

The Effect of Low-Level Laser Therapy (LLLT) Applied Prior to Muscle Injury

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Aim: To evaluate the effect of LLLT (780 nm; 10 J/cm², 40 mW, 3.2 J) prior to injury on the morphological analysis, collagen deposition, and activity of matrix metalloproteinase-2 (MMP-2).

Methods: Wistar rats were divided into groups: control; sham; only LLLT; only muscle injury and LLLT + injury. The rats were euthanized at 1, 3, and 7 days following cryoinjury to muscle that was removed for analysis.

Results: LLLT applied prior to muscle injury led to a reduction in myonecrosis and inflammatory cells, an increase of blood vessels and immature muscle fibers. An increase in MMP-2 activity and a decrease in collagen deposition were also found, with a better collagen organization and distribution.

Conclusion: LLLT applied immediately prior to injury had positive effects during the muscle regeneration process. Therefore, this resource may have considerable therapeutic value, especially for athletes who practice sports in which there is a constant risk of muscle injury. *Lasers Surg. Med.* 47:571–578, 2015. © 2015 Wiley Periodicals, Inc.

Key words: low-level laser therapy; muscle; skeletal; regeneration collagen; matrix metalloproteinase 2

INTRODUCTION

Muscle injury is common in sports and it can result in the absence of athletes from training and competition for long periods of time and reduced their performance [1]. After the injury, there is necrosis of injured fibers and migration of inflammatory cells, mainly neutrophils, and macrophages, that phagocyte cell debris [2]. Furthermore, there is activation of the satellite cell (SC) to migrate to the site of injury and proliferate as myoblasts that fuse to generate multinucleated muscle cells (myotubes), which, in turn, differentiate to form new functional muscle fibers or fuse to pre-existing fibers [2,3,4].

Simultaneously, the muscle repair process occurs the remodeling of the extracellular matrix (ECM) by calcium-dependent and zinc-dependent enzymes denominated matrix metalloproteases [5]. Matrix metalloproteinase-2 (MMP-2) is specifically involved in the muscle regeneration

process by degrading the components of the basal lamina as well as facilitating the migration, proliferation, and differentiation of SC [6,7]. This is important because the excessive accumulation of ECM components after injury, especially collagen, resulting in a permanent scar tissue (fibrosis) that reduces the capacity and performance of the muscle, besides increasing the recurrence of injury [1,8].

The low-level laser therapy (LLLT) has been used to modulate and accelerate the process of muscle repair. Studies with irradiation following induction of the injury demonstrated positive effects in modulating the inflammatory process, in the growth factors and myogenic regulatory factors, and increased angiogenesis [9]. However, few studies have evaluated the effects of LLLT applied prior to an injury. Studies using animal models [10] and human subjects [11,12] have shown that the use of the LLLT prior to the induction of muscle fatigue causes reductions in the blood lactate level and markers muscle damage. The evaluation of prior laser effect is important, especially among athletes for whom the risk of injury is always imminent. Thus, the aim of the present study was to investigate the effects of LLLT administered prior to injury on morphological aspects of the muscle tissue,

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