

## Tissue Temperature Increases from a Red and Blue Combination Photobiomodulation Light Patch

Wells AM\*, Rigby JH†, Castel JC‡, Draper DO\*: \*Brigham Young University, Provo, UT, †Texas State University, San Marcos, TX, ‡Carewear Corp, Reno, NV

**Context:** Photobiomodulation has been used to treat musculoskeletal injuries, reduce pain, and improve muscle performance and function. Many physiological effects of photobiomodulation therapy have been examined, but the thermal effects of photobiomodulation therapy have yet to be determined. **Objective:** To determine the superficial tissue heating characteristics of a red and blue combination photobiomodulation light patch. **Design:** Controlled laboratory study. **Setting:** Research laboratory. **Patients or Other Participants:** Ten healthy individuals (M = 5, F = 5, age =  $22.2 \pm 2.3$ , height =  $170.3 \pm 8.3$  cm, mass =  $76.8 \pm 13.1$  kg). **Interventions:** Participants were positioned prone on a treatment table and their posterior calf was cleansed before an IT-21 needle thermocouple was inserted 0.5 cm into the subcutaneous tissue. A PT-6 skin thermocouple was secured to the posterior calf adjacent to the needle thermocouple. A second PT-6 skin thermocouple was secured to the skin 3 cm away from the treatment location. All thermocouples interfaced with an Isothermex electrothermometer. A single Carewear Firefly light patch was positioned over the subcutaneous and skin thermocouple within the treatment area. A 15 minute photobiomodulation therapy (wavelength = 640 and 450 nm, average irradiance =  $3 \text{ mW/cm}^2$ , peak power = 9 mW, continuous peak power = 3 mW, energy density =  $5.4 \text{ J/cm}^2$ , treatment area =  $50 \text{ cm}^2$ ) was administered to the posterior calf. After the treatment, a 5 minute post-treatment temperature decay was recorded. **Main Outcome Measures:** Tissue temperature measurements from the thermocouples were taken every 1 minute throughout the 15 minute treatment and for 5 minutes post-treatment. Absolute tissue temperature and change from baseline temperature were used during the data analysis. A repeated measures ANOVA was used to determine if tissue temperature increased between the 3 measurement sites over the treatment time. **Results:** The light patch increased subcutaneous tissue temperature  $6.22 \pm 2.25$  °C to a peak absolute temperature of  $37.71 \pm 1.78$  °C. The light patch increased skin temperature  $8.22 \pm 2.62$  °C to a peak absolute temperature of  $38.90 \pm 2.24$  °C. The skin temperature 3 cm away from the treatment remained relatively constant throughout the treatment ( $-0.11 \pm 0.30$  °C). The subcutaneous and skin temperatures directly under the treatment area significantly heated compared to the reference 3 cm away from the treatment site ( $P < .001$ ). During the 5 minutes post-treatment, tissue temperature decreased  $2.68 \pm 1.45$  °C,  $4.54 \pm 1.93$  °C, and  $0.23 \pm 0.12$  °C at the subcutaneous, treatment skin surface, and 3 cm away skin surface sites, respectively. **Conclusions:** The red and blue wavelength combination photobiomodulation light patch significantly increases superficial tissue temperature. Thermal physiological effects may be an added benefit to this type of photobiomodulation therapy.

