Participants completed standardized measures of neurocognitive functioning, including the California Verbal Learning Test (CVLT-3), Delis Kaplan Executive Function System (D-KEFS), Continuous Performance Test (CPT-3), and The NIH Toolbox Cognition Battery. Neurocognitive assessments were collected prior to and following tPBM treatment. Paired t-tests and Wilcoxon's signed-rank tests were used to evaluate change in performance on measures of neurocognitive functioning for normal and non-normal variables, respectively, and estimates of effect size were obtained.
Results: Study participants' ability for adapting to novel stimuli and task requirements (i.e., fluid cognition; t=5.96; p<.001; d=.90), verbal learning/encoding (t=3.20; p=.003; d=.48) and delayed recall (z=3.32; p=.002; d=.50), processing speed (t=3.13; p=.003; d=.47), sustained attention (t=-4.39; p<.001; d=-.71), working memory (t=3.61; p=.001; d=.54), and aspects of executive functioning improved significantly following tPBM treatment. No significant improvements in phonemic and semantic verbal fluencies, reading ability, and vocabulary were shown following tPBM treatment.
Conclusions: The results of this pilot study demonstrate that following 8-10 weeks of active tPBM treatment, retired athletes with a history of SRC and/or RHI experienced significant improvements in fluid cognition, learning and memory, processing speed, attention, working memory, and aspects of executive functioning. Importantly, the majority of effect sizes ranged from moderate to large, suggesting that tPBM has clinically meaningful improvements on neurocognitive functioning across various cognitive domains. These results offer support for future research employing more rigorous study designs on the potential neurorehabilitative effects of tPBM in athletes with SRC/RHI.

Categories: Concussion/Mild TBI (Adult)
Keyword 1: cognitive functioning
Keyword 2: sports-related neuropsychology
Keyword 3: treatment outcome
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62 Effect of Blast TBI on Axonal Structure in Networks of Emotional Regulation and Cognitive Control

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Objective: Blast-related traumatic brain injury (bTBI) is one of the most common injuries among Veterans who have served in recent wars in Iraq and Afghanistan. Despite representing a distinct mechanism of injury, long-term clinical and functional outcomes of bTBI are generally comparable with non-blast-related traumatic brain injury (TBI). However, controversy remains over whether bTBI etiology differentially impacts emotional regulation and neurocognition – particularly with respect to post-traumatic stress disorder (PTSD) and verbal and visual memory. Through diffusion tensor imaging (DTI), the present study investigates the microstructural pathophysiology of bTBI, compared to non-blast TBI, in neural pathways involved in emotional regulation and cognitive control.
Participants and Methods: Participants included 36 Veterans (25% female; age M = 36.33, SD = 10.11; years of education M = 15.67, SD = 2.34). Axial diffusivity (AD) in networks of emotional and cognitive control was acquired using magnetic resonance imaging (MRI) with a DTI protocol. Analyses of variance (ANOVA) were used to compare Veterans with self-reported bTBI (n = 23) to those with non-blast-related TBI (n = 13).
Results: In the left hemisphere, Veterans with bTBI exhibited significantly smaller AD in axonal projections from the caudate nucleus (CN) to the orbitofrontal cortex (OFC), as well as in projections from the putamen to the OFC ($p < 0.05$). In the right hemisphere, Veterans with bTBI also exhibited significantly smaller AD in networks connecting the hippocampus to the amygdala ($p < 0.05$).
Conclusions: Compared to Veterans with non-blast-related TBI, Veterans with bTBI exhibited decreased AD in neural pathways from the CN to the OFC, the putamen to the OFC, and the hippocampus to the amygdala – indicative of increased axonal injury in these areas. Our results suggest that, on a microstructural level, emotional and cognitive networks are

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susceptible to longitudinal blast-related white matter damage. This is consistent with the literature in post-concussion syndrome (PCS) and provides a potential mechanism underlying results previously reported from this sample, describing subjective cognitive complaints in the absence of objective clinical deficits. As such, therapies that target networks of emotional and cognitive control may be particularly beneficial for Veterans with bTBI.

Categories: Concussion/Mild TBI (Adult)
Keyword 1: traumatic brain injury
Keyword 2: neuroimaging: structural connectivity
Keyword 3: cognitive control
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63 A Multimodal Investigation of Attention in Pediatric Concussion

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Objective: Concussion patients frequently report increased distractibility, with more than half endorsing "concentration difficulty". Previous studies have demonstrated impairments in maintaining attention and voluntary attentional allocation in concussion patients. However, involuntary attentional allocation (distraction) is not well understood in the context of concussion. The goal of this study was to examine distraction in acute pediatric concussion patients, monitoring frontal lobe activity using functional near-infrared spectroscopy (fNIRS) – a non-invasive measure of local hemodynamic activity – to elucidate whether post-concussion distractibility is associated with the availability of attentional control resources.
Participants and Methods: Participants included concussion patients (cases; n=19) presenting to specialty care within 28 days of injury (M=8.05, SD=5.55) and controls (n=16) presenting for reasons other than concussion. Participants were 13-17 years old (M=14.83, SD=1.10) and 57.1% female. Participants completed a computerized measure of behavioral distraction (the additional singleton paradigm) while frontal lobe activity was recorded using fNIRS 4-channel split sensor. On each trial, an array of shapes (five squares and one circle) was presented, and participants reported the orientation of a line segment inside a target shape (circle). The search array included a distractor (a square that differed in color) on 50% of trials. For each participant, the fNIR signal for epochs of each trial type (distractor present/absent) were averaged and subjected to a linear regression in which the data were fitted to a hemodynamic response function (HRF).
Results: 34 participants (19 cases, 15 controls) were included in our behavioral analysis. Reaction time (RT) was significantly slower on distractor present compared to distractor absent trials; $F(1,32)=17.151$, $p<.001$. There was no significant effect of group (case/control) on RT ($F(1,32)=1.24$, $p=.273$) or interaction between group and trial type ($F(1,32)=1.05$, $p=.313$).
29 participants (15 cases, 14 controls) were included in fNIRS analyses. The effect of group and distractor presence/absence on oxygenated hemoglobin (HbO_2) was examined for each channel. A significant effect of distractor presence/absence was observed in channel 3; $F(1,27)=8.510$, $p=.007$. There were no significant effects of group or interactions between group and distractor presence/absence.
Lastly, a capture index was calculated for each participant by subtracting average RT on distractor absent trials from distractor present trials and correlated with HbO_2 (beta weights averaged across trial type) for each group at each channel. No significant correlations were observed. There was a trend towards a negative correlation for case participants, particularly in channel 1, which strengthened when an outlier was removed ($r=-.407$, $p=.149$).
Conclusions: Reaction time and frontal lobe activity – which serves as a proxy for attentional

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