Table I: Visual Analogue Scale (VAS)

72,45 J energy delivered.

Patient was also subjected to a progressive personalized functional rehabilitation, consisting of passive mobilization, assisted or active at natural load.

The protocol consisted in 10 sessions (3 sessions per week) and in the drafting of a specific patient form prepared by ASA S.r.l. and optimized by outpatient of Dr. Caruso.

The patient form reported:

1. the progressive number of session,
2. personal data of patient (personal details, profession, etc...),
3. the beginning and end of sessions,
4. pathology (location and cause),
5. indication of the instrumental tests provided for the initial evaluation,
6. a table for indicating the parameters set during the sessions,
7. a second table for the evaluation of the patient (pain and muscle strength),
8. a section dedicated to the ongoing evaluation
9. diagrams for the anatomical location of the point of treatment.

Treatment was carried out on a Bobath bed, electrically adjustable in height, which made the treatment even more versatile for the use of MLS device which has a swivel head on one arm also adjustable for height and angle.

The room used was dedicated to laser therapy, with doors closed and monitored by the operator. Patient and therapist wore for the entire duration of the session appropriate protective eyewear provided by ASA s.r.l. Where necessary, regions adjacent to the treated area were shielded with charge

material (lymph node regions, etc..).

The patient's evaluation was performed during treatment sessions. In each session, the sensation of pain reported by patient, both before treatment and at the end of it, was assessed. Patient was reassessed after 60 days to evaluate the post-treatment course. The evaluation of pain was made through the visual analogue scale (VAS).

PATIENT

Sex, age: F, 54

Profession: cook

Treatment start: 24/5/2011

Treatment end : 4/7/2011

Sessions: 10

Pathology: post-traumatic knee pain

Follow-up: the patient was reassessed 60 days after the end of treatment. Result was the same, except for occasional relapse in their efforts.

RESULTS

The patient subjected to M6 laser treatment showed a marked improvement in knee pain. At the beginning of treatment the patient reported a knee pain that can be placed at level 4 on the VAS scale. During the 10 sessions pain progressively decreased to level 0 (Table 1). At the end of the therapy the patient did not complain of any pain, as well as at 60 days follow-up, except for occasional relapse during intense efforts.

DISCUSSION

Acute or chronic pain, is an unpleasant subjective sensory experience and is the leading cause of functional limitation in patients who have undergone trauma.

Pain may resolve in a few days or may persist over time and then determine actual degenerative tissue anatomy as a result of alterations in the recruitment and muscle control. When pain interest one of the joints of the lower limb, as in the case report, also determines changes of deambulation, posture and functional limitations that affects negatively on the recovery [6, 7].

In the present study, the patient had a marked improvement in the knee pain until the complete disappearance at the end of treatment and at 60 days follow-up.

Possible contributing factors related to the results, such as the absence of work efforts, must be examined. These factors can have favoured the disappearance of pain acutely. The patient performs a job where she needs to maintain an orthostatic position for long periods and submit the knee to intense and continuous efforts.

CONCLUSION

The instrument used in this case report belongs to the group of NIR, class IV laser systems and seems to be very effective in the treatment of pain caused by trauma, also thanks to the in depth effect of biostimulation. Furthermore, activation of the microcirculation and anti-edema action, are effective when pain is predominantly inflammatory.

A further advantage of MLS therapy, is the control of heat produced in the tissues by the treatment. The control of the heat minimizes the contraindications to the use. For these reasons, NIR laser therapy, administered by a M6 laser device, may play an important role in the treatment of acute pain and its effectiveness has been reported by our patient.

Finally, it is hoped a large-scale research to obtain scientifically significant results on the effectiveness of this device in pain syndromes of different tissues.

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