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Comparison of Light Penetration of Continuous Wave 810 nm and Superpulsed 904 nm Wavelength Light in Anesthetized Rats

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Objective: The purpose of this study was to investigate light transmission of continuous wave (CW) 810 nm wavelength light and 904 nm wavelength superpulsed light through skin and gastrocnemius muscle and skin only using an anesthetized Sprague-Dawley rat model.

Materials and Methods: The hair was shaved from the left thigh region of the anesthetized rats and a detector, which measured fluence rate, was placed either in the fascial plane deep into the muscle or below the dermis. The laser probe was placed in contact with the surface of the skin and measurements were taken for 4, 5, 10, 15, and 20 min depending on the experiment.

Results: The initial fluence rate measurements through the muscle and skin demonstrated that if the 904 nm wavelength superpulsed laser was turned on for a minimum of 15 min, there was no increase in light penetration over time. With appropriate warm-up periods, both lasers had stable output powers, which were reflected in stable fluence rate measurements over 4 min. The percentages of light transmission (fluence rate) through muscle and skin were 7.42% (810 nm wavelength) and 4.01% (904 nm wavelength) and through skin were 24.63% (810 nm wavelength) and 19.94% (904 nm wavelength). These data prove that transmission of CW 810 nm wavelength light through muscle and skin and skin alone is greater than transmission of superpulsed 904 nm wavelength light.

Conclusion: It has been previously reported that superpulsing 904 nm wavelength light increased depth of penetration over time due to photobleaching. Based on our data, the observed increase in light penetration over time was due to an insufficient warm-up period of the superpulsed laser.