Concussion and the Student-Athlete: Considerations for the Secondary School Setting

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medical professionals and sports leaders have misunderstood sport-related concussions for decades. For health care providers, concussions are not a new phenomenon. Back when American football was just beginning to take off on college campuses, team physicians from Harvard College tracked the number of concussions that occurred during a single season in 1905 — they counted 19 concussions. Despite this number, little was done within the physician groups at that time to address these injuries because they faced the same situation as today: There was no visible physical proof (Harrison, 2014). This confusion drove the need for more education and unity — not only among medical professionals but also within the sports community — to find ways to effectively diagnose and treat student-athletes who have suffered a concussion. Leaders in the medical field interested in sport-related concussions have joined together in the hope of creating an agreed-upon definition, standardized evaluation and treatment protocol for student-athletes who have sustained a concussion (Aubry et al., 2002; Giza et al., 2013; Harmon et al., 2013; McCrory et al., 2005, 2009, 2013). During the past five years, sports leaders from the professional to the recreational levels have aligned with the medical community to create policies and procedures aimed at protecting student-athletes from these devastating head injuries.
It is the purpose of this article to consolidate the most recent concussion information and provide administrators, coaches and teachers with the means to develop and refine their schools’ concussion programs.

Concussions occur within a variety of sports, from football to cheerleading, and student-athletes can present with an array of symptoms. Concussions also range in severity. A student-athlete may appear healthy but may be struggling with symptoms related to the head injury, making it challenging for others to fully comprehend the extent of the impairment (Halstead et al., 2013). In addition, concussions are not isolated to sports participation and affect more than playing time. Concussions may also affect a student-athlete’s ability to function academically. Student-athletes are students first, which puts the responsibility on school districts and athletic departments to develop policies based on current and evolving medical and academic best practices. Therefore, it is the purpose of this article to consolidate the most recent concussion information and provide administrators, coaches and teachers with the means to develop and refine their schools’ concussion programs. School personnel will be able to use this information to create or revise policies and procedures for concussion management, thereby making each school community a safer place for student-athletes.

**Background**

For many years, there was no universal protocol for concussion evaluation and management, and it was left up to the health care professional or coach to choose from various guidelines from a multitude of sources (Lovell, Collins, Iverson, Johnston, & Bradley, 2004). Previous guidelines, such as the Cantu system and American Academy of Neurology guidelines, focused mainly on grading systems (i.e., Grade 1, Grade 2, Grade 3), which based the assessment of a concussion on loss of consciousness and how long it took for symptoms to resolve (Guskiewicz et al., 2004). In 2001, the creation of the first international consensus statement on sports concussions acknowledged that loss of consciousness could still occur but was no longer required to diagnose a concussion, nor does it determine the severity of a concussion (Aubry et al., 2002). The presence of a single symptom was enough to suspect a concussion, and returning to play on the same day or to the same event was not advised when a concussion was suspected.

Since 2001, there have been additional meetings by various medical groups, such as the International Conference on Sports Concussions (2001, 2004, 2008, 2012), the National Athletic Trainers’ Association (2004, 2014), the American Academy of Neurology (1997, 2013), the American Medical Society for Sports Medicine (2013), and other renowned medicine groups, where concussion guidelines and protocols have been discussed and continue to evolve. These meetings produced concussion evaluation tools such as the Sports Concussion Assessment Tool that enabled medical professionals and coaches to identify concussions as they occurred (McCrory et al., 2005, 2009, 2013). These international conferences gather experts to meet in one location to discuss current evidence, data and information on concussion evaluation, management and current research areas. Based on evidence presented during the conferences, revisions are often made to promote current knowledge and best practices, and this information is accessible to not only medical professionals, but also the sports community.

**What Is a Concussion?**

After considerable research and debate, medical experts have agreed that concussions are more than a “ding” or “getting one’s bell rung” (Guskiewicz et al., 2004). According to a consensus statement from the November 2012 International Conference on Concussion in Sport, a concussion is “a brain injury and is defined as a complex pathophysiological process affecting the brain, induced by biomechanical forces” (McCrory et al., 2013, p. 250). Although this definition has stayed consistent since the 2001 conference, the way concussions are evaluated and treated has improved.

It is important to understand that although a concussion is often viewed or described as a bruise to the brain, it is certainly more complex. A concussion is actually classified as a mild traumatic brain injury (mTBI) and falls on the less severe end of the spectrum of all brain injuries (Harmon et al., 2013). A concussion can occur in a variety of ways. A direct blow to the head or an indirect force to the body can cause rotational or linear movements of the skull and can jolt the brain (Harmon et al., 2013; Littleton & Guskiewicz, 2013; McCrory et al., 2013). One such example of an indirect force is a student-athlete who is hit from the side and whose head whips back and forth or side to side, causing a rapid acceleration or deceleration of the brain (Broglio et al., 2014). This shaking causes a reaction at the cellular level in the brain that results in decreased blood flow, increased energy demand and an imbalance in brain function (Barkhoudarian, Hovda, & Giza, 2011).

When trying to identify whether a concussion has occurred, a student-athlete will typically report immediate symptoms and show signs of neurological impairment; however, it may take some time for signs and symptoms to fully develop, making it very important to complete a thorough evaluation and
follow-up (McCrory et al., 2013). If there is any reason or cause to suspect that a student-athlete may have sustained a concussion, a series of follow-up examinations should occur during the next several hours to determine if any signs or symptoms develop (Harmon et al., 2013; McCrory et al., 2013). Though every concussion presents differently, some typical symptoms include headaches, feeling “out of it” or slowed down, sensitivity to noise and lights, and fatigue. Common signs are slow reaction or response time, confusion, change in behavior — such as extreme or out-of-the-ordinary emotional responses — and difficulty focusing when being addressed (Harmon et al., 2013; McCrory et al., 2013). For a full list of common signs and symptoms, refer to Table 1.

Unlike in the past, a student-athlete does not need to lose consciousness to be diagnosed with a concussion (Aubry et al., 2002; McCrory et al., 2005, 2009, 2013). To a coach, physical education teacher or administrator, a concussion may seem to be an alarming injury to manage, especially in the absence of a health care professional, such as an athletic trainer. It is common for student-athletes experiencing symptoms of a concussion to visit a physician or emergency department where a diagnostic tool such as a computed tomography (CT) scan or magnetic resonance imaging (MRI) may be ordered. These diagnostic tests will determine whether a more severe injury, such as an intracranial hemorrhage or skull fracture, is present (Giza et al., 2013). However, in the case of a concussion, the function of the brain is affected rather than the structure, in which case it would not be visible on a CT scan or MRI (McCrory et al., 2013). Even with a negative scan, a student-athlete who is experiencing any concussion-related symptoms likely still has a concussion and will need a follow-up evaluation with an appropriately trained health care professional.

**Concussion Protocol and Policy**

The current concussion crisis has led to a rise in awareness and increased demand for proper management of these mTBIs. The medical community responded with guidelines from various medical groups and conferences. In 2009, Washington became the first state to pass a youth concussion law. The “Zackery Lystedt Law” came in response to an incident in which a junior high football player became permanently disabled following a mismanaged concussion sustained during a game. During the past nine years, 25 student-athletes have died as a result of head injuries related to participation in football, and six of these student-athletes died in 2013 alone (Kucera, Klossner, Colgate, & Cantu, 2014). In an effort to prevent further student-athlete tragedies, all 50 states and the District of Columbia have now passed individual legislative policies, ranging from increasing education among coaches and parents to requiring written medical clearance before a student-athlete can return to athletic participation after suffering a concussion (National Conference of State Legislatures, 2014). While each law differs, the essential components of developing guidelines can be found in the legislation and management protocols. Additional information regarding each state’s concussion legislation can be found through the National Conference of State Legislatures (2014) *Traumatic Brain Injury Legislation* (see Table 2).

With the passing of concussion legislation, each school or school district must ensure that they are compliant with the rules and regulations outlined for their individual state. This joint effort of creating or revising a school’s plan based on state law or high school association policies can be made easier by establishing a concussion management committee composed of individuals from multiple disciplines including administration, athletics, sports medicine and academics. This diverse group will ensure that the best interests of the student-athletes are taken into account. Further, each discipline will have an opportunity to play an active role in creating and maintaining a policy that will ultimately benefit the entire school community. In addition to school personnel, inviting local health care professionals to be part of the committee will help to form the medical aspect of the concussion policy and establish a continuum of care for injured student-athletes.

Once the committee has been established, the first task should be to review and understand the components of their individual state concussion law. However, these guidelines are
### Table 2. State Law Components

<p>| State Law Components                                                                 | AK | AZ | AL | AR | CA | CO | CT | DE | DC | FL | GA | HI | ID | IL | IN | IA | KS | KY | LA | ME | MD | MA | MI | MN | MS |
|-------------------------------------------------------------------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| Information sheet given to parent/guardian and student-athlete                     | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  |
| Must be signed by parent/guardian and/or student-athlete                            | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  |
| Must advise on risk of continuing to play with concussion/head injury               | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  |
| Training/education for all coaches                                                  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  |
| Immediate removal of athlete with suspected concussion/head injury                  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  |
| Notify parent/guardian of injury                                                    | X  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Athlete must be evaluated by physician                                             | X  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Athlete must be evaluated by health care professional                              | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  |
| Athlete must receive written clearance before returning to sports                   | X  | X  | X  | X  | X  | X  | X  | ?  | X  |    | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  |
| Athlete must receive written clearance from a physician prior to return             | X  |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
| Athlete must complete a return-to-play progression before returning                |    | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  | X  |</p>
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*Source: National Conference of State Legislatures (2014).*
just minimum requirements, and schools may still want to create their own policies with more stringent rules and procedures. Many states post concussion policies on their department of education or interscholastic athletic/activities association websites. These model policies are based on the best current practices outlined by the various consensus statements, the Centers for Disease Control and Prevention policies, and other nationally recognized organizations. Reviewing the policies and guidelines of other states, schools and school districts will also help provide the concussion management team with a full spectrum of what can and should be considered when dealing with concussion prevention, education and management. These protocols and policies should be revised and amended annually to stay current with new information and best medical practices.

**Education**

In most states, educational training is required for all coaches prior to the start of a sports season. Additionally, student-athletes and their parents need to provide written documentation of receipt and review of educational information on concussions before student-athletes are allowed to participate in any form of athletics, including tryouts. These processes are typically required on an annual basis. Key points in the educational material should include an explanation of the nature and risk of concussions with emphasis on the negative effects of playing when a concussion is suspected or diagnosed, signs and symptoms of a concussion or head injury, what to do if one suspects a concussion, and the return-to-play process student-athletes must complete before resuming participation. Acknowledging receipt of this concussion education forces student-athletes and their parents to be accountable for reporting a possible concussion to coaches or school medical personnel. Educational training for coaches requires them to be responsible for recognizing a possible concussion and removing a student-athlete who may have a concussion from participation. All groups should also be educated on proper technique for their sport, safety considerations to help minimize the possibility of injuries, and the use and limitations of protective equipment. Providing education to coaches, student-athletes and parents gives ownership to each group in recognizing, reporting and reducing the incidence of possible concussions.
Recognition, Removal and Return

Recognizing that a concussion has occurred is an important step in managing head injuries. This responsibility falls on the shoulders of the coach, athletic trainer and other qualified health care professionals. It is important to encourage student-athletes to self-report symptoms or possible injury; however, if any coach, referee, athletic trainer or health care professional suspects a student-athlete may have a head injury, the student-athlete needs to be immediately removed from participation and evaluated for a possible concussion. Continuing to play with a concussion or symptoms of a possible concussion can not only result in a more severe brain injury, but could also result in permanent disability or even death. Reinforcing open and accurate communication regarding the reporting of concussions is a vital piece of the concussion management program. This communication should be stressed in the planning, review and implementation of each school’s protocol.

Once a student-athlete is removed from participation for a suspected concussion, he or she must be evaluated by an appropriate medical professional as per each state’s concussion law, be given written clearance, and complete the appropriate return-to-play protocol before being allowed to resume any athletic activity. No states allow a student-athlete who has been removed for a possible concussion to return on the same day. However, if the student-athlete is evaluated by an appropriate health care professional or physician and is found to have not sustained a concussion, he or she may resume athletic participation. It is essential that the health care professional evaluating the student-athlete be knowledgeable and experienced in concussion assessment and management.

When writing or revising a concussion policy, knowing who may be allowed to evaluate and treat a student-athlete with a concussion is important. Some state laws specifically indicate that only a physician can evaluate and clear a student-athlete, while other states allow for any licensed, registered or certified health care provider with concussion training to treat a possible concussion. In addition to provider restrictions, some state laws also require other components to be addressed when evaluating and treating student-athletes with a concussion. For example, Tennessee requires the use of a concussion symptom checklist when removing a student-athlete with a suspected concussion from play. In New Hampshire and Texas, the parent or legal guardian is required to give permission for his or her child to return to athletics after completing the return-to-play requirements and receiving written medical clearance. While not all state laws entail the same components or levels of restriction, each school reserves the right to add more stringent guidelines to their concussion policy. Individual schools or districts may want to review other state laws to determine if further guidelines are needed for their policies (see Table 2 or National Conference of State Legislatures, 2014, for more specific details).

Every student-athlete returning from a concussion must be completely symptom-free and have written medical clearance from the treating health care professional or physician on file with the school before resuming any athletic activity. It is also advisable that the student-athlete not begin the return to athletics until he or she has resumed full academic activity and normal daily activities outside of school. Though not all state laws require a gradual return-to-play progression, it is part of the current best practices, which are listed in Table 3 (Broglio et al., 2014; Giza et al., 2013; Harmon et al., 2013; McCrory et al., 2013). The gradual return-to-play progression should also be outlined in the school’s concussion management policy to avoid any confusion among the involved parties when a student-athlete begins the process of returning to athletics. Standard return-to-play progressions include the steps outlined in Table 4.

Table 3. Best Practices for Concussion Management

1. Remove student-athlete from practice or game.
2. Complete a graded symptom checklist (coach or certified athletic trainer).
4. Have athlete evaluated by a certified athletic trainer and/or state/school-approved health care provider/physician trained in the evaluation and management of concussions.
5. Provide athlete with academic adjustments as needed.
6. Have athlete provide written clearance from the treating physician or approved health care provider.
7. Have athlete complete gradual return-to-play protocol prior to returning to full athletic activity.

Source: McCrory et al. (2013).

Table 4. Functional/Gradual Progression for Return to Play

1. No activity: Promote physical and cognitive rest while symptomatic.
2. Light aerobic exercise: walking or stationary bike, nonimpact activities, low-level balance exercises
4. Sport-specific exercise or drills: jogging, weightlifting, dynamic balance exercises
5. Noncontact practice drills: sport-specific activities, plyometrics, aggressive strength exercises
6. Full-contact practice
7. Return to full participation (games)

*Extra day in McCleod Sports Medicine’s return-to-play guidelines.
Sources: Broglio et al. (2014), McCrory et al. (2013).
Each step must be completed without the reproduction of any concussion symptoms prior to progression to the next level. No more than one step may be completed in a 24-hour period, and the individual charged with supervising the return-to-play process should appropriately document each step.

Academic Adjustments

It is common practice for physicians to prescribe academic adjustments for a student-athlete with a concussion. Common adjustments include frequent breaks throughout the day, decreased workload, no test taking, and removal from physical education class and Reserve Officers’ Training Corps. As such, it is advisable to educate all school staff and teachers on concussions and the management of these injuries. With the rise in diagnosed concussions, it is more likely the staff will come in contact with a concussed student-athlete during the school year. Teachers must be educated on how to make the necessary adjustments for each individual, as well as how to provide valuable feedback on how the student-athlete is doing in class during the recovery process. As the student-athlete improves, the teacher can increase cognitive demands and aid in the return to normal classroom participation. However, if the student-athlete has difficulty progressing, the teacher will be able to relay that information to a member of the school’s concussion team so that the student-athlete is provided with the necessary adjustments. The information from teachers may also be used in follow-up physician visits to aid in the return-to-play decision.

One established concussion management program that serves as a good example and reference for creating or enhancing a concussion management policy is the program known as REAP. It stands for Remove/Reduce, Educate, Adjust/Accommodate, and Pace and follows the concept of treating a concussion from a multidisciplinary team approach (McAvoy, 2013).

The creation of a school-wide or district-wide concussion management policy will provide a safe and supportive environment for student-athletes, coaches, administrators, medical professionals and parents.

Created by Dr. Karen McAvoy in response to the death of a student-athlete following a traumatic brain injury, the REAP program goes into effect at the moment of injury. It takes into account all aspects of a student-athlete’s life, from family to school, and combines this information with medical treatment, which makes the injury response community-wide and all-encompassing. The REAP program is now utilized not only by the Rocky Mountain Hospital for Children Center for Concussion but other states and clinics around the country. To view more information regarding the REAP program, please visit the Center for Concussion at Rocky Mountain Hospital for Children at http://rockymountainhospitalforchildren.com/service/concussion-management-reap-guidelines.

Following review by the concussion management team, the approved policy should be put into action and practiced. Providing proper education on the policy ensures that the school faculty and staff involved in concussion management know their responsibilities, which is crucial for the care of the student-athlete, as the process starts at the moment of injury and continues until the student-athlete returns to full participation both academically and athletically. An in-service or staff development meeting is a great way to review and practice for emergency situations and allows involved personnel to discuss and ask questions. Schools should also arrange an educational session for all students and their parents and should bring in local experts on concussions to explain the injury as well as the school’s concussion management policy. Allow time for any questions or concerns to be addressed. These educational sessions should be conducted early in the school year, preferably before the start of the athletic season, because many states require student-athletes and parents to sign a consent form acknowledging participation in concussion education.

Conclusion

There is still a long way to go to fully understand concussions and the accumulated effect of multiple concussions. Medical experts continue to search for connections and long-term effects, but concussions need to be addressed in the short term to protect the future of student-athletes and their sports participation. Preliminary studies of high school football athletes who sustain repetitive hits to the head without a diagnosed concussion have shown how damage to the brain can still occur (Talavage et al., 2014). Rule changes, limiting contact during practices, reducing full-contact practices, modifying techniques, and establishing national policies and laws can help address the risk for concussion in sport and minimize exposure to concussions. However, simply changing rules and policy does not change individuals’ perceptions.

The creation of a school-wide or district-wide concussion management policy will provide a safe and supportive environment for student-athletes, coaches, administrators, medical professionals and parents. A lack of education on concussions can lead to conflict among these individuals, but having a policy in place before an injury occurs can minimize misunderstanding or mishandling of concussion injuries. Because concussions...
in sports are still viewed negatively and young student-athletes are resistant to reporting when they have sustained a concussion, schools and coaches need to portray positive views and attitudes about these types of injuries (Chrisman et al., 2013; Register-Mihalik et al., 2013). Those who are closest to and have a significant influence on the perceptions and beliefs of the student-athletes need to take a proactive approach to dealing with concussions in sports, and coaches often fill this role and play a crucial part in how student-athletes respond to their injuries (Chrisman et al., 2013). Student-athletes need to feel safe to report a concussion to a coach, athletic trainer or teammate without being considered weak or embarrassed (Chrisman et al., 2013; Register-Mihalik et al., 2013). The creation and implementation of a concussion policy would proactively promote safe sport participation among today’s youth. It is the job of coaches, teachers, medical professionals and administrators to emphasize and ensure the importance of the health and well-being of the athlete above athletic performance or accomplishments.

References


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