



The benefits of a multimodal Baseline Test for return to play decision in paediatrics

Elizabeth Laurent, MPT and Kiersten McMaster, MPT

Elizabeth@kidsphysio.ca | Kiersten@kidsphysio.ca

What is a concussion?

A mild traumatic brain injury which results in functional disturbances rather than a structural injury (1). This injury can result from a hit to the head/body which results in metabolic disturbance, changes in cerebral blood flow and perfusion, as well as other pathological processes known as the *Neurometabolic Cascade* (2,3). A study in 2017 showed that 19.5% of adolescents (ages 13-18) in the US reported being diagnosed with at least one concussion and 5.5% reported more than one concussion (4).

What is Baseline Testing?

Baseline Testing is a procedure which should involve a battery of tests that assess various areas of brain function, have good test-retest reliability, and are able to show subtle dysfunctions even after symptom resolution.

It is important to note that Baseline Testing should involve more than just computerized neurocognitive measures (which are insufficient as stand-alone entities displaying reliability and validity concerns). As well, these tests lack to assess important aspects of concussion injuries such as balance, visual tracking and processing speed, strength & physical performance measures, auditory memory and concentration.

We partner with Complete Concussion Management Inc. (CCMI) who provide us with the evidence protocols for Baseline Testing.

Components of a multimodal Baseline Test:

- Medical and concussion history
- Symptom Score
- Orientation, Auditory memory (immediate and delayed), and concentration
- Visual tracking and processing speed
- Balance testing (BESS and postural sway)
- Strength and physical performance measures
- Neurocognitive testing in children 13+

Why is Baseline Testing important?

Several studies have shown that prior to full metabolic recovery the brain is extremely vulnerable and that even with a small second impact could result in secondary impact syndrome, placing the brain at risk for severe injury (5, 6).

Recent literature suggests that the physiological time of recovery may outlast the time for clinical/symptom recovery. Relying on symptoms alone to guide return to play may expose athletes to additional risk by returning to play while there is ongoing brain dysfunction (1). It is our role to ensure that there has been complete recovery of the brain before an athlete is allowed to return to their sport. This process has been demonstrated in adults to take at least 3-4 weeks and is unknown in children (7, 8).

Without a Baseline Test, clinicians have to rely on self-reported symptoms in order to make return to play decisions which come at a risk. This is why baseline testing is important - it offers clinicians an insight into pre-injury physical and cognitive functioning that they would not otherwise have, thus making informed return to play decisions (9).



How are they used clinically?

While in most cases a Baseline Test is not required to make a concussion diagnosis, it can help lower our chances of misclassifying concussed athletes who may neglect to disclaim their concussion symptoms. In a 2013 study, 43% of athletes with a history of concussion reported that they had hidden symptoms of a concussion to stay in a game. (10) Components of a baseline test can be used to aid in identifying acute concussions on the sidelines, remove the concussed athlete from play, and hence reduce the risks of further injuries (11).

Using physical and cognitive testing in high level athletes prior to the start of their season to determine a baseline of function and systems that are commonly affected by concussions. Should an athlete suffer from a concussion, a pre-season baseline test can guide the clinician in making an informed return to play decision.

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