

**IOWA STATE UNIVERSITY SPORTS MEDICINE
STANDARD OPERATING PROCEDURES FOR THE ATHLETIC TRAINER
MEDICAL EMERGENCIES
Cerebral Concussions**

This plan is intended to meet all policy requirements set forth by the NCAA Executive Committee and the Big 12 Conference on the prevention, identification, evaluation, and follow-up management of concussions. This plan is endorsed by the university employed team physician and fully supported by the Director of Athletics. It is understood that according to this plan, "a student-athlete who exhibits signs, symptoms, or behaviors consistent with a concussion shall be removed from practice or competition and evaluated by Sports Medicine personnel (either athletic trainer or physician) with experience in the evaluation and management of concussion." Based on results of the clinical evaluation and comparison to baseline testing, any student-athlete diagnosed with a concussion shall not return to activity for the remainder of that calendar day and will enter a concussion follow-up management program. Details of identification, evaluation, management, return-to-learn, and return-to-play procedures are contained in this document. A bibliography of all resources used to develop this program is listed at the end of the document.

Definition of Concussion (as per the Consensus Statement on Concussion in Sport 4th International Conference on Concussion in Sport Held in Zurich, November 2012)

Concussion is defined as a subset of mild traumatic brain injury (MTBI) and is a complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathological and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:

1. *Concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head.*
2. *Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously. However, in some cases, symptoms and signs may evolve over a number of minutes to hours.*
3. *Concussion may result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.*
4. *Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course; however, it is important to note that, in a small percentage of cases, post-concussive symptoms may be prolonged.*

Pre-Season Education of Student-Athletes, Coaches, and Medical Staff

Education on concussions will be performed annually for all student-athletes, coaches, and medical staff during which a concussion fact sheet made available by the NCAA will be presented. Each person will review the concussion fact sheet and individually sign a concussion education acknowledgement statement confirming their awareness and responsibilities of reporting signs and symptoms of concussion to the medical staff for evaluation (see accompanying sheets). Student-athlete acknowledgment forms will be placed in their permanent athletic health care record. Coaches, sports medicine staff, and Athletic Director acknowledgment forms will be kept on file by the Associate Athletics Director for Sports Medicine.

Pre-Participation Baseline Measurements

No student-athlete will be allowed to participate in any Athletics Department activities until cleared by the team physician in the pre-participation physical examination process. Student-athletes in all sports will have baseline testing performed prior to their participation in any officially sanctioned team activity.

Baseline testing will include the following:

1. History of brain injury and concussion in the pre-participation physical examination and during C3 Logix and ImPact testing.
2. Current symptom evaluation (during C3 Logix and/or ImPACT tests)
3. Cognitive assessment (during C3 Logix and ImPACT tests, and/or King-Devick for selected sports who employ rapid sideline assessment due to sport rules constraints).
4. Balance assessment (during C3 Logix and/or BESS tests).
5. Vestibular-oculomotor function (C3 Logix)
6. Reaction times (C3 Logix, simple and choice)

Testing will be done in accordance with the appropriate testing protocol as established by the developers of each of these tests.

For any athlete diagnosed with a concussion, particularly student-athletes with complicated or multiple concussions in their history, re-baseline testing will be performed at six months or beyond complete resolution of concussion to establish new baseline values.

Scores from all objective baseline testing will be used as comparisons to established baseline values to assist in the clinical evaluation following a suspected concussion. There is no current standard set for a symptom score that indicates concussion. Symptoms reported should be taken into consideration when determining a possible concussion and scores can be used to track symptom severity over time.

Immediate Assessment Techniques for Potential Concussion Injuries

As per NCAA rules, a student-athlete who exhibits signs, symptoms, or behaviors consistent with a concussion will be removed from practice or competition and evaluated by a member of the ISU Sports Medicine Staff (licensed/certified athletic trainer or physician). Athletes may be identified as exhibiting signs and symptoms of a concussion either through self-reporting or identified by others, and an immediate evaluation of the suspected concussion will be performed with the following steps:

1. On-field assessment ruling out need for initiation of the emergency action plan and transportation to emergency medical facility.
 - Glasgow Coma Scale <13
 - Prolonged loss of consciousness
 - Focal neurological deficit suggesting intracranial trauma
 - Signs/Symptoms associated with spine injury
2. If no emergency transport is needed, assist athlete from court/field.
3. Allow the athlete time to calm down
4. Move the athlete to an area where they will not be interrupted and can concentrate if at all possible (i.e. Locker Room)
5. Perform a thorough evaluation of a suspected concussion which may include, but is not limited to:
 - Symptom Scoring
 - Standardized Assessment of Concussion Test (SAC Test on C3 Logix)
 - Evaluation of balance (BESS Test on C3 Logix)
 - Reaction Time (simple (C3 Logix)
 - Visual tracking/testing (manual)

**There may be instances where alternate orientation questioning and cognitive assessment may be utilized due to sport and rules including the King-Devick Test. King-Devick test may be utilized to determine if there has been a suspected concussive episode in a short time frame with high reliability and utilized in sports with limited injury time such as wrestling and gymnastics.*

Injury event information will be recorded in the C3 Logix system for tracking details of all concussions. This information will be transferred to the student-athletes electronic medical record.

The determination of a concussion will be based on the collective interpretation of all test results.

- Interpretation of comparison of test results and baseline scores.

Symptom Scoring Scale

Student-athletes symptoms will be assessed using the concussion symptom list on the C3 Logix system or other suitable alternative. It should be noted that much of the same symptom scale is utilized in post-concussion evaluation during the IMPACT Test. Total score of their symptoms can be used to compare to baseline scoring as well as immediate post-injury and follow-up testing for an infinite amount of time. Reporting of symptoms should be correlated to injury mechanism and other testing results in determining whether an athlete has suffered a concussion.

SAC TEST –

A drop of 3 points or greater is indicative of some alteration in cerebral function and the student-athlete is considered to have sustained a concussion and should be withheld from activity, and monitored.

Balance Testing

The preferred balance testing system will be the C3 Logix system. Following a suspected head injury, C3 Logix scores significantly lower than baseline average measurement will be indicative of possible head injury related balance problems.

BESS test will be utilized in conjunction with C3 Logix as a back-up to computerized balance testing. Errors will be scored on the C3 Logix system during the test. The double leg, single leg, and tandem stances (heel to toe with the non-dominant foot in back) balanced error scoring system (BESS) tests will be utilized on both ground and on unstable surface (AirEx pad). Eyes will be closed and hands on hips for 20 seconds. More than 7 errors above baseline in balance may suggest that there may be a concussion. More than one simultaneous error will be scored as one error (i.e. eyes open while stumbling). Fatigue can compound scores and must be considered during the evaluation. Errors include:

1. hands come off of hips
2. eyes open
3. lifting of the forefoot or heel
4. step, stumble, or fall
5. remain out of the starting position for more than 5 seconds
6. exceed 30 degrees of hip abduction to either side

Reaction Times – Simple reaction time testing on the C3 Logix system will be evaluated.

Visual Tracking/Testing

-Examine pupils: note symmetry, reaction, size, visual tracking changes, or painful areas in ROM

-Visual Clarity.

Abnormalities in any of these areas are cause for suspected concussion

Same Day Return To Play Guidelines

Following a suspected concussion, any student-athlete with abnormal testing results indicating a concussion will be removed from the game and/or practice. Final determination of diagnosis of concussion and possibility of return-to-play is left solely to the team physician or medically qualified physician designee (i.e. licensed/certified athletic trainer). If the player is diagnosed with a concussion, they will be removed from participation for the remainder of the calendar day.

If all testing falls within normal limits and exhibits no significant symptoms during or following the examination, the student-athlete will not be considered to have suffered a concussion, and will be allowed to return to play and continue to be monitored closely.

Initial Management of the Diagnosed Concussion

Once diagnosed with a concussion, the athlete will be monitored at frequent intervals for deterioration of symptoms for the remainder of the day. Should symptoms deteriorate; the student-athlete will be taken to an appropriate medical care facility for follow-up care, monitoring, and possible diagnostic imaging as dictated by physicians. These symptoms would include:

- Repetitive emesis
- Persistently diminished/worsening mental status
- Other deteriorating neurological signs/symptoms.

Should symptoms remain steady or improve, the student-athlete will be provided with written home care instructions upon release, preferably with a roommate, guardian, or other adult who can follow instructions (see example). These instructions will be reviewed with the responsible party before sending them home with the student-athlete. A follow-up appointment time for recheck evaluation will be established with the student-athlete prior to being released for home care. Should the injury occur on the day of academic classes, the student-athlete will not attend any classroom activity for the remainder of the day.

Follow-Up Management of the Diagnosed Concussion

Following a diagnosed concussion, the student-athlete will be re-evaluated and additional testing will be performed to track progress. This testing will include, but not be limited to:

1. Monitoring of symptom scoring (until symptoms resolve, tracked on C3 Logix)

2. Computerized Neuropsychological Testing (ImpACT Testing – Immediate Post-Concussion Assessment and Cognitive Testing) will be performed and compared to baseline values at a minimum of 24 hours post-injury and again at 72 hours and 1 week post-injury if necessary. ImpACT Testing will cease once there are no score drops in any of the testing areas of statistical significance as determined by ImpACT research numbers. Interpretation of ongoing abnormalities will be made by the team physician or designated neuropsychologist.
3. Balance Testing – C3 Logix Balance Testing and/ Balance Error Scoring System (BESS) testing will be performed on the C3 Logix System.
4. A Vestibular/Oculomotor screening examination will be performed utilizing the C3 Logix Visual Acuity test and will be compared to baseline norms. Visual and/or vestibular exercises may be prescribed if indicated by test results.
5. Vision/Neurological Evaluation/Oculomotor Examination
Evaluation will include identification of any abnormalities including, but not limited to:
 - pupils: note symmetry, reaction, size, visual tracking changes, or painful areas in ROM.

**It should be noted that student-athletes with diagnosed ADD/ADHD or learning disabilities, migraines, or other chronic headache conditions may complicate recovery and may require other special considerations.*

The licensed athletic trainer will communicate all testing results and progress changes to the team physician. The team physician will have access to all concussion management developments with access to all testing results on the C3 Logix and ImpACT testing systems.

Once the student-athlete's symptoms are resolving and scores are within normal limits on ImpACT and C3 Logix testing, graduated return to play guidelines will be initiated

Prolonged Recovery Guidelines

It is recognized a majority of student-athletes who are concussed fully recovery occurs in 7-10 days and can be managed daily based on resolution of symptoms. Any student-athlete who has a prolonged recovery and symptoms lasting longer than two weeks will return for a full evaluation by the team physician in order to consider additional compounding factors and additional diagnoses including, but not limited to:

- Post-concussion syndrome
- Sleep dysfunction
- Migraine or other headache disorders
- Mood disorders such as anxiety and depression
- Ocular or vestibular dysfunction.

For student-athletes with prolonged recovery of greater than one month, secondary opinions may be sought through the University of Pittsburgh Medical Center concussion experts for diagnosis and/or suggested additional management methods. Results of all testing will be forwarded to them as requested to assist in their evaluation.

Graduated Return-to-Learn

Return-to-Learn is a parallel concept to return-to-play and follows a stepwise progression as such. The hallmark of return-to-learn is cognitive rest immediately following concussion just as the hallmark of return-to-play is physical rest. The majority of student-athletes who are concussed do not need a detailed return-to-learn program because full recovery occurs in 7-10 days and can be managed daily based on resolution of symptoms. However, Return-To-Learn becomes more difficult when the student-athlete has ongoing symptoms for greater than two weeks.

Return-to-Learn Concepts

1. Return-to learn will be managed in a stepwise program which fits the needs of the individual student-athlete.
2. Return-to-learn guidelines assume that both physical and cognitive activities require brain energy utilization, and they similarly assume that for such brain injury to recover, energy is not available for physical and cognitive exertion due to the concussion-induced brain energy crisis.
3. Return-to-learn recommendations are based on consensus statements, with a paucity of evidence-based data to correlate with such consensus recommendations.
4. Return-to-learn recommendations will be made within the context of a multi-disciplinary team which could include, but is not limited to the team physician, athletic trainers,

psychologists/counselors, the Faculty Athletic Representative, academic counselors, and administrators.

5. Like return-to-play, it is difficult to provide prescriptive recommendations for return-to-learn because the student-athlete may appear physically normal, but is unable to perform at his/her expected normal due to concussive symptomology and effects.

Return-to-Learn Administrative Procedures

1. Following the diagnosis of concussion, the athletic trainer for the sport will notify the Assistant Athletics Director of Student Athlete Development and forward them a letter of notification to be sent to the Dean of Students and any/all instructors notifying them of the student-athletes diagnosis and possible difficulties and potential accommodations needed during recovery. The Assistant AD for Student Athlete Development will serve as the point of contact between academics and athletics in regards to return-to-learn accommodations.
2. The student-athlete will begin the stepwise return-to learn program listed below.
3. If the student-athlete has not had a resolution of symptoms in 7-10 days, the Student-Athlete Well-Being Group (Senior Associate AD for Student Services, Senior Associate AD SWA, Assistant AD for Student-Athlete Development, Associate AD for Compliance, Associate AD for Sports Medicine) will meet to discuss the status of the student-athlete and potential need for further accommodations and specialty care or evaluation. This meeting may also involve other parties including the team physician, sports psychologist/counselor, faculty athletic representative, and coach. The group will discuss the need for special accommodations and further course of action within academics based on medical progress and evaluation.
 - Accommodation request and recommendations will be communicated with the Dean of Students Office and the ISU Student Disability Resource Center by the Asst. AD for Student-Athlete Development (see example recommendations for accommodations for common ongoing post-concussive symptoms chart)
 - The Assoc. AD for Sports Medicine will contact the Faculty Athletic Representative to make them aware of the recommendations for accommodations and any follow-up progress as needed.
4. Communication regarding the progress of the student-athlete will be communicated to the Dean of Students and ISU Student Disability Resource Center by the Asst. AD for Student-Athlete development as needed until condition is resolved. Required documentation will be supplied as needed to comply with section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities act and Amendments Act of 2008.

Concussion Return-to-Learn Recommendations		
Stage	Stage Description	Procedures/Activities
1	Cannot tolerate cognitive activity, symptoms at rest	-Remain at home and avoid classroom work for at least one day, avoid school work, video games, reading, texting, and watching television, no team meetings. -Letter sent to academic services notifying relevant parties of concussion and accommodation considerations. -As symptoms resolve, move into Stage 2 as tolerated. -If symptoms exceed two weeks initiate meeting with Student-Athlete Well-Being Group, campus officials, and specialists as needed for potential further formal Accommodations. Additional examinations with team physician and/or Specialists will be arranged.
2	Ability to perform cognitive activities for up to 1 hour with no increase in symptoms. Allow for cognitive rest periods and reduce rest periods as tolerated.	-Monitor symptoms and make appropriate adjustments to exposure to cognitive activities. May return to team meetings as part of cognitive activities as tolerated. -If athlete cannot attend class due to symptoms, they also cannot attend team meetings. -Likely will start return to play progression once cognitive activities are tolerated for multiple hour time periods.
3	Return to all activities	-Return to all cognitive activities including classes and team meeting activities. Report any reoccurrence of symptoms.

Examples of Potential Accommodations/Recommendations Based on Symptom Type	
Symptoms	Potential Accommodations
Headaches	-Allow frequent breaks -Identify triggers which cause headaches to worsen and avoid them
Sensitivity to Noise (phonophobia)	-No physical activity in or around loud areas -Avoid lunch room; eat in quiet settings -Avoid attending athletic events, gymnasiums -Refrain from using headphones/earbuds
Sensitivity to Light (photophobia)	-Allow to wear sunglasses -Move to area with low-lighting, dimly lit room -Avoid seating with direct sunlight from windows -Avoid or minimize bright projector or computer screens, film screens
Other Visual Problems (i.e. blurred or double vision, eye tracking problems, near-point convergence)	-Limit computer use -Reduce/shorten reading assignments -Record lectures, use auditory learning apps if possible/as needed -Allow for more listening discussions vs. reading -Increase font size on computer screens -Desktop work only -Refrain from texting, video gaming -Refrain from watching TV close-up or from a distance
Concentration or Memory (Cognitive) Problem	-Place main focus on essential academic content/concepts -Postpone major tests or participation in standardized testing -Allow extra time for assignments, quizzes -Allow extra time to complete tests, projects -Reduce class assignments, homework
Sleep Difficulties	-Allow frequent breaks

Graduated Return-to-Play Guidelines

The cornerstone of concussion management is physical and cognitive rest until symptoms start to resolve and then a graded program of exertion and return-to-learn program prior to medical clearance and return to play. Graduated return to play following a concussion will follow a stepwise process. If any post-concussion symptoms occur while in the stepwise program, then the student-athlete should drop back to the previous asymptomatic level and try to progress again after a further 24 hour period of rest has passed. Time frames within each level are not established, but dictated by monitoring of symptoms. Listed below are general guidelines to be used as a stepwise process for return to activity. Other stepwise programs for return to activity such as the UPMC Sports Medicine Concussion Program Guidelines for Post-Concussion Rehabilitation may also be used. There is typically a period of time of complete rest between stages to assess reaction to activity and subsequent progress. The student-athlete will be returned to full play only with clearance by the team physician following a diagnosed concussion.

Rehabilitation Stage	Functional Exercise at Each Stage of Rehabilitation	Stage Objective
1. No Activity	Complete physical and cognitive rest	Recovery
2. Light Aerobic Exercise	Walking, swimming or stationary cycling keeping intensity <70% HR max, no strength training	Increase Heart Rate
3. Sport-Specific Exercise	Sport related individual skill type drills with NO risk of head impact activities	Add movement
4. Non-Contact Training Drills	Progression to more complex training drills with no contact. May return to low load, high repetition strength training activities	Exercise, coordination, and cognitive load
5. Full Contact Practice	Following medical clearance, participate in normal training/practice activities	Restore confidence and assess functional skills by coaching staff
6. Return to Play	Normal game play	

Reducing Exposure to Head Trauma

While exposure to head trauma is inherent with many sports, the Iowa State University Department of Athletics and its coaches are committed to reducing unnecessary exposure to head trauma. Coaches will conform to current best practices and recommendations for their sport in regards to reducing exposures to head trauma. This may include, but not be limited to:

- Adherence to the Inter-Association Consensus: Year-Round Football Practice Contact Guidelines
- Adherence to Inter-Association Consensus: Independent Medical Care Guidelines
- Reducing gratuitous contact in practices
- Always taking a "safety first" approach to the sport
- Taking the head out of contact
- Utilizing proper coaching techniques and student-athlete education regarding safe play.
- Tracking of injury data in regards to injury rates in different activities and equipment types with recommendations for change annually to reduce injury risk as indicated.

Resources

1. National Athletic Trainers Association Position Statement: Management of Sport Concussion (NATA, 2014)
2. American Academy of Neurology Guidelines. *Neurology*, 1997
3. McCrea, Kelly, Randolph et al. *Standardized assessment of concussion (SAC): on-site mental status evaluation of the athlete*. J Head Trauma Rehabil. 1998
4. ImPACT Neuropsychological Testing Procedural Manual, 2013
5. Consensus Statement on Concussion in Sport: 4th International Conference on Concussion in Sport Held in Zurich, November, 2012. *Br. J Sports Med* 2013 47:250-258
6. C3 Logix Testing System Protocols 2014
7. Bell, Guskiewicz, Clark, Padua. *Systematic Review of the Balance Error Scoring System*. Sports Health May 2011 3(3); 287-295