A quick, simple, effective screening test for concussion

Concussion is a real prospect in many physical contact sports and physically demanding sports. Immediately after a concussion the brain doesn't act normally. Typical issues for a person with concussion are confusion, difficulty responding to emotional situations (blunted affect), amnesia and slowed reaction time. The dysfunction may indicate microscopic damage in the brain but there is usually no morphological damage visible on imaging of the brain. For the athlete with concussion it is important to document the occasion as multiple concussions with associated neurologic symptoms such as headache, dizziness or heightened sensitivity to some sounds may indicate a state known as post-concussion syndrome. This syndrome may require cognitive, psychiatric and psychological rehabilitation.

Various tools have been used to assess concussion. The Glascow Coma Scale (GCS) is used in emergency departments to assess the level of consciousness but is not sufficiently precise to assess mild head injuries. A 30 point side-line evaluation scale has been developed to assist decision making in mild head injury. This scale requires establishment of a baseline result before the sport season begins. Another standardised tool is the Sport Concussion Assessment Tool version 3 (SCAT3) that combines multiple assessments. This tool has been updated twice and is endorsed by several world sporting administrations. More recently researchers have developed a blood test for a protein called tau that is released as a result of damage to nerve cells. This test is suggested to provide an indirect measure of the magnitude of the damage and so can be very helpful in planning rehabilitation. While many of these tools can assess concussion and aid in planning treatment they lack the urgency of result that may seem imperative during a game.

Other researchers have focussed on reaction time as an indirect measure of concussion. A fingertip field measurement may be obtained by randomly dropping a ruler between the participant's thumb and first finger while they try to arrest the fall of the ruler as quickly as possible. The distance the ruler has fallen can be used to calculate the reaction time. However, there was no indication of how this measurement of reaction time would relate to one obtained under laboratory conditions.

Thus, in our research, we used both male and female senior school students aged between 16 years 6 months and 17 years 6 months. By this age, students have attained most of their height and have passed a period of hormonal adjustment. All of our participants had a 'normal' BMI and none were athletes. We tested the reaction time in both the laboratory setting and in the field with each participant. In the laboratory the participants reacted by pressing a button in response to a visual signal shown on a computer screen after random intervals. The computer was able to measure the reaction time with an accuracy of ±1ms. For the field fingertip method, the participants sat with their arm, up to their wrist, resting comfortably on a table. A metallic ruler was suspended by an assistant with the zero point between the thumb and first finger that were 20mm apart. The ruler was then dropped after random delays of 4 – 8s and the participant tried to arrest the fall as quickly as possible.

We found a high agreement between the two methods of measuring reaction time. There was no difference between the left and right hands nor between males and females. Therefore, we conclude that a simple fingertip field test can be used to rapidly and accurately screen an athlete for possible concussion enabling informed decisions to be made on the side-line.

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Computerized and fingertip measures of reaction time compared in individuals.
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