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Mechanisms and Pathways of Pain Photobiomodulation: A Narrative Review

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Abstract

A growing body of evidence supports the modulation of pain by light exposure. As such, phototherapy is being increasingly utilized for the management of a variety of pain conditions. The modes of delivery, and hence applications of phototherapy, vary by wavelength, intensity, and route of exposure. As such, differing mechanisms of action exist depending upon those parameters. Cutaneous application of red light (660 nm) has been shown to reduce pain in neuropathies and complex regional pain syndrome-I, whereas visual application of the same wavelength of red light has been reported to exacerbate migraine headache in patients and lead to the development of functional pain in animal models. Interestingly visual exposure to green light can result in reduction in

pain in variety of pain conditions such as migraine and fibromyalgia. Cutaneous application typically requires exposure on the order of minutes, whereas visual application requires exposure on the order of hours. Both routes of exposure elicit changes centrally in the brainstem and spinal cord, and peripherally in the dorsal root ganglia and nociceptors. The mechanisms of photobiomodulation of pain presented in this review provide a foundation in furtherance of exploration of the utility of phototherapy as a tool in the management of pain. PERSPECTIVE: This review synthesizes the pathways and mechanisms through which light modulates pain and the therapeutic utility of different colors and exposure modalities of light on pain. Recent advances in photobiomodulation provide a foundation for understanding this novel treatment for pain on which future translational and clinical studies can build upon.

Keywords: Pain management; complementary medicine; light therapy; photoreception; visual exposure.

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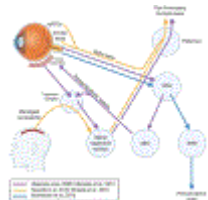


Figure 1.. Neural pathways of visual phototransduction...



Figure 2.. Mechanisms of visual phototransduction



Figure 3.. Mechanisms of cutaneous phototransduction

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