Baseline Scores On SCAT2 Concussion Test Vary By Youth Athlete's Gender and Concussion History, Says Study

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Created 07/07/2011 - 14:40

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Scores on a test commonly used to assess concussions on the sport sideline vary by an athlete’s gender and concussion history, reports a new study\(^1\) presented at the American Orthopaedic Society for Sports Medicine’s (AOSSM) 2011 Annual Meeting in San Diego. The report emphasizes the importance of establishing an individual baseline for each youth athlete in contact and collision sports as critical to proper management of a subsequent concussion and the timing for safe return to play, researchers say.

Gender, concussion history matter

Researchers from Phoenix and Mesa, Arizona found that males and those with a history of at least one prior concussion had significantly worse baseline scores (e.g. lower total points on the 100-point SCAT2 scale) than their female or non-concussed peers.

In contrast to earlier studies finding that females report more symptoms compared to males, the study did not find differences between males and females for the symptom score\(^1\) component of the SCAT2, which the study's authors attributed to different scoring methodology and use of a different symptom scale. The percentages of those who reported at least one symptom during their baseline test (83% of males, 85.5% of females) was higher than reported in a 2009 study finding that 52.6% of college male athletes and 75.5% of college female athletes had at least a score of 1 on the SCAT symptom scale.

"Our results showed that otherwise healthy adolescent athletes do display some variability in results so establishing each player's own baseline before the season starts and then comparing it to test results following a concussion leads to more accurate diagnosis and treatment," said lead author, Anikar Chhabra, MD, MS of The Orthopaedic Clinic Association in Phoenix, Arizona, who presented the findings to the AOSSM Annual Meeting.

Study details

Chhabra and his colleagues from A.T. Still University tested 1,134 athletes who were participating on interscholastic athletic teams at 15 different high schools in the Phoenix area, as part of a funded research project by the National Operating Committee on Standards for Athletic Equipment (NOCSAE). There were 872 males and 262 females in the study with an average age of 15. The predominant male and female sports were football and volleyball, accordingly. A brief questionnaire regarding concussion history\(^2\) and the SCAT2 test was given to all participants.

Females scored significantly better (e.g. had higher total scores on the SCAT2) compared to the males. Athletes with a prior history of concussion\(^3\) scored significantly lower on the SCAT2 with 88.7% of adolescent athletes with a positive concussion history reporting at least one symptom of concussion, compared to 79.5% of athletes with no previous history of concussion.

First-of-its-kind study

"This data provides the first insight into how the SCAT2 scores can be used and interpreted as a sideline concussion tool and as an initial baseline analysis. With concussions accounting for approximately nine percent of all high school athletic injuries, accurately utilizing assessments like these to quickly determine an athlete's return-to-play probability is critical to long term athletic and educational performance," said Chhabra.

Brief neurological examinations on the sports sideline are important to rule out a more serious, potentially fatal, head injury and to begin
individualized concussion management by identifying acute deficits or impairments of cognition and balance. Because concussions can also result in serious long-term cognitive deficits (e.g. impaired thinking, concentration, learning, and reasoning), the "need for proper initial sideline assessment is critical to determine proper management and the timing for safe return to play," says the study.

About the SCAT2

The Sport Concussion Assessment Tool-2 (SCAT2) was recommended as a sideline test by a consensus of sport concussion experts at the Third International Conference on Concussion in Sport in Zurich in 2008. It is comprised of:

- 22-item graded symptom scale (22 points);  
- 2-item sign score determining loss of consciousness (2 points);  
- Glasgow Coma Scale (GCS) evaluating eye response, verbal response, and motor response (15 points);  
- Standard Assessment of Concussion (SAC) for orientation, immediate memory, concentration, and delayed recall (30 points)  
- Modified Balance Error Scoring System (BESS) (30 points);  
- Coordination examination (1 point); and Maddocks' questions for sideline assessment (asking the athlete if he/she knows where he is, what half/period it is, who scored last, what team they played last, did their team win; not included in SCAT2 summary score and only used for sideline diagnosis of concussion).

The SCAT2 total score is calculated by summing each component score, and has a maximum of 100 points. Since the purpose of the Arizona study involved (healthy) baseline scores, the Maddocks' questions were not administered and the sign score and GCS score were automatically assigned with the correct response point values of 2 and 15, respectively.

Sideline assessment: how helpful?

While she believes the SCAT2 has value for gathering data at the time of injury, emphasizing the importance of individualized management and care, sports neuropsychologist and MomsTeam expert, Rosemarie Scolaro Moser, Ph D., is very concerned about the use of the test in making an immediate return to play decision on the sports sideline, noting that more studies are needed to establish its validity and reliability to make such clinical decisions.

"If one suspects a concussion, doing sideline testing should not sway that decision," says Dr. Moser, especially since we know, particularly with younger athletes, that symptoms may not appear until hours (or longer) after the initial injury.

"Even if an athlete 'passes' the test on the sideline, we should not let him or her continue to play. We should continue to be guided by the rule 'When in doubt, sit them out,'" advises Moser.

In the twenty-four states that have passed strong youth sports safety laws since May 2009, that is exactly the required approach: any athlete suspected of having suffered a concussion must be immediately taken out of the game or practice, is not allowed to return to play on the day of injury, and can return to play or practice only after receiving written medical clearance.

Promising sideline assessment tool

One test which has shown promise in an early study in providing rapid and accurate sideline screening of concussion on the sports sideline, is the so-called King-Devick (K-D) test.

The results of a 2011 study of kick boxers and mixed martial arts (MMA) athletes demonstrated that the K-D test is an accurate and reliable method for identifying athletes with head trauma, and is a strong candidate for a rapid sideline screening test for concussion, with particular relevance to contact sports including football, soccer, hockey, MMA and boxing," wrote Dr. Laura J. Balcer of the Department of Neurology, Ophthalmology, and Epidemiology at the University of Pennsylvania School of Medicine, co-author of the study reported in the journal Neurology.

A study of members of the University of Pennsylvania football team, men's and women's soccer teams, and men's and women's
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basketball teams has been completed, with the results expected to be reported soon. The hope, says Dr. Balcer, is that the new study "will establish large-scale test norms and expected ranges of pre-competition scores for this age group, and will further investigate the capacity for K-D scores to capture closed head injury and concussion."

**Importance of baseline scores**

The strong consensus of sport concussion experts is that a multi-faceted approach to concussion assessment, evaluation and management is the proper approach, including an evaluation of self-reported symptoms [12], neurocognitive assessment [13] (ImPACT, CogState, Headminders), and an evaluation of balance [9] and postural stability. "Regardless of the tool," notes Dr. Chhabra, "a preseason baseline score for the tests being used [should be performed]."

Source: American Orthopaedic Society for Sports Medicine (AOSSM)


*Posted July 7, 2011; revised July 21, 2011*

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