Medical Xpress

# Visio-vestibular examination is critical part of diagnosing concussion in young athletes

April 15 2021

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Early and accurate diagnosis leads to optimal recovery from concussion. Over the past year across a series of studies, the Minds Matter Concussion Program research team at Children's Hospital of

Philadelphia (CHOP) has systematically evaluated the use of the visio-vestibular examination (VVE) and its ability to enhance concussion diagnosis and management. The latest of these studies published online today in the *Clinical Journal of Sports Medicine*.

The VVE involves a series of brief eye movement and balance tests intended to identify deficits in brain function involving the visual and vestibular systems. Researchers found that the VVE presents several advantages over current clinical measures, moving beyond subjective symptoms with a rapid, repeatable and quantifiable clinical exam. The team also found that the VVE is easy to administer across various clinical settings where children are initially seen following head injury when a concussion is suspected. In doing so, researchers believe there is the opportunity to ensure the diagnosis is made accurately and soon after injury to improve outcomes for all youth who suffer a concussion.

"There is growing evidence that visual, vestibular, and balance impairments are common after concussion, and these impairments have been linked to worse outcomes, including a delayed return to school and sports," says lead investigator Christina L. Master, MD, a sports medicine pediatrician and co-director of the Minds Matter Concussion Program at CHOP. "Recently, we have focused our efforts on developing objective measures of impaired eye movement and pupil response as physiological biomarkers of concussion. In this line of research, we also wanted to see if this simple and rapid clinical exam could provide diagnostic utility for a variety of providers outside the specialist setting."

Across four different studies published over the past year, the CHOP research team make a strong case for the implementation of the VVE across a variety of practice settings:

- In this most recent study, the researchers focused on the

assessment of saccadic eye function, which involves assessing the level of symptom provocation with rapid eye movements between two fixed objects, and gaze stability, where symptoms are assessed with head movement while the eyes are fixed on a stationary object. Previously, these assessments were performed up to 10 repetitions in a traditional screening, but this study showed that raising the number of repetitions to 20 increased the sensitivity of the test. This more demanding task provides a more rigorous 'stress test' for the brain and can help to identify subtle deficits that may go unnoticed in regular clinical assessments and avoids the ceiling effect of a test that is too easy.

- A second study compared clinical and device-based metrics to measure gait and balance in the diagnosis of concussion. The study found that the complex tandem gait used in the VVE performed as well as, if not slightly better than, a biomechanical force plate device for assessing deficits in concussion. The most challenging component of the complex tandem gait from the VVE—having the subject walk backward with his or her eyes closed—had the highest sensitivity for diagnosing a concussion of any of the clinical balance tests.
- Another study established the reliability of VVE among providers in a pediatric emergency department in patients presenting after a head injury. The individual elements of the VVE showed fair to moderate agreement between providers and moderate to substantial agreement within the same provider, especially when used with adolescents. When comparing abnormalities on exam between patients with and without a final diagnosis of a concussion, the researchers found each additional abnormal examination element more than doubled the odds of a concussion diagnosis.
- A final study showed that patients who were immediately diagnosed with a concussion in the emergency department were significantly more likely to have received a VVE during that visit

compared with patients who were evaluated in the ED for a head injury, but not diagnosed with a concussion until later at a subsequent medical visit. The patients who received these early and appropriate diagnoses were nearly three times less likely to experience prolonged symptoms, suggesting that a VVE can improve both diagnostic accuracy as well as patient outcomes.

"With its ease-of-administration, the visio-vestibular examination can be conducted in multiple care settings where children are initially seen with head injury to effectively diagnose concussion," says co-author Daniel J. Corwin, MD, MSCE, an emergency medicine physician, associate director of research in the Division of Emergency Medicine at CHOP, and Minds Matter Concussion Program researcher. "This is particularly important since many concussed youth are diagnosed outside of the specialty setting where these tests were initially developed. Our previous research also underscores how early and accurate diagnosis can improve outcomes in children."

With training and clinical support tools, pediatricians, emergency medicine clinicians, and advanced practice practitioners are able to conduct the VVE assessments for saccades, gaze stability, and tandem gait in a repeatable manner in the workflow of a high-volume acute care setting.

"Health care professionals have new important considerations for evaluating and managing sports-related concussion," Master said. "The visio-vestibular examination is an inexpensive, feasible, and readily available means by which concussions can be more accurately diagnosed, thereby improving outcomes for these vulnerable patients. In doing so, we have the opportunity to shorten the time to diagnosis and treatment to improve outcomes for all youth who suffer a concussion."

**More information:** Storey, Eileen P et al. Assessment of Saccades and

Gaze Stability in the Diagnosis of Pediatric Concussion
*Clinical Journal of Sport Medicine* April 9, 2021 DOI: 10.1097/JSM.0000000000000897

Provided by Children's Hospital of Philadelphia