Improvements in Resting-State Functional Connectivity of the Cerebellum after Transcranial Photobiomodulation in Adults with a History of Repetitive Head Acceleration Events

Objective: The current study sought to explore the impact of a novel noninvasive treatment called transcranial photobiomodulation (PBM) on resting-state functional connectivity (rsFC) of the cerebellum in individuals with a history of repetitive head acceleration events (RHAEs). ***Background:*** RHAEs are associated with cumulative neurological compromise, including chronic alterations in rsFC; however, few treatments have been investigated to mitigate these effects. A recent study by our team demonstrated that PBM treatment led to improvements in measures of balance and motor function in adults with RHAE exposure. Due to the cerebellum's role in motor functioning and its connectivity with cerebral regions targeted by PBM, we sought to examine changes in the rsFC of the cerebellum following PBM treatment. ***Methods:*** Thirty individuals with RHAE used an at-home PBM headset with an intranasal cannula for 20 min every other day for a period of 8-10 weeks. A total of 240 J/cm^2 of red and near-infrared light was administered to cortical nodes of the default mode network (DMN) and subcortical structures in each session. Using resting-state functional magnetic resonance imaging, rsFC was measured before and after treatment in 11 cerebellar seed regions associated with the DMN, salience network (SN), and frontoparietal network (FPN). ***Results:*** We observed an overall decrease in between-network connectivity and an increase in within-network connectivity after PBM treatment, particularly in the SN and FPN. ***Conclusions:*** These results suggest that PBM may improve network efficiency of the cerebellum by regulating overactive connections and increasing network segregation.

Keywords: cerebellum; functional magnetic resonance imaging; repetitive head acceleration events; resting-state functional connectivity; traumatic brain injury.