

Section Editors  
David C. Spencer, MD  
Steven Karceski, MD

# Concussion

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**WHAT DID THE RESEARCHERS DO?** In their article, “The King-Devick test as a determinant of head trauma and concussions in boxers and MMA fighters,” Dr. Galetta and colleagues<sup>1</sup> studied head injuries, and a new way of evaluating people who have had head trauma. In order to do this, they looked at a group of people who are at high risk for concussion: boxers and mixed martial arts (MMA) fighters. They compared a new, rapid test for concussion called the King-Devick (K-D) test. They compared this to a longer, more detailed test called the Military Acute Concussion Evaluation (MACE). Dr. Galetta and colleagues wanted to know if there a simpler, faster test that can accurately assess people who have had a concussion.

The K-D test is simple, fast, and easy to perform. It is based on measuring how quickly a person can name numbers read from 3 test cards. The person has to read the numbers as fast as he or she can, without making mistakes. The sum of the scores from the cards is added, including how many mistakes are made. The test takes 2 minutes to complete, and can easily be performed on the sidelines or ringside.

The MACE is more detailed. MACE takes 15–20 minutes to complete. It takes into account a person’s cognitive history. In addition, MACE combines answers to questions with a neurologic assessment. In short, it is a more detailed, comprehensive test. However, because it is longer, it cannot be easily administered “in the field.”

Dr. Galetta compared the K-D results to the more detailed MACE examination. The goal of the study was not to see if K-D was better than MACE. Instead, the doctors wanted to determine if there was a shorter test that could accurately assess a head trauma.

**WHAT WERE THE RESULTS?** In order to do this, they looked at many factors. First, they looked at

how the fighters performed on serial tests. What they found was that the fighters did well. In fact, most scores improved (a little) when the fighters took the test more than once. This makes sense. The fighters learned how to take the test, and performed better on subsequent tests. As one might expect, the fighters who did better on repeat testing were the ones who did not have a head injury during their boxing/MMA match.

In the group of fighters who had a head injury, Dr. Galetta found that their K-D scores were worse. Overall, the fighters who had a head injury performed the test 5 seconds slower than they did before the match. None of the fighters without head injury performed it slowly. In addition, it was rare for fighters to make a mistake. The ones who did were the ones who had a head injury.

MACE was given before the match to the MMA fighters only. The fighters who had head trauma, especially if they lost consciousness, failed the postfight MACE. When the MACE scores were compared to the K-D scores, there was a good correlation between the results of the 2 tests. In other words, it appeared that the K-D test was a reliable test whose results compared well with a more detailed, longer test.

**WHY IS THE STUDY IMPORTANT?** Dr. Galetta and colleagues did not propose that the shorter test should replace the longer test. Instead, what they showed was that the shorter test was fast, reliable, and reproducible. When compared to the longer test, K-D did a good job in assessing problems due to head injury. In short, the K-D test may be a quick way to assess athletes who sustain a head injury during a sports match.

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# About concussion

**WHAT IS CONCUSSION?** Concussion is a type of mild brain injury. It is usually caused by hitting or jolting the head. The American Academy of Neurology defines concussion as “trauma-induced alteration in mental status that may or may not involve loss of consciousness.” In other words, a person who has a concussion does not need to pass out as a result of the injury. In fact, many people who have had a concussion never lost consciousness.<sup>2</sup>

Almost any sport can cause a head injury and therefore a concussion. American football and ice hockey players have the most concussions. However, concussions also occur in European football (soccer), wrestling, basketball, baseball, and softball. Mostly, concussions occur during games. Less often, head injuries and concussions occur during sports practice.<sup>2</sup> In college sports, concussion is common. McCrea et al.<sup>3</sup> reported the percentage of head injuries as follows: ice hockey (12.2%), football (8%), and soccer (4.8%). In high school students, McCrea estimated that up to 8% have had a concussion.

The symptoms of concussion vary. Common complaints are vacant stare, confusion, dizziness, memory problems, poor balance, and vomiting. However, not every person who has a concussion will have all of these symptoms. For some people, the symptoms may be very mild.

In general, there are 3 main categories of symptoms of concussion.

1. Somatic refers to bodily complaints. Headaches, tiredness, low energy, dizziness, and balance problems are a few examples of this.
2. Emotional refers to symptoms that are primarily related to changes in mood. For instance, irritability, depression, anxiety, and personality changes can be the main symptoms of concussion.
3. Cognitive refers to the way that a person thinks. A concussion can affect thinking by changing how quickly a person responds (they seem slower). A person might have trouble concentrating or focusing. They may become easily distracted.

There are several ways that concussions are graded. The lowest is grade I. In grade I concussion, the person is confused for less than 15 minutes, but never loses consciousness. Grade II means confusion

without loss of consciousness for more than 15 minutes. Grade III means that the athlete lost consciousness. Any loss of consciousness should be evaluated by a neurologic examination, and some type of imaging of the brain (MRI or CT).

In the past, doctors thought that children were less affected by head injuries than adults. However, more recent evidence suggests that the opposite may be true, and that children are more susceptible to the effects of head injuries than adults. In one study, high school football and soccer players were compared to college level athletes.<sup>2</sup> The high school athletes needed more time to recover from a concussion as compared to the older athletes.

Although these studies have focused on athletes, there is another at-risk group: soldiers. It is estimated that over 300,000 soldiers in Iraq have suffered from some type of head injury.<sup>4</sup> The Department of Veterans Affairs is very interested in concussion. They are conducting their own studies, but it is clear that studies of head injury in athletes can be important to many other people (and vice versa).

**POSTCONCUSSION SYNDROME** Most athletes recover fully from a concussion in hours, days, or (at most) weeks. The time to full recovery depends on the person as well as how he or she was injured. In addition, research has suggested that having a second concussion before recovering from the first can lead to serious problems with thinking, attention, concentration, and other brain functions. The most severe form of this is a condition called chronic traumatic encephalopathy. After many head injuries and concussions, a boxer can start to have the kinds of problems that happen when people have Alzheimer disease.

**TREATMENT OF CONCUSSION** The treatment needs to begin before the injury occurs. More specifically, parents and the athletes themselves need to consider how they can prevent a head injury. In some sports, like ice hockey, protective equipment is mandatory. In other sports, this type of equipment may be recommended, but not required. In short, prevention of the concussion is probably the most important aspect of treatment.

## EVALUATING A PERSON WHO HAS HAD A CONCUSSION

There are many ways to test a person who has had a concussion. Some of the tests can be performed on the sidelines. These tests are usually brief, and require no special equipment. For instance, the Graded Symptom Checklist (GSC) is a questionnaire that the person who had the concussion fills out. The checklist includes 17 symptoms that can occur after a head injury. The injured person rates or grades each of these, and a score is then assigned. The higher the score, the more severe the injury. The test takes 2 or 3 minutes to complete.<sup>3</sup>

Another test is the Standardized Assessment of Concussion (SAC). The examiner does a brief screen for neurologic and cognitive function which takes about 5 minutes. In addition, the SAC takes into account whether there was loss of consciousness, or if amnesia occurred as a result of the head injury. As with GSC, a score is assigned, with a higher score indicating a more severe head injury.<sup>3</sup>

The Immediate Postconcussion Assessment and Cognitive Test (ImPACT) is a computer test that the injured person takes. Unlike GSC or SAC, which do not require special equipment, ImPACT requires a computer. The computer administers a series of tests which are then scored.<sup>5</sup> Because the test is computer-driven, it is given in exactly the same way each time. In short, there is less room for errors that can occur if a person does the assessing.

The military has long been interested in head injuries. They have developed their own test: the Military Acute Concussion Evaluation (MACE). MACE uses a history of the person's thinking, and combines it with memory testing and a neurologic screen. It usually takes 15–20 minutes to complete.<sup>1</sup> Depending on the score, MACE then recommends more detailed testing for brain injury.

Finally, there is detailed neuropsychological testing. This usually takes about 30 minutes (or more), and is administered by a specially trained person.

Neuropsychological testing is made up of many separate tests. These assess several brain functions, including both word-related and visual tasks.<sup>3</sup> They are complicated tests, and usually are not performed on the sidelines. Instead, they are usually done in the first few days following the head injury.

The above tests have been studied carefully. The tests are reliable. They can be used to assess the severity of a head injury. Some are quick, while others require more time to complete, special equipment, and specially trained personnel. This was one of the reasons that Dr. Galetta and colleagues studied the K-D test. It is easy to perform, can be done right after the head injury, and does not require a specially trained person to complete. Although further testing is needed, this test offers yet another way to quickly and accurately assess head injuries.

## FOR MORE INFORMATION

AAN.com for Patients & Caregivers

<http://patients.aan.com/>

Mayo Clinic Information

[http://bit.ly/MayoClinic\\_Concussion](http://bit.ly/MayoClinic_Concussion)

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Steven Karceski

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