Pulsed Transcranial Red/Near-Infrared Light Therapy Using Light-Emitting Diodes Improves Cerebral Blood Flow and Cognitive Function in Veterans with Chronic Traumatic Brain Injury: A Case Series

Objective: This study explored the outcome of applying red/near-infrared light therapy using light-emitting diodes (LEDs) pulsed with three different frequencies transcranially to treat traumatic brain injury (TBI) in Veterans.

Background: Photobiomodulation therapy (PBMT) using LEDs has been shown to have positive effects on TBI in humans and animal models. ***Materials and methods:*** Twelve symptomatic military Veterans diagnosed with chronic TBI >18 months post-trauma received pulsed transcranial PBMT (tPBMT) using two neoprene therapy pads containing 220 infrared and 180 red LEDs, generating a power output of 3.3 W and an average power density of 6.4 mW/cm^2 for 20 min, thrice per week over 6 weeks. Outcome

measures included standardized neuropsychological test scores and qualitative and quantitative single photon emission computed tomography (SPECT) measures of regional cerebral blood flow (rCBF). ***Results:*** Pulsed tPBMT significantly improved neuropsychological scores in 6 of 15 subscales (40.0%; $p < 0.05$; two tailed). SPECT analysis showed increase in rCBF in 8 of 12 (66.7%) study participants. Quantitative SPECT analysis revealed a significant increase in rCBF in this subgroup of study participants and a significant difference between pre-treatment and post-treatment gamma ray counts per cubic centimeter [$t = 3.77$, $df = 7$, $p = 0.007$, 95% confidence interval (95,543.21-21,931.82)]. This is the first study to report quantitative SPECT analysis of rCBF in regions of interest following pulsed tPBMT with LEDs in TBI. ***Conclusions:*** Pulsed tPBMT using LEDs shows promise in improving cognitive function and rCBF several years after TBI. Larger, controlled studies are indicated.