**Results:** 52 patients were included in this exploratory analysis (Mean age 14.6, SD ±2.7; 57.7% female; 55.7% White, 21.2% Black or African American, 21.2% Hispanic). Two percent of our sample did not disclose their race or ethnicity. Prior concussion history was present in 36.5% of patients and 23.1% had a comorbid psychiatric diagnosis. The patient referral distribution included emergency departments (36%), local pediatricians (26%), neurologists (10%), other concussion clinics (4%), and self-referrals (24%).
Given the nature of our specialty concussion clinic sample, the data was not normally distributed and more likely to be skewed by outliers. As such, the median value and interquartile range were used to describe the results. Regarding recovery variables, the median days to clinic from initial injury was 50.0 (IQR=33.5-75.5) days, the median PCSS score at initial visit was 26.0 (IQR=10.0-53.0), and the median overall recovery time was 81.0 (IQR=57.0-143.3) days.
After initiating care within our specialty concussion clinic, the median recovery time was 21.0 (IQR=14.0-58.0) additional days, the median total visits were 2.0 (IQR=2.0-3.0), and the median PCSS score at follow-up visit was 7.0 (IQR=1-17.3).
**Conclusions:** Research has shown that early referral to specialty concussion clinics may reduce recovery time and the risk of protracted recovery. Our results extend these findings to suggest that patients with protracted recovery returned to baseline similarly to those with an acute concussion injury after initiating specialty clinic care. This may be due to the vast number of resources within specialty concussion clinics including tailored return-to-learn and return-to-play protocols, rehabilitation recommendations consistent with research, and home exercises that supplement recovery. Future studies should compare outcomes of protracted recovery patients receiving care from a specialty concussion clinic against those who sought other forms of treatment. Further, evaluating the influence of comorbid factors (e.g., psychiatric and/or concussion history) on pediatric concussion recovery trajectories may be useful for future research.

**Categories:** Concussion/Mild TBI (Child)
**Keyword 1:** concussion/ mild traumatic brain injury

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## 21 Associations Between Initial Injury Severity, Cerebral Metabolites, and the Local Connectome in Remote Mild-to-Moderate TBI

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**Objective:** To determine the association between in-vivo spectroscopy metabolite data, the local connectome, and markers of initial injury severity (I.e., history of loss of consciousness; LoC) in traumatic brain injury (TBI), in a heterogenous sample of Veterans and non-Veterans with a history of remote mild-to-moderate TBI (I.e., >6 months).
**Participants and Methods:** Participants with complete PRESS magnetic resonance spectroscopy (MRS) and diffusion weighted imaging (DWI) data ($N$ = 41) were sampled from a larger multisite study of chronic mild-to-moderate TBI ($N_{mild}$ = 38; $N_{moderate}$ = 3; 54% with LoC; 46% with multiple TBI). The sample was predominantly male (76%) with ages ranging from 23–59 ($M$ = 36.9, $SD$ = 10.1), with 98% holding at least a high school degree ($M$ = 14.5 years of education, $SD$ = 2.4). Fully tissue-and-relaxation-corrected metabolite concentration estimates in the dorsal anterior cingulate (30x30x30mm voxel) were modeled using Osprey 2.4.0. Total creatine (tCr), total choline (tCho), total N-acetylaspartate (tNAA), glutamate/glutamine (Glx), and myo-inositol (mI) were analyzed. Logistic regression was used to measure the association between metabolites and history of TBI with LoC. Correlational connectometry using the normalized spin distribution function was performed for metabolites associated with LoC, to characterize

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the local connectome associated with metabolites of interest, controlling for age and sex, and correcting for multiple comparisons (FDR < .050 with 4000 permutations). A profile approach was used to interpret diffusion metrics, contrasting quantitative anisotropy (QA) with fractional anisotropy (FA). Local connectome tracks were then clustered to identify the larger white matter tract.
**Results:** Glx ($p$ = .008) and tCr ($p$ = .032) were significantly associated with history of TBI with LoC. Increased Glx was associated with increased QA in 11,001 tracks, accounting for 1.4% of the total white matter tracks in the brain. 90% of tracks were identified in bilateral cingulum (33%), bilateral thalamic (13%), bilateral corticospinal (13%), corpus callosum (12%), left arcuate fasciculus (9%), left fronto-parietal aslant tracts (6%), and bilateral inferior fronto-occipital fasciculus (4%) tracts. In contrast, FA was not associated with Glx. The same pattern emerged for tCr, with 10,542 tracks identified predominantly in bilateral cingulum (29%), corpus callosum (21%), bilateral corticospinal (15%), bilateral corticostriatal (7%), bilateral medial lemniscus (7%), left cortico-pontine (3%), left thalamic (2%), and bilateral superior longitudinal fasciculus (2%) tracts. Post-hoc exploratory analyses of mean QA across regions of cingulum found that increased QA was associated with self-report measures of headache intensity, fatigue, and perceived change in executive functioning.
**Conclusions:** Results provided evidence that multimodal imaging can identify subtle markers of initial TBI severity years after injury. Neurometabolite concentrations were associated with diffuse changes in the local connectome; the pattern of discrepancy between FA and QA was suggestive of reduced potential for neuroplasticity. Exploratory analyses further indicated that variability in white matter density in the cingulum, an important connection for limbic regions, was associated with a range of problems commonly reported in clinical settings, which may be informative for diagnosis and treatment planning.

**Categories:** Acquired Brain Injury (TBI/Cerebrovascular Injury & Disease - Adult)
**Keyword 1:** brain injury
**Keyword 2:** magnetic resonance spectroscopy
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## 22 The Effect of Ibogaine on Cognitive Functioning

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**Objective:** To determine the effects of the non-classic psychedelic, ibogaine, on cognitive functioning. Ibogaine is an indole alkaloid derived from the Tabernanthe Iboga plant family, indigenous to Africa, and traditionally used in spiritual and healing ceremonies. Ibogaine has primarily been studied with respect to its clinical efficacy in reducing substance addiction. There are, however, indications that it also may enhance recovery from traumatic experiences. Ibogaine is a Schedule 1 substance in the USA.
**Participants and Methods:** Participants were U.S. Special Operations Veterans who had independently and voluntarily referred themselves for an ibogaine retreat at a specialized clinic outside the USA prior to learning about this observational study. After meeting rigorous screening requirements, 30 participants were enrolled, all endorsing histories of combat and repeated blast exposure, as well as traumatic brain injury. Participants were seen in person pre-treatment, post-treatment, and one-month post-treatment for neuropsychological testing, neuroimaging, and collection of clinical outcome measures. All 30 participants were seen pre- and post-treatment, of whom 27 were also able to return one-month post-treatment.
The neuropsychological battery included the the Hopkins Verbal Learning Test (HVLT), the Brief Visuospatial Memory Test - Revised (BVMT-R), the Wechsler Adult Intelligence Scale - Fourth Edition (WAIS-IV) Working Memory Index (Digit Span and Arithmetic) and Processing Speed Index (Symbol Search and Coding), and the Delis-Kaplan Executive Function System (D-KEFS) tests of Verbal Fluency (VF), Trail Making (TMT), Color Word (CW), and Tower Test (TT). For repeated measures, alternate forms were used whenever possible.
**Results:** Repeated-measures ANOVA revealed significant effects of time, with post-treatment improvements across multiple measures including processing speed (WAIS-IV PSI;

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