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Reaction times after mTBI: a comparison across multiple domains

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Keywords

mild traumatic brain injury, reaction time, standing balance, concussion, dynamic balance

Abstract

Background:

Reacting to external stimuli (reaction time) is critical for everyday life and is assessed after a mild traumatic brain injury (mTBI) with a seated computerized cognitive test. However, reaction times during daily life may require speed, accuracy, and gross movement that may not reflect seated cognitive reaction time tasks. Balance control is impaired after mTBI and measuring reaction times during standing and dynamic balance is an area of growing interest. Seated cognitive reaction time measures are used to determine return-to-activity but it is unknown if seated cognitive reaction times will predict reaction times for gross sensorimotor balance responses.

Purpose:

Explore reaction times across seated cognitive, standing balance, and dynamic stepping reactions.

Methods:

All participants sustained a recent mTBI (n=152). Seated cognitive reaction time was assessed with simple and procedural reaction times (SRT & PRT) from the Automated Neuropsychological Assessment Metrics (ANAM). We assessed standing balance sensorimotor reaction time with the Central Sensorimotor Integration test, which identified the time delay that accounted for stimulus-evoked body sway. An instrumented push and release test (iP&RT) measured the reaction time-to-stabilize from a dynamic stepping task. Independent t-tests compared reaction times across tasks between the mTBI group and a healthy control (HC) database (n=89) and Spearman Rank correlations evaluated the relationships among different reaction time measures.

Results:

The mTBI group had longer reaction times in all 3 assessment domains compared to the HC group (p's<0.0001). Longer CSMI time delays significantly related to longer ANAM SRT ($p=0.005$) and longer iP&RT time-to-stabilization ($p<0.001$). There were no other significant relationships (p's>0.133).

Conclusions:

Impaired reaction time, cognitive or sensorimotor, is a fundamental deficit after mTBI. However, the weak relationships among the measures suggest these are separate impairment domains. Thus, it may be necessary to evaluate multiple aspects of reaction time to ensure optimal cognitive and sensorimotor function when returning to activity.