Precision-Tinted Spectral Filters Reduce TBI-Related Migraines and visual cortical sensitivity

Background. The lingering effects of TBI can continue for months or years, especially with regard to headaches and migraines. These issues can be frustrating and debilitating, especially when they are unresponsive to standard courses of treatment. Increasing evidence suggests light wavelength regulates brain activity in ways extending beyond color perception. Here we investigated the use of precision-tinted spectral filters on brain activity and their application to persistent headaches and migraines as a result of brain or head trauma that have not been successfully remediated through standard medical and alternative treatment, including medications. **Methods. Study 1.** 184 participants diagnosed with medically resistant headaches and migraines as a result of brain or head trauma completed the Headache Impact Test™ (HIT-6™) before and after treatment with precision-tinted spectral filters, worn as glasses for 4-12 weeks. The HIT-6™ is designed to capture the impact of headache and its treatment on an individual's functional health and well-being, and is considered useful both for screening and monitoring change in headache impact. Participants also reported on migraine frequency. **Study 2**. A pilot study (n=7) of individuals with abnormal light sensitivity and history of headaches were administered retinotopic mapping fMRI scans with spectral filters or blank lenses to examine regulation of neural hypersensitivity to visual stimulation. **Results.** Pre versus post comparison of migraine frequency, medication usage, and scores on the HIT-6™ showed that there was significant reduction in migraine frequency (M=18.8, SD=22.0 vs. M=2.0, SD=6.0); t(181) = 10.6, p=.000. There was also significant improvement (M=66.0, SD=8.0 vs. M=41.6, SD=9.9) in terms of impact of headaches on functional health and well-being, t(183) = 32.9, p=.000. Precision-tinted spectral versus blank filters reduced within primary and secondary visual regions as well as fronto-parietal attentional networks, consistent with reduced hyperactivity to visual stimulation and reduced recruitment of neural networks outside of the visual system proper. These results suggest that precision-tinted spectral filters can reduce migraine frequency with headaches reduced from having a significant negative impact to having little or no impact on subjects' health and well-being. Preliminary evidence supports reduced

uncontrolled cortical excitability to patterned light stimulation as a potential mechanism of action. **Conclusions.** For individuals who have suffered head trauma resulting in light sensitivity and chronic headaches and migraines that fail to respond to standard interventions, precision-tinted spectral filters may provide relief that translates to improved functional health and well-being by regulating neural responses to light.

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