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Transcranial Low-Level Laser (Light) Therapy for Brain Injury.

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Abstract

BACKGROUND: Low-level laser therapy (LLLT) or photobiomodulation (PBM) is a possible treatment for brain injury, including traumatic brain injury (TBI).

METHODS: We review the fundamental mechanisms at the cellular and molecular level and the effects on the brain are discussed. There are several contributing processes that have been proposed to lead to the beneficial effects of PBM in treating TBI such as stimulation of neurogenesis, a decrease in inflammation, and neuroprotection. Both animal and clinical trials for ischemic stroke are outlined. A number of articles have shown how transcranial LLLT (tLLLT) is effective at increasing memory, learning, and the overall neurological performance in rodent models with TBI.

RESULTS: Our laboratory has conducted three different studies on the effects of tLLLT on mice with TBI. The first studied pulsed against continuous laser irradiation, finding that 10 Hz pulsed was the best. The second compared four different wavelengths, discovering only 660 and 810 nm to have any effectiveness, whereas 732 and 980 nm did not. The third looked at varying regimens of daily laser treatments (1, 3, and 14 days) and found that 14 laser applications was excessive. We also review several studies of the effects of tLLLT on neuroprogenitor cells, brain-derived neurotrophic factor and synaptogenesis, immediate early response knockout mice, and tLLLT in combination therapy with metabolic inhibitors.

CONCLUSIONS: Finally, some clinical studies in TBI patients are covered.

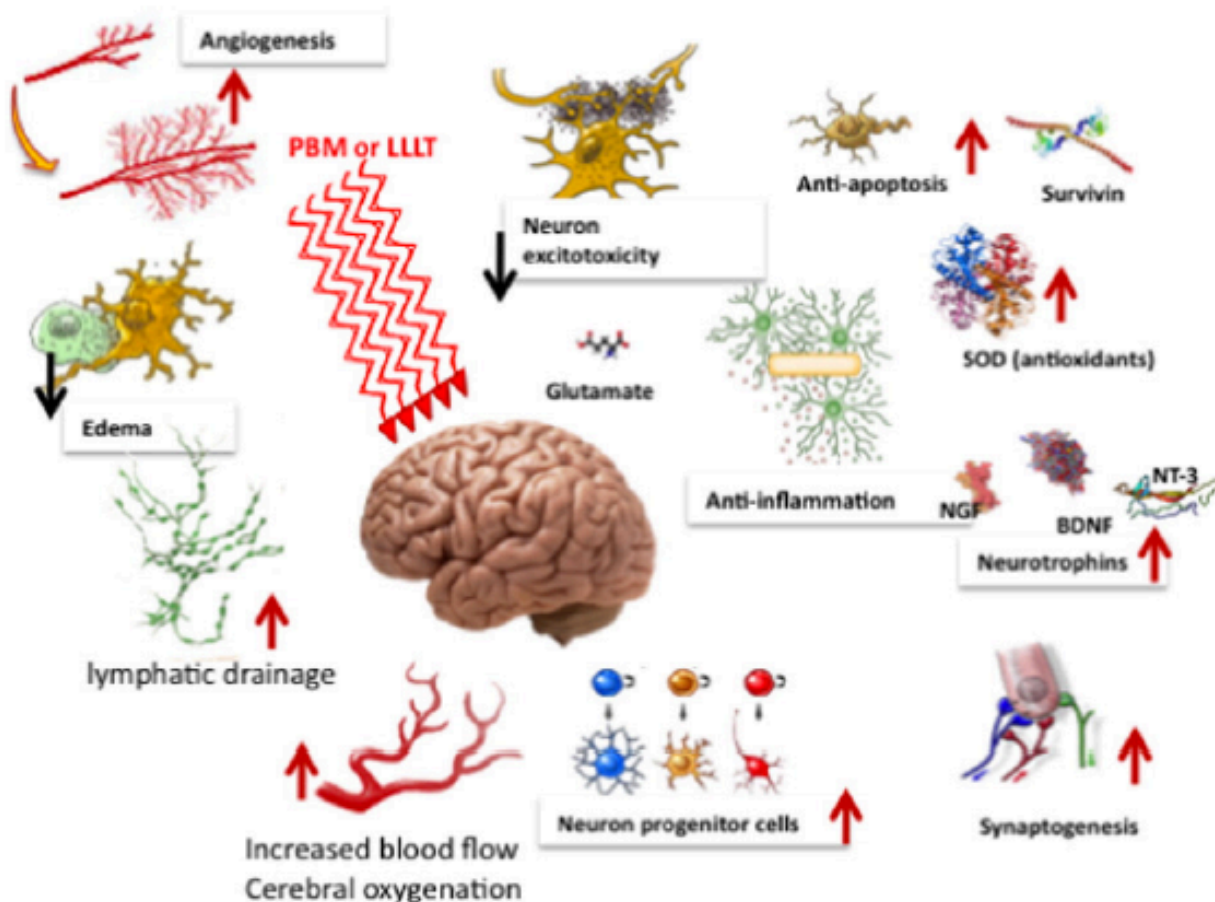
Shining Light on the Head: Photobiomodulation for Brain Disorders

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Photobiomodulation (PBM) describes the use of red or near-infrared light to stimulate, heal, regenerate, and protect tissue that has either been injured, is degenerating, or else is at risk of dying.

One of the organ systems of the human body that is most necessary to life, and whose optimum functioning is most worried about by humankind in general, is the **brain**.

The brain suffers from many different disorders that can be classified into three broad groupings: traumatic events (**stroke, traumatic brain injury, and global ischemia**), degenerative diseases (**dementia, Alzheimer's and Parkinson's**), and psychiatric disorders (**depression, anxiety, post traumatic stress disorder**). There is some evidence that all these seemingly diverse conditions can be beneficially affected by applying light to the head.

There is even the possibility that PBM could be used for **cognitive enhancement** in normal healthy people.