Conclusions An approach that utilises objective and quantitative measures to characterise multiple aspects of neurocognitive and motor function are more sensitive than traditional measures of concussion assessment. These new outcomes provide value in the stratification of patients and their potential time to recovery.

Competing interests JLA and SML have authored intellectual property associated with the mobile application presented in this study. The remaining authors declare no competing interest.

None.

Objective To determine the association between previous history of concussion and sport-specific skill performance in youth ice hockey players.

Design Cross-sectional.

Setting Arenas in Calgary, Alberta, Canada over three seasons of play (2012–2015).

Participants Five hundred and ninety-six players were recruited from youth hockey teams [525 males and 71 females, aged 11–17, representing elite (upper 30% by division of play) and non-elite (lower 70%)].

Assessment of risk factors Players completed a baseline questionnaire including the number, date of occurrence, and length of recovery following any previous concussions.

Outcome measures On-ice skills performance was measured using the Hockey Canada Skills Test (HCST) battery including forward agility weave, forward to backward transition agility, forward/backward speed skate, and a 6-repeat endurance skate.

Results Previous history of concussion and time since most recent concussion were not associated with any HCST component. Players reporting two or more concussions were faster than those with no history of concussion on forward agility weave with the puck [–7.32 (95% CI: –11.05, –3.59)]. For every additional day of recovery post-concussion, a player’s time was significantly faster on forward agility weave with [–0.11 (95% CI: –0.16, –0.05)] and without the puck [–0.08 (95% CI: –0.13, –0.04)], transition agility without the puck [–0.01 (95% CI: –0.02, –0.01)], and backward speed with [–0.06 (95% CI: –0.1, –0.03)] and without the puck[–0.05 (95% CI: –0.07, –0.03)].

Conclusions Players with a concussion history had similar HCST performance scores to those without. A longer post-concussion recovery was associated with better performance. These results provide reference values which will inform risk assessment and future injury prevention studies.

Competing interests None.

THE ASSOCIATION BETWEEN MODERATE AND TRANSCRANIAL DOPPLER ULTRASOUND MEASURES OF NEUROVASCULAR COUPLING ARE MAINTAINED FOLLOWING ACUTE SPORT-RELATED CONCUSSION

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Objective The association between moderate and severe MT-DUS measures of neurovascular coupling are maintained following acute sport-related concussion.

Methods A total of 23 concussed players (16 males, 7 females) were compared to 19 non-concussed players (14 males, 5 females). An average of 21 days post-concussion and 9 days post-MDUS measures.

Results Moderate MT-DUS markers were significantly reduced following concussion (p < 0.05). Severe MT-DUS markers decreased significantly in concussed compared to non-concussed players (p < 0.05).

Conclusions Moderate MT-DUS measures are maintained following acute sport-related concussion.
Objective To determine the extent to which an acute sport-related concussion disrupts elevations in cerebral blood velocity (CBV) in the posterior cerebral artery (PCA) during visual tasks.

Design Prospective Cohort.

Setting Laboratory.

Participants 136 male contact-sport athletes (19.1±1.4 years) recruited, subset of 14 participants (19±1.4 years) sustained concussions.

Intervention Transcranial Doppler ultrasound was used to index CBV in the PCA during a series of visual tasks. Participants closed their eyes (20 seconds), and when prompted, opened their eyes and completed a visual task (40 seconds). Testing was completed prior to the start of their athletic season (T0), and again (if concussed) at 72-hours (T1), 2-weeks (T2), and 1-month (T3) post-injury. The raw traces from each trial were averaged to enhance the signal-to-noise ratio of the outcome measurements. Independent variable tested was time (4 points).

Outcome measures Eyes-closed CBV (cm/s), peak elevation in CBV (cm/s), relative change in CBV (%) and total activation during the first 30 seconds of the task (indexed via area under the curve-AUC)

Main results RM-ANOVA indicated there were no time effects for any of the outcome metrics: Eyes-closed CBV (p=0.473), peak CBV (p=0.541),% CBV elevation (p=0.603) and AUC (p=0.972).

Conclusions These negative findings are important, as they indicate the PCA is able to maintain nutrient delivery required for visual challenges. Thus, neurovascular coupling is maintained despite the reported impairments in indices of cerebral autoregulation in the same population.

Competing interests None.

INVESTIGATING A 7-DAY BASELINE WHILE ESTABLISHING HEALTHY SCAT3 SYMPTOM FREQUENCY AND SEVERITY

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Objective The reliability of a concussion symptom checklist can become compromised by external conditions (weather, medical conditions, stress, medications, etc.). This study assessed the day-to-day reliability of the SCAT3 Symptom Evaluation to determine if participants provide consistent responses in addition to determining the frequency and severity of the 22 symptoms in a non-concussed, adult, athletic population.

Design Repeated measure observational design.

Setting This study was conducted at a University in Ohio, U.S.A.

Participants 52 volunteers (18 to 30 years), self-identified as an athlete and had not suffered a concussion in the past 6 months.

Intervention Participants completed the SCAT3 Symptom Evaluation at prescribed times through the day over a 7 day period. Participants were randomly assigned to two equal groups, alternating between completing the SCAT3 Symptom Evaluation twice (at wake up and before bed) or once (in the afternoon) each day.

Outcome measures Severity and frequency of each of the 22 symptoms over a 7 day period.

Main results The single measure intraclass correlation coefficient was 0.496 (95% CI=0.382 to 0.620, SEM=0.134) for the frequency of symptoms and 0.438 (95% CI=0.325 to 0.568, SEM=0.221) for the sum of the symptom severity over 7 days.

Conclusions The results demonstrated poor day-to-day reliability for the reporting of the frequency and severity of symptoms. All of the 22 symptoms on the SCAT3 Symptom Checklist were reported by at least one participant with the most commonly reported symptoms being fatigue or low energy, drowsiness, and headaches.

Competing interests None.

A RETROSPECTIVE REVIEW OF BASELINE BALANCE SCORES IN COLLEGE ATHLETES

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Objective While the approach to concussion and post-concussion syndrome management remains largely clinical, significant advancements have been made in identifying potential biomarkers to aid in the diagnosis and management of head injuries. One such potential biomarker is Brain Network Activation (BNA) analysis. BNA is a multi-channel, EEG-ERP based platform that involves algorithmic analysis to provide a network map of cortical activity and quantitative data during specific tasks.

Design Case Series.

Setting Outpatient, clinic-based.

Participants Three (3) athletes.

Outcome measures Analysis of the subject’s BNA performance yields BNA score, which reflects the degree of similarity between the performance of the subject and the normative data. BNA scores are further placed into one of three subcategories: Working Memory and Attention (Target Stimuli), Automatic Attention Orienting (Novel Stimuli), and Sensory (Frequent Stimuli). Each subject underwent a BNA analysis while symptomatic, followed by repeat analyses once subjects were identified as clinically asymptomatic.

Main results In each of the three studies, there were improvements in BNA scores identified in one, or several, subcategories. More importantly, improvements in BNA scores directly correlated with clinical improvement in the post-concussive setting.

Conclusions Approach to concussion management, in both the short-term and long-term setting, remains largely clinical. Current research seeks a more objective means of assessing not only potential structural abnormalities following a concussion, but also an improved means of assessing a patient’s neurocognitive status. BNA has proven to be an effective, supportive tool in allowing clinicians and patients to objectify one’s progress following a concussive injury.

Competing interests None.