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 λ=808 nm and maximum power of 1W, the other one with λ=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 ensuit fatigue protects the muscle against further exercise which might be harmfull.

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 physiotherapic 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 (λ = 808nm) may emit in continuous and in pulsed mode, in the first case with a power P = 1.1W, in the second with an average power Pa = 0.55W and a maximum frequency of 2000Hz. The other one (λ = 905 nm) may emit only in pulsed mode with a maximum frequency of 2000Hz and an average power Pa = 60mW. 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 J energy delivered by handpiece.

The treatment protocol was always carried out under the threshold of pain reported by the athlete

	FIRST DAY	SECOND DAY	THIRD DAY
Morning	Cyclette 15′ Low resistence Mild tecar-therapy 20′ Laser-therapy (muscle contracture program)	Ultrasound (contracture) Cyclette 20′ Low-mild resistence 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 resistence 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

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.

REFERENCES

1. Serratrice G, Pouget J, Azulay P. Exercise intolerance: classification and semiology. In: Serratrice G, Pouget J, Azulay P (Eds.), Exercise intolerance and muscle contracture, Pergamon University Press, New York (1999), pp. 1–16.
2. Leal Junior EC, Lopes-Martins RA, Baroni BM, De Marchi T, Taufer D, Manfro DS, Rech M, Danna V, Grosselli D, Generosi RA, Marcos RL, Ramos L, Bjordal JM. Effect of 830 nm low-level laser therapy applied before high-intensity exercises on skeletal muscle recovery in athletes. Lasers Med Sci. 2009 Nov;24(6):857-63. Epub 2008 Dec 5
3. Leal Junior EC, Lopes-Martins RA, de Almeida P, Ramos L, Iversen VV, Bjordal JM. Effect of low-level laser therapy (GaAs 904 nm) in skeletal muscle fatigue and biochemical markers of muscle damage in rats. Eur J Appl Physiol. 2010 Apr;108(6):1083-8. Epub 2009 Dec 19.
4. Bäumler W, Vural E, Landthaler M, Muzzi F, Shafirstein G. The effects of intense pulsed light (IPL) on blood vessels investigated by mathematical modelling. Lasers Surg Med. 2007 Feb;39(2):132-9.
5. Yousefi-Nooraie R, Schonstein E, Heidari K, Rashidian A, Pennick V, Akbari-Kamrani M, Irani S, Shakiba B, Mortaz Hejri SA, Mortaz Hejri SO, Jonaidi A. Low level laser therapy for nonspecific low-back pain. Cochrane Database Syst Rev. 2008 Apr 16;(2):CD005107. Review
6. Chow RT, Johnson MI, Lopes-Martins RA, Bjordal JM. Efficacy of low-level laser therapy in the management of neck pain: a systematic review and meta-analysis of randomised placebo or active-treatment controlled trials. Lancet. 2009 Dec 5;374(9705):1897-908. Epub 2009 Nov 13. Review. Erratum in: Lancet. 2010 Mar 13;375(9718):894.
7. Bjordal JM, Johnson MI, Iversen V, Aimbire F, Lopes-Martins RA. Low-level laser therapy in acute pain: a systematic review of possible mechanisms of action and clinical effects in randomized placebo-controlled trials. Photomed Laser Surg. 2006 Apr;24(2):158-68. Review
8. Pallotta RC, Bjordal JM, Frigo L, Leal Junior EC, Teixeira S, Marcos RL, Ramos L, Messias Fde M, Lopes-Martins RA. Infrared (810-nm) low-level laser therapy on rat experimental knee inflammation. Lasers Med Sci. 2012 Jan;27(1):71-8. Epub 2011 Apr 12.
9. de Morais NC, Barbosa AM, Vale ML, Villaverde AB, de Lima CJ, Cogo JC, Zamuner SR. Anti-inflammatory effect of low-level laser and light-emitting diode in zymosan-induced arthritis. Photomed Laser Surg. 2010 Apr;28(2):227-32.
10. Rizzi CF, Mauriz JL, Freitas Corrêa DS, Moreira AJ, Zettler CG, Filippin LI, Marroni NP, González-Gallego J. Effects of low-level laser therapy (LLLT) on the nuclear factor (NF)-kappaB signaling pathway in traumatized muscle. Lasers Surg Med. 2006 Aug;38(7):704-13.