

## **The Effect of Pulsed vs. Continuous Photobiomodulation Therapy for Muscle Recovery after an Eccentric Exercise Protocol**

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**Context:** Photobiomodulation therapy has previously improved muscle recovery when applied before strenuous exercise. However, several parameters have not been determined to maximize the effects of photobiomodulation therapy. **Objective:** To determine if pulsed or continuous photobiomodulation therapy is better at increasing muscle recovery and limiting muscle soreness after a strenuous eccentric exercise bout. **Design:** Randomized clinical trial. **Setting:** Research laboratory. **Patients or Other Participants:** Twenty-four healthy participants (M=12 and F=12, age=23.3±3.4 y, height=175.4±10.2 cm, mass=80.34±18.1 kg). **Interventions:** Participants were randomly assigned into a pulsed (N=12) or continuous (N=12) treatment group and were blinded to their group assignment. Four Carewear Firefly light patches (wavelength=640 and 450 nm, average irradiance=3 mW/cm<sup>2</sup>, pulsed peak power=9 mW, continuous peak power=3 mW, energy density=5.4 J/cm<sup>2</sup>, treatment area=200 cm<sup>2</sup>) provided 30 minutes of treatment over the quadriceps muscles before and for each of the 4 days following the eccentric exercise bout. Participants performed 3 bouts of 10 sets of 10 eccentric knee extension reps with a 1-minute rest between each set for a total of 30 sets and 300 reps. **Main Outcome Measures:** All dependent variables, except for serum creatine kinase, were measured at baseline and immediately, 24, 48, 72, and 96 h post-exercise bout. Strength deficits were measured via isometric peak torque using a Biodex dynamometer. Participant's perceived function and soreness was measured using the Lower Extremity Functional Scale (LEFS) and visual analog scale (VAS), respectively. Blood draws were collected at baseline, 48 and 96 h post-exercise bout for serum creatine kinase analysis. To normalize the data between participants, strength was analyzed as percent of baseline and subjective measures of LEFS and VAS were analyzed as change from baseline. A logarithmic transformation was used to normalized creatine kinase data. For each dependent variable, a repeated measures ANOVA was used to determine differences between treatment groups over time. **Results:** The pulsed treatment improved the rate of recovery over the continuous treatment for LEFS (P=.005), VAS (P=.023), and creatine kinase levels (P=0.013), but did not alter isometric peak torque (P=0.453). Isometric strength decreased to 84.1±27.5 and 64.6±28.7 % of baseline immediately after the exercise for the pulsed and continuous treatment groups, respectively, but returned to near baseline values by 96 h (pulsed=99.5±23.5, continuous=95.3±27.7 % of baseline). Across all time points, LEFS scores decreased 4.4±10.0 and 14.1±21.6 points and VAS scores increased 14.0±24.9 and 30.4±31.2 mm for the pulsed and continuous groups, respectively. Creatine kinase levels were still elevated at 96h post-exercise in the continuous group (9453.5±16823.2 U/L) compared to the pulsed group (444.4±990.0 U/L). **Conclusions:** Pulsed photobiomodulation therapy improved participants perceived function, soreness, and muscle recovery measured via serum creatine kinase, but this did not affect isometric strength between treatment groups. **Word Count:** 443