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Near infrared Transcranial Laser Therapy applied at Various Modes to Mice Following Traumatic Brain Injury Significantly Reduces Long-Term Neurological Deficits

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Near-infrared transcranial laser therapy (TLT) has been found to modulate various biological processes including traumatic brain injury (TBI). Following TBI in mice, in this study we assessed the possibility of various near-infrared TLT modes (pulsed vs. continuous) producing a beneficial effect on the long-term neurobehavioral outcome and brain lesions of these mice. TBI was induced by a weight-drop device, and neurobehavioral function was assessed from one hour and up to 56 days post-trauma using a neurological severity score (NSS). The extent of recovery is expressed as dNSS, the difference between the initial score, and that at any other, later, time point. An 808nm Ga-Al-As diode laser was employed transcranially 4, 6 or 8 hrs post-trauma to illuminate the entire cortex of the brain. Mice were divided into several groups of 6-8 mice: one control group that received a sham treatment and experimental groups that received either TLT continuous wave (CW) or pulsed wave (PW) mode transcranially. MRI was taken prior to sacrifice 56 days post-CHI. From 5 to 28 days post-TBI, the NSS of the laser-treated mice were significantly lower ($p<0.05$) than the non-laser-treated, control mice. The percentage of surviving mice that demonstrated full recovery 56 days post-CHI, namely NSS=0 (as in intact mice) was the highest (63%) in the group that had received TLT in the PW mode at 100 Hz. In addition, MRI analysis demonstrated significantly smaller infarct lesion volumes in laser treated mice as compared to control. Our data suggest that non-invasive TLT of mice post-TBI provides a significant long-term functional neurological benefit, and that the pulsed laser mode at 100 Hz is the preferred mode for such treatment.

Key words: low-level laser therapy; mice; traumatic brain injury; pulsed laser; motor function, MRI.