

# Concussion Management and Diagnosis Best Practices

## Diagnosis and Management of Sport-Related Concussion Guidelines

### **Purpose:**

The *Safety in College Football Summit* resulted in inter-association consensus guidelines for three paramount safety issues in collegiate athletics:

1. Independent medical care in the collegiate setting;
2. Concussion diagnosis and management; and
3. Football practice contact.

This document addresses diagnosis and management of sport-related concussion in the collegiate setting for *all* sports.

### **Background:**

There are more than 42 consensus-based definitions of concussion. A recently published, evidence-based definition of concussion follows.<sup>1</sup>

Concussion is:

- a change in brain function,
- following a force to the head, which
- may be accompanied by temporary loss of consciousness, but is
- identified in awake individuals, with
- measures of neurologic and cognitive dysfunction.

Diagnosis and management of sport-related concussion is a clinical diagnosis based on the judgment of the student-athlete's health care providers.<sup>2</sup> The diagnosis and management of sport-related concussion is challenging for many reasons:

- The physical and cognitive examinations are often normal, and additional tests such as brain computerized tomography (CT), brain MRI, electroencephalogram and blood tests are also commonly normal. Although comprehensive neuropsychological tests may be a useful adjunctive tool supporting the diagnosis of sport-related concussion, there remains controversy regarding interpretation and utility as a clinical tool.
- The clinical effects of sport-related concussion are often subtle and difficult to detect with existing sport-related concussion assessment tools.
- The symptoms of sport-related concussion are not specific to concussion and it is challenging to evaluate a student-athlete who presents non-specific symptoms that may be related to other conditions.
- Sport-related concussion may manifest with immediate or delayed-onset symptoms. Symptom manifestation can vary between individuals and in the same individual who has suffered a repeat concussion.
- Modifying factors and co-morbidities -- such as attention deficit hyperactivity disorder, migraine and other headache disorders, learning disabilities and mood disorders -- should be

considered in making the diagnosis, in providing a management plan, and in making both return-to-play and return-to-learn recommendations.<sup>3-7</sup>

- “Signal detection” on clinical measures (e.g., cognitive and balance testing) often quickly diminishes in the acute setting of early recovery. Although cognitive function and balance assessed within 24 hours with various sideline tests (Standardized Assessment of Concussion [SAC] and Balance Error Scoring System, respectively) have been shown to be useful in diagnosing concussion, these tests often normalize within a few days and cannot be used to make a definitive diagnosis.
- Student-athletes may underreport symptoms and inflate their level of recovery in hopes of being rapidly cleared for return to competition.<sup>8,9</sup>
- Clinical assessment of sport-related concussion is a surrogate index of recovery and not a direct measure of brain structure and functional integrity after concussion.

In summary, the natural history of concussion remains poorly defined, diagnosis can be difficult, there are often few objective findings for diagnosis or physiological recovery that exist for clinical use, and there often remains a significant reliance on self-report of symptoms from the student-athlete.

The *NCAA Concussion Policy and Legislation* mandates that institutions implement the following:<sup>10</sup>

1. An annual process that ensures student-athletes are educated about the signs and symptoms of concussion;
2. A process that ensures a student-athlete who exhibits signs, symptoms or behaviors consistent with a concussion shall be removed from athletics activities and evaluated by a medical staff member with experience in the evaluation and management of concussion;
3. A policy that precludes a student-athlete diagnosed with a concussion from returning to athletic activity for at least the remainder of that calendar day; and
4. A policy that requires medical clearance for a student-athlete diagnosed with a concussion to return to athletics activity as determined by a physician or the physician’s designee.

### **Guidelines:**

The goals of developing guidelines for the diagnosis and management of sport-related concussion are: (1) helping athletic health care providers to diagnose and manage sport-related concussion; (2) developing prevention strategies for sport-related concussions and repeat sport-related concussion; (3) promoting sport-related concussion injury resolution; (4) minimizing factors that contribute to prolonged or recurrent symptoms of sport-related concussion; and (5) preventing or minimizing complications of other co-morbidities that may accompany sport-related concussion (e.g., ADHD, migraine and other headache disorders, learning disabilities and mood disorders).

### **Concussion Management Plan:**

Institutions should make their concussion management plan publically available, either through printed material, their website, or both. Guideline components of a concussion management plan are:

1. Education: Institutions should provide applicable NCAA concussion fact sheets or other applicable educational material annually to student-athletes, coaches, team physicians, athletic trainers, and athletics directors. There should be a signed acknowledgement that all parties have read and understand these concussion facts and their institution's concussion management plan.
2. Pre-participation assessment: A one-time, pre-participation baseline concussion assessment for all varsity student-athletes should include, but not necessarily be limited to:
  1. A brain injury/concussion history;
  2. Symptom evaluation;
  3. Cognitive assessment; and
  4. Balance evaluation.

The team physician should determine pre-participation clearance and/or the need for additional consultation or testing.<sup>11</sup>

3. Recognition and diagnosis of concussion: All student-athletes who are experiencing signs, symptoms or behaviors consistent with a sport-related concussion, at rest or with exertion, must be removed from practice or competition and referred to an athletic trainer or team physician with experience in concussion management. A student-athlete's health care provider experienced in the diagnosis and management of concussion should conduct and document serial clinical evaluation inclusive of symptom inventory and evaluation of cognition and balance. A student-athlete diagnosed with sport-related concussion should not be allowed to return to play in the current game or practice and should be withheld from athletic activity for the remainder of the day. Disposition decisions for more serious injuries such as cervical spine trauma, skull fracture or intracranial bleed, should be made at the time of presentation.
4. Post-concussion management: The foundation of sport-related concussion management is initial physical and relative cognitive rest as part of an individualized treatment plan.<sup>2</sup> Initial management of sport-related concussion is based on individual serial clinical assessments, taking a concussion history, modifying factors, and taking specific needs of the student-athlete into consideration. Such management includes, but is not limited to:
  1. Clinical evaluation at the time of injury. When the rapid assessment of concussion is necessary (e.g., during competition), symptom assessment, physical and neurological exam, and balance exam should be performed. Brief concussion-evaluation tools such as the Standardized Concussion Assessment Tool 3 (SCAT3), which includes the Standardized Assessment of Concussion (SAC), provide standardized methods and can be compared to a baseline evaluation.<sup>12</sup>

2. Assessment for head and cervical spine injury at time of injury and implementation of the emergency action plan, as warranted.
3. Transportation to the nearest hospital if any of following signs and symptoms are present: Glasgow Coma score less than 13; prolonged period of loss of consciousness (longer than 1 minute); focal neurological deficit; repetitive emesis; persistently diminished or worsening mental status or other neurological signs or symptoms; and potential spine injury.
4. Serial evaluation and monitoring for deterioration following injury. Upon discharge from medical care, both oral and written instructions for home care should be given to the student-athlete and to a responsible adult (e.g., parent or roommate) who should continue to monitor and supervise the student-athlete during the acute phase of sport-related concussion.<sup>12</sup>

### **Return to activity:**

Sport-related concussion is a challenging injury for student-athletes and, unlike other injuries, the timeline for return to full activity (including return-to-play and return-to-learn) is often difficult to project. The psychological response to injury is also unpredictable. Sometimes, student-athletes who are kept out of their sport for a prolonged period of time experience emotional distress related to being unable to participate in sport.<sup>13</sup> It is important that health care providers remain alert to the signs and symptoms of depression and other emotional responses to injury that can be particularly challenging following concussive injury.<sup>13</sup> A student-athlete's health care providers should verify the diagnosis instead of assuming that the student-athlete has prolonged concussion symptoms. These symptoms may represent post-concussion syndrome, sleep dysfunction, migraine or other headache disorders, or co-morbid mood disorders such as anxiety and depression.<sup>7</sup> Passive management, such as prolonged physical and cognitive rest, may be counter-productive in these scenarios.

### **Return-to-Play:**

Once a student-athlete has returned to his/her baseline, the return-to-play decision is based on a protocol of a stepwise increase in physical activity that includes both an incremental increase in physical demands and contact risk supervised by a physician or physician-designee.<sup>12</sup> Most return-to-play protocols are similar to those in the *Consensus Statement on Concussion in Sport* guidelines,<sup>2</sup> which outline a progressive increase in physical activity if the individual is at baseline before starting the protocol and remains at baseline throughout each step of the protocol. It is noteworthy that all return-to-play guidelines are consensus-based and have not been validated by evidence-based studies.<sup>14-15</sup> McCrea and colleagues<sup>16</sup> have reported that a symptom-free waiting period is not predictive of either clinical recovery or risk of a repeat concussion. Further, student-athletes have variable understanding of the importance of reporting possible concussion symptoms.<sup>8-9</sup> In summary, it should be recognized that current return-to-play guidelines are based on expert consensus.

There is emerging evidence that focused exercise or recovery techniques may be utilized before full recovery has occurred, but more study is needed. Given the paucity of scientific evidence

regarding return-to-play and expert consensus documents that have been published, adherence to consensus guidelines is recommended. However, it is important to stress an individualized approach for return-to-play. Some student-athletes may have minimal concussive symptomatology with minimal symptom duration and no modifiers (conditions that may prolong recovery such as prior concussion, migraine, ADHD, depression/anxiety). In scenarios of this nature, and with experienced clinicians in a highly select setting, the return-to-play protocol may be modified.<sup>17</sup> In contrast, if a student-athlete has a concussion history, increased symptom burden or duration, or has symptoms for three to four weeks with other concussion modifiers, then the return-to-play progression should proceed more cautiously and each stage may take more than a day.<sup>12</sup>

Distinctive neurological deficits, such as vestibular or oculo-motor dysfunction, should be specifically addressed to avoid prolonged return-to-play. For example, if a student-athlete suffers from vestibular dysfunction as a manifestation of sport-related concussion, and is unable to progress in the return-to-play protocol, it is important to address the specific vestibular dysfunction rather than to simply return the student-athlete to the previous level of return-to-play progression.<sup>7</sup> In other words, ‘rest’ can sometimes lead to adverse outcomes if an accurate diagnosis based on neurological dysfunction is not made. The guidelines presented herein serve as a general guide and are not meant to be prescriptive.

### **Stepwise progression:**

The initial management of sport-related concussion is relative physical and cognitive rest. Athletes diagnosed with sport-related concussion must be removed from play and must not return to sport-related activity for at least one calendar day and are to be evaluated by a health care provider with expertise in sport-related concussion. Once a concussed student-athlete has returned to baseline level of symptoms, cognitive function and balance, then the return-to-play progression can be initiated, as follows in this general outline:

1. Light aerobic exercise such as walking, swimming or riding a stationary bike. No resistance training. If asymptomatic with light aerobic exercise, then;
2. Mode, duration and intensity-dependent exercise based upon sport. If asymptomatic with such exertion, then;
3. Sport-specific activity with no head impact. If asymptomatic with sport-specific activity, then;
4. Non-contact sport drills and resumption of progressive resistance training. If asymptomatic with non-contact drills and resistance training, then;
5. Full-contact practice. If asymptomatic with full-contact practice, then;
6. Return-to-play. Medical clearance will be determined by the team physician/physician designee, or athletic trainer in consultation with a team physician.

At any point, if the student-athlete becomes symptomatic (i.e., more symptomatic than baseline), or scores on clinical/cognitive measures decline, the team physician should be notified and the

student-athlete should be returned to the previous level of activity. Final determination of return-to-play ultimately resides with the team physician/physician designee.

### **Return to academics:**

Return to academics (return-to-learn) is a parallel concept to return-to-play,<sup>6,18-20</sup> but has received less scientific evaluation. Return-to-learn guidelines assume that both physical and cognitive activities require brain energy utilization, and that after a sport-related concussion, brain energy may not be available for physical and cognitive exertion because of a brain energy crisis.<sup>3</sup> Return-to-learn should be managed in a stepwise program that fits the needs of the individual, within the context of a multi-disciplinary team that includes physicians, athletic trainers, coaches, psychologists/counselors, neuropsychologists, administrators as well as academic (e.g. professors, deans, academic advisors) and office of disability services representatives. The return-to-learn recommendations outlined below are based on expert consensus. Like return-to-play, it is difficult to provide prescriptive recommendations for return-to-learn. The student-athlete may appear physically normal but may be unable to perform as expected due to concussive symptomatology.

### **Stepwise progression:**

As with return-to-play, the first step of return-to-learn is relative physical and cognitive rest. Relative cognitive rest involves minimizing potential cognitive stressors, such as school work, video games, reading, texting and watching television. Data from small studies suggest a beneficial effect of cognitive rest on concussion recovery.<sup>20</sup> For the college student-athlete, consideration should be given to avoiding the classroom for at least the same day as the sport-related concussion. The period of time needed to avoid class or homework should be individualized. The gradual return to academics should be based on the absence of concussion symptoms following cognitive exposure. The consensus to date includes:<sup>3,19</sup>

1. If the student-athlete cannot tolerate light cognitive activity, he or she should remain at home or in the residence hall.
2. Once the student-athlete can tolerate cognitive activity without return of symptoms, he/she should return to the classroom, often in graduated increments.

At any point, if the student-athlete becomes symptomatic (i.e., more symptomatic than baseline), or scores on clinical/cognitive measures decline, the team physician should be notified and the student-athlete's cognitive activity reassessed.

The extent of academic adjustments needed should be decided by a multi-disciplinary team that may include the team physician, athletic trainer, faculty athletics representative or other faculty representative, coach, individual teachers, neuropsychologist and psychologist/counselor. The level of multi-disciplinary involvement will vary on a case-by-case basis. The majority of student-athletes who are concussed will not need a detailed return-to-learn program because full recovery typically occurs within two weeks. For the student-athlete whose academic schedule requires some minor modification in the first one to two weeks following a sport-related

concussion, adjustments can often be made without requiring meaningful curriculum or testing alterations.

For those student-athletes whose symptoms persist for longer than two weeks, there are differing ways to access academic adjustment or accommodations. The student-athlete may need a change in his or her class schedule; special arrangements may be required for extended absences, tests, term papers and projects. Many institutions offer “provisional or temporary” accommodations for individuals who have impairments that are short-term in nature – six months or less (such as a broken arm or concussion). Such accommodations are often accessed through the disability services office.

A more difficult scenario occurs when the student-athlete experiences prolonged cognitive difficulties. In this case, considerations should include neuropsychological evaluation to: (a) determine the nature and severity of cognitive impairment, and (b) identify the extent to which psychological issues may be present and may be interacting with the cognitive processes. Institutions can develop a detailed academic plan that specifies the support services available for that student-athlete. The student-athlete can also choose to disclose the documentation to the disability office in order to seek long-term accommodations or academic adjustments. The disability office will verify if the impairment is limiting a major life activity per the Americans with Disabilities Act. Accommodations or academic adjustments are often provided in order to ‘level the playing field’ for the student-athlete with prolonged cognitive difficulties resulting from a concussion. A detailed academic plan coupled with accommodations can provide the needed support for a student-athlete as he or she returns to learning after a concussion.

The successful implementation of return-to-learn depends on several variables:

- Recognition that concussion symptoms vary widely among student-athletes, and even within the same individual who may be suffering a repeat concussion.
- Identification of a point person or case manager for the student-athlete who can navigate the dual obligations of academics and athletics.
- Identification of co-morbid conditions that may impair recovery, such as migraine or other headache conditions, attention-deficit hyperactivity disorder, anxiety and depression, or other mood disorders.
- Identification of campus resources that can help assure that student-athletes are provided their full rights during this transition period.

Campus resources vary, and may include the following:

- *Learning specialists.* Many college campuses have certified learning specialists who have specialized knowledge of medical conditions such as concussion and post-concussion syndrome. They usually work directly with the disability office.
- *Office of disability services.* Most campuses have a disability office that is responsible for verifying each student’s impairment under the Americans with Disabilities Act Amendments Act (ADAAA). Sometimes there is a separate disability office and ADAAA office. In this

case the first resource is the campus disability office. Concussion and mild traumatic brain injury are covered under ADA.

It is advisable for the concussed student-athlete's medical team to identify an academic point person and to be certain this academician is interwoven into the medical management plan. Because return-to-learn is often under-managed and under-recognized, there should also be broad discussions of this important paradigm with athletics departments across the country, engaging organizations such as the National Association of Academic Advisors for Athletics, the American College Personnel Association, NASPA, Student Affairs Administrators in Higher Education, the Coalition on Intercollegiate Athletics, National Athletic Trainers Association, College Athletic Trainers Society, American Medical Society for Sports Medicine and other allied organizations. Student-athletes are more likely to return successfully to full classroom activity in the setting of a proactive and well-integrated management plan.

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**\*This Consensus Best Practice, Diagnosis and Management of Sport-Related Concussion, has been endorsed by:**

- American Academy of Neurology
- American College of Sports Medicine
- American Association of Neurological Surgeons
- American Medical Society for Sports Medicine
- American Orthopaedic Society for Sports Medicine
- American Osteopathic Academy for Sports Medicine
- College Athletic Trainers' Society
- Congress of Neurological Surgeons
- National Athletic Trainers' Association
- NCAA Concussion Task Force
- Sports Neuropsychological Society