

Photobiomodulation Therapy in Skeletal Muscle: From Exercise Performance to Muscular Dystrophies

Ernesto Cesar Pinto Leal-Junior, PhD, PT

SCIENTIFIC INTEREST IN SPORTS RECOVERY MODALITIES has been increasing in recent years. Several studies have been investigating the effects of modalities on subjective outcomes such as post-exercise well-being, objective outcomes such as physical performance, and surrogate outcomes such as biochemical markers related to recovery.

A large number of therapeutic modalities are used after sports activities to improve skeletal muscle recovery. The most commonly modalities used are: active recovery, cryotherapy, massage, contrast heat therapy (use of hot and cold water immersion), stretching, and electric stimulation. Cryotherapy is one of the most popular therapeutic modalities used to improve muscle recovery after high-intensity exercise.¹ Interestingly, there is only anecdotal scientific information regarding the effectiveness of this therapy. The most recent Cochrane Systematic Review about this issue concludes that: “There was some evidence that cold-water immersion reduces delayed onset muscle soreness after exercise compared with passive interventions involving rest or no intervention. There was insufficient evidence to conclude on other outcomes or for other comparisons. The majority of trials did not undertake active surveillance of pre-defined adverse events. High quality, well reported research in this area is required.”² Therefore, the scientific evidence behind cryotherapy in enhancement of recovery after exercises is limited.

On the other hand, skeletal muscle performance and exercise recovery are novel and recent areas of research in the photobiomodulation field. Since the first clinical trial was published in 2008³ several studies have reported positive effects of photobiomodulation with red^{3,4} and infrared wavelengths^{4–8} and both with low-level laser therapy (LLLT)^{3–8} and light emitting diode therapy (LEDT).^{9–12} Interestingly, different kinds of exercises were employed in these studies, such as: repeated contractions,^{3,5,6,8,10} isometric sustained contraction,^{4,11,12} cycling,⁹ and running.⁷ These reports increase the evidence supporting use of photobiomodulation therapy for improvement of performance and also to accelerate recovery of functional and biochemical markers related to exercise restitution.

It is interesting that although it is a recent area of research, there are already two systematic reviews published^{13,14} showing that photobiomodulation therapy (applying LLLT

and/or LEDT) administered immediately before a bout of resistance exercise has ergogenic effects on skeletal muscle by improving physical performance. These reviews also provide scientific evidence that photobiomodulation therapy preserves tissue against exercise-induced muscle damage and speeds up recovery when applied before exercises. Furthermore, photobiomodulation therapy applied before sessions of training programs such as strength training, also lead to enhancement of outcomes like muscular torque and muscular thickness.¹⁵ Therefore, the current scientific evidence totally supports the use of photobiomodulation therapy when applied before exercises.

To achieve better outcomes in clinical practice, it seems reasonable to think that the use of different light sources and wavelengths is beneficial. Actually, some animal experiments have supporting this line of thinking.^{16,17} This line of thinking has been supported also by a clinical trial in which phototherapy applied with different light sources and wavelengths simultaneously had outstanding results in enhancement of performance and in improvement of recovery in healthy volunteers.¹⁸

Interestingly, the outcomes in this promising area are not restricted only to high-level athletes and healthy volunteers. Recently very interesting results were published showing that photobiomodulation therapy can enhance performance also in chronic obstructive pulmonary disease (COPD) patients,¹⁹ which opens more possibilities regarding use of this therapeutic modality in diseases in which fatigue plays a key role. Furthermore, the protective effects of photobiomodulation therapy on skeletal muscle tissue seem to help to delay the progression of dystrophies²⁰ when used preventively. It obviously needs to be more exhaustively tested in animal experiments to afterwards be translated to clinical trials, but this undoubtedly illustrates how powerful the use of light in skeletal muscle is.

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Address correspondence to:
 Ernesto Cesar Pinto Leal-Junior
 Laboratory of Phototherapy in Sports and Exercise
 Nove de Julho University
 Sao Paulo – SP
 Brazil

E-mail: ernesto.leal.junior@gmail.com