Effect of near-infrared light-emitting diodes on nerve regeneration.

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BACKGROUND: Photobiomodulation by red to near-infrared light-emitting diodes (LEDs) has been reported to accelerate wound healing, attenuate degeneration of an injured optic nerve, and promote tissue growth. The purpose of this study was to investigate the effect of LEDs on nerve regeneration. A histological study as well as a measurement of antioxidation levels in the nerve regeneration chamber fluid was performed. METHODS: For the histological study, the bilateral sciatic nerves were transected, and the left proximal stump and the right distal stump were inserted into the opposite ends of a silicone chamber, leaving a 10-mm gap. Light from an LED device (660 nm, 7.5 mW/cm(2)) was irradiated for 1 h per day. At 3 weeks after surgery, regenerated tissue was fixed and examined by light microscopy. For the antioxidation assay of chamber fluid, the left sciatic nerve and a 2-mm piece of nerve from the proximal stump were transected and inserted into opposite sides of a silicone chamber leaving a 10-mm gap. LEDs were irradiated using the same parameters as those described in the histological study. At 1, 3, and 7 days after surgery, antioxidation of the chamber fluid was measured using an OXY absorbent test. RESULTS: Nerve regeneration was promoted in the LED group. Antioxidation of the chamber fluid significantly decreased from 3 days to 7 days in the control group. In the LED group, antioxidation levels did not decrease until 7 days. CONCLUSIONS: Chamber fluid is produced from nerve stumps after nerve injury. This fluid contains neurotrophic factors that may accelerate axonal growth. Red to near-infrared LEDs have been shown to promote mitochondrial oxidative metabolism. In this study, LED irradiation improved nerve regeneration and increased antioxidation levels in the chamber fluid. Therefore, we propose that antioxidation induced by LEDs may be conducive to nerve regeneration.

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