Project Title: Retinal Ganglion Cell Photoreceptors in TBI Patients with Photophobia
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Background: Intolerance to light, or photophobia, is a common symptom in individuals that have experienced traumatic brain injury (TBI).
Objective: This study will investigate the light sensitivity of melanopsin-containing ganglion cells in TBI patients. These intrinsically photosensitive retinal ganglion cells (ipRGCs) act as irradiance detectors, providing the brain with information regarding the amount of light present in the environment.
Hypothesis: Following traumatic brain injury, ipRGCs respond to dimmer light levels and this contributes to the photophobia experienced by these patients.
Specific Aims: By monitoring the pupil response to flickering light, we will characterize ipRGC sensitivity in TBI patients.
Study Design: A consequence of the sluggish properties of ipRGC light responses is that these photoreceptors have a reduced ability to distinguish flickering and continuous light, as compared to rod and cone photoreceptors. The researchers will measure the pupil response to flickering red and blue light in TBI patients and age-matched controls. The pupil constriction data will then be correlated to measures of patient photophobia. As ipRGCs are particularly sensitive to blue light, the flicker in the pupil response to bright flashing blue light is expected to be less than that elicited by a bright red flashing light. They predict that this difference in the pupil response to flickering red versus blue light will occur at dimmer light intensities in TBI patients experiencing photophobia, indicating that the ipRGCs are hypersensitive.
Relevance: In addition to establishing a role for ipRGCs in the neural circuitry that mediates photophobia, the pupil testing strategy tested in this proposal could be used as an objective test to quantify photophobia in TBI patients. This work could stimulate future investigations into strategies that limit ipRGC stimulation as a potential therapy for photophobia.