Editorial

The Concussion Puzzle: 5 Compelling Questions

Kevin M. Guskiewicz

Sport-related concussion has received significant attention in recent years. Media coverage of multiple injuries to several high-profile athletes, some of whom were forced into retirement because of repeated concussions, has created a welcome awareness among sports medicine personnel and the general public. Many of the questions that researchers have failed to address in the past are now being studied. Despite the complexities associated with studying sport-related concussion, answers to some of the more intriguing questions are on the horizon.

1. Which concussion grading scale and return-to-play guideline is the best?

Currently, at least 16 different grading systems are proposed in the literature. Although most systems are considered safe, clinicians often question their practicality. Most are based on limited scientific data, if any, and therefore, none has emerged as the ''gold standard.'' Much emphasis is placed on loss of consciousness and amnesia, when fewer than one third of all sport-related concussions involve either condition. Perhaps grading of the injury should take place after total symptom resolution, as length of symptoms (be it minutes, days, or weeks) is an important factor that is often overlooked. In any event, the sports medicine team is best equipped when a plan is agreed on by both the athletic trainer and the team physician. Once a plan is in place, consistent use of that plan should provide safe decision making.

2. After how many concussions should a career be ended?

We do not currently know the answer to this question, and researchers and clinicians should be reluctant to state a specific number. No two concussions are the same. A great deal of variability exists in the amount of transient impairment associated with these injuries, depending on the mechanism, location, forces applied to the brain, and resultant tissue damage. Some evidence suggests that if injury severity remains constant, total recovery time (ie, time until asymptomatic) increases with each successive injury. This rate of recovery is the telling factor and emphasizes the need for baseline neuropsychological and balance testing for measuring recovery after repeated injuries.

3. Which is the best battery or combination of concussion tests to conduct?

Clearly, the research community is making progress in this area. Assessment of concussion can be likened to putting together a puzzle with many pieces. Decisions should not be made based on the fitting of only one piece of the puzzle. Some neuropsychological tests are simply not sensitive enough to detect neurocognitive deficits in athletes suffering from concussion, while others are rising to the surface as more efficient tests. Computerized testing appears to be the wave of the future, saving significant time and resources while permitting group baseline testing; however, most of these programs have not yet been validated. Postural stability tests, whether performed on a forceplate or as more simple clinical tests, appear to offer valid information regarding the athlete's motor domain after injury. The most important piece of the puzzle must be symptom resolution. All comprehensive concussion assessment protocols should place symptom resolution and techniques for determining the status of an athlete's symptoms at the forefront.

4. Are long-term deficits associated with repeated concussion?

Again, more research is needed. The one thing that is obvious to most clinicians and researchers is that several pieces to the ''concussion puzzle'' dictate outcome. In some cases, poor outcome is the result of a severe injury, whereas in other cases, it is the result of an excessive number of previous injuries. Early research seems to suggest that recovery after recurrent injury is delayed when compared with an earlier injury. We also know that athletes with a history of concussion have a 3-fold increase in risk of further injury after 1 previous injury. Extrapolation of these findings could suggest that recurrent injury is associated with long-term deficits, but longitudinal studies will be needed to confirm this theory.

5. Are long-term cognitive deficits associated with soccer heading, and should headgear be made mandatory for youth soccer players?

There is no proof of neurocognitive impairment in collegiate soccer players with a long history of soccer participation or a history of concussion, or both. Furthermore, no compelling evidence suggests that headgear is necessary in youth soccer players at this time. Some investigators propose that headgear may even increase rotational loads and increase contact time with the head.

I believe that you will find that this special issue on sport-related concussion provides the answers to many of these very important questions. Answers to other questions that have yet to be answered are just on the horizon and will eventually provide athletic trainers and team physicians with answers that are likely to change the way in which this very complex injury is managed. I thank all of the authors, reviewers, editors, and editorial staff for their commitment to this project. I hope that this special issue on sport-related concussion will become your most useful and referenced holding for managing cases involving an athlete with concussion.

Editor's Note: Kevin M. Guskiewicz, PhD, ATC, is Associate Professor in the Department of Exercise and Sport Science and the Department of Orthopaedics, University of North Carolina at Chapel Hill, Chapel Hill, NC, and Guest Editor for this special issue of the Journal of Athletic Training.