



980 nm Wavelength Light Decreases Mechanical Allodynia in a Rat Neuropathic Pain Model

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Background and Objectives:

Peripheral neuropathy is a common debilitating disorder. We hypothesized that 980 nm wavelength light would improve neuropathic sensory alterations in a spared nerve injury rat model.

Study Designs / Materials and Methods:

A 5mm segment of the common peroneal and tibial nerves was removed and their proximal ends were ligated. The sural nerve was left intact. Seven days post-surgery, rats were randomized into light treated group (LT) and control group (CTRL). For the LT, a 980 nm wavelength laser was used to transcutaneously irradiate the dorsal root ganglia (DRG) and spinal cord segments related to the injured nerves (output power 1.25W, 19s, 10mW/cm² at depth of the DRG) and the lateral skin of the involved hind paw (output power 1W, 20s, power density 10 or 60 mW/cm² at sub-dermal level). Von Frey filaments were used to measure mechanical allodynia. Testing was done seven days after surgery (baseline) and days following two light treatments (3, 7, 11 and 15). On day 15, the rats were euthanized. Skin samples were collected for immunohistochemistry. Protein gene product 9.5 (PGP9.5) antibody was used to label intra-epidermal nerve fibers and Langerhan cells (LC).

Results:

The CTRL exhibited increased mechanical allodynia. LT significantly decreased the mechanical allodynia compared to the CTRL on days 7 (60 mW/cm²), 11, and 15 (both power densities). In the CTRL, there was distal degeneration of intra-epidermal A δ and C nerve fibers and denervation of the LC accompanied by increased expression of PGP9.5. In the LT group, there was regeneration of the intra-epidermal nerve fibers, re-innervation of the LC and a decrease in expression of PGP9.5.

Conclusions:

LT significantly decreased mechanical allodynia. Cutaneous changes involving distal nerve degeneration, and LC have been implicated in development of chronic pain and sensory aberration in peripheral neuropathy. These results indicate that transcutaneous irradiation can alter these neuropathic changes.

Keywords: Spared nerve injury, Von Frey test, Intra-epidermal fibers

Abstract presented at ASLMS 2013 Annual Conference on April 5, 2013