

LASER PRECONDITIONING POSITIVELY IMPACTS MUSCLE PERFORMANCE

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Clinicians are starting to understand that laser therapy has the ability to positively impact injured tissue in a variety of ways via photobiomodulation (PBM). PBM occurs when an effective dose of photons photochemically, photomechanically, and/or photothermally stimulate tissue at the mitochondrial level. This triggers several positive biochemical changes that can decrease pain,^{1,2} reduce inflammation,³ and accelerate tissue healing.^{3,4,5}

Preconditioning is a lesser known clinical application of PBM. Cells can be preconditioned in different ways. The concept was first applied to myocardial cells, where short episodes of ischemia and reperfusion were introduced to develop resistance to a subsequent ischemic insult (heart attack).⁶

Recently, lasers have been used to precondition skeletal muscle to slow muscular fatigue and reduce biochemical stress during and after strenuous exercise.^{6,8,7} This is accomplished through lasers' ability to improve cellular oxygen utilization via stimulation of the electron transport chain.² Enhancing oxidative phosphorylation leads to increased production of ATP and modulates reactive oxygen species (ROS), which protects eukaryotic cells from physiological stress.^{6,7}

A study published in February 2019 from the University of Florida looked at the impact laser could have on the work capacity of the quadriceps muscle group. Phototherapy was administered using a near-infrared laser to the quadriceps at 10 J/cm² (total dose of 1600-2400 J). Laser was applied intermittently during passive recovery phases between repeated bouts of high volume, high intensity isokinetic quadriceps exercise. The findings showed that the laser promoted higher knee extensor torque, increased power output, and attenuated muscle fatigue compared to controls.⁷

This concept has led professional athletic training rooms to start treating athletes both before and after competition to maximize different aspects of muscle performance and minimize Delayed Onset Muscle Soreness (DOMS)⁸. For example, many major league pitchers are having their throwing shoulders treated with laser both before and after competition. Preconditioning the throwing muscles at



least 30 minutes before the activity improves muscle performance and endurance during the event,^{10,11} while PBM after the event helps with recovery by managing inflammation, tissue repair, and improving circulation to the area.^{2,5}

Laser preconditioning is a safe, non-invasive ergogenic aid that has proven efficacy — but there are a handful of considerations to optimize outcomes:

- Treatment must be applied at least 30 minutes before an event to get optimal results.
- Depending on the sport and level of physical activity, repeated treatments may be warranted during the event.

- Application of the laser should be performed over exposed skin in a laser-safe environment.
- Having the appropriate laser equipment is essential. Higher power lasers are key for delivering an effective dose in a reasonable time.

The ability for light to help with muscle function has only recently been discovered with the advent of therapeutic lasers. As more studies evolve and the spotlight on laser preconditioning grows brighter, practitioners pursuing optimal performance and recovery for their athletes may look towards this new horizon.



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