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### Multi-Watt Near Infrared Phototherapy as a Treatment for Traumatic Brain Injury

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**ABSTRACT:** Background: Depression treatment is hampered by low efficacy of antidepressant medications and concerns about alternative modalities. Animal studies of treatment with low-level (0.5 Watt or less) near infrared (NIR) light from diodes has shown some benefit in models of traumatic brain injury (TBI) with evidence of reduced lesion size, increased neurotrophin production, synaptogenesis, fewer apoptotic cells, and improved neurological function. Two small case series have demonstrated transient clinical improvement with low-level NIR treatment given on a daily basis over several weeks. We have previously shown marked and persistent clinical improvement in a case series of patients with chronic mild-to-moderate (m-MTBI) after treatment with NIR at a power of 9 Watts or greater. We also have published a review of the potential for application of NIR for the treatment of depression. The current study explores NIR efficacy in a proof-of-concept study as a treatment for depression.

**METHODS:** Thirty-nine sequential patients treated for TBI between March 2013 and May 2017 provided depression self-assessment data and/or were administered the Hamilton Depression Rating Scale. Each completed the Quick Inventory of Depression Symptomatology-Self Reports (QIDS) before and after treatment. Patients received transcranial multi-Watt near-infrared light treatment (NILT) using near-infrared lasers (810/980 nm at 8-15 Watts) applied to forehead and temporal regions bilaterally for 9-12 minutes to each area.

**RESULTS:** For 36 of the 39 patients, after  $16.82 \pm 6.26$  treatments, QIDS scores indicated a robust response (decrease of QIDS total score by  $> 50\%$ ). For 32 of 39 patients post-treatment QIDS scores indicated a remission from depression (decrease of QIDS total score  $< 5$ ). Overall, the QIDS score fell from  $14.10 \pm 3.39$  to  $3.44 \pm 3.39$  SD ( $p = 6.29 \times 10^{-19}$ ). With 12 or fewer treatments, QIDS score dropped from  $14.83 \pm 2.55$  to  $4.17 \pm 3.93$ . Patients receiving 13 or more treatments showed a change in QIDS score from  $13.67 \pm 3.64$  to  $3.11 \pm 3.14$ . Those ( $N = 15$ ) who received the entire treatment course

within 8 weeks or less ( $5.33 \pm 1.72$  weeks) showed a change in QIDS score from  $13.86 \pm 3.14$  to  $4.5 \pm 3.94$ . Suicidal ideation resolved in all, but two patients. The non-responsive patients are described in detail. Patients remained in remission for up to 55 months after a single course of treatment.

**CONCLUSION:** This is the first report of high-powered NILT showing efficacy for depression. Patients saw benefit often within 4 treatments and some had resolution of depressive symptoms in as little as 4 weeks. These data raise an intriguing possibility – that NILT may be a safe, effective, and rapid treatment for depression. A double-blind, placebo controlled trial is warranted to verify these proof-of-concept data.

**FUNDING ACKNOWLEDGEMENTS:** Neuro-Laser Foundation

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### Multi-Watt Near Infrared Phototherapy is an Effective Treatment for Depression

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