Boston University Athletic Training Services
Head Injury Assessment and Management Protocol

Policy #:	Title: Head Injury Assessment and Management Protocol	Distribution: Athletics Department, PERD Department, ROTC Department, All Clinical Staff
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Purpose

- To be in accordance with current accepted best practices for head injury and concussion management in sport.
- To obtain medical history of concussion and baseline concussion information for patients who through the normal course of athletic activity are at increased risk of sustaining a concussion.
- To guide patient care decisions for appropriate return to physical and cognitive activity following a concussion.
- To delineate role, responsibilities, and a framework for treatment of patients following a concussion.

Concussion Definition

According to the *Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport – Amsterdam, October 2022:*

Sport-related concussion is a traumatic brain injury caused by a direct blow to the head, neck, or body resulting in an impulsive force being transmitted to the brain that occurs in sports and exercise-related activities. This initiates a neurotransmitter and metabolic cascade, with possible axonal injury, blood flow change, and inflammation affecting the brain. Symptoms and signs may present immediately, or evolve over minutes or hours, and commonly resolve within days, but may be prolonged.

No abnormality is seen on standard structural neuroimaging studies (computed tomography or magnetic resonance imaging T1- and T2-weighted images), but in the research setting, abnormalities may be present on functional, blood flow, or metabolic imaging studies. Sport-related concussion results in a range of clinical symptoms and signs that may or may not involve loss of consciousness. The clinical symptoms and signs of concussion cannot be explained solely by (but may occur concomitantly with) drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction) or other comorbidities (such as psychological factors or coexisting medical conditions).

Education

- Athletic Training Services will provide and allow an opportunity to discuss educational information to all varsity and club sports officers, patients, coaches, athletic administrators, pertinent faculty members, team physicians, athletic trainers and other personnel involved in student-athlete health and safety decision making on a yearly basis.
- The educational information provided will include but is not limited to the signs and symptoms of concussion, encouragement to report their own and/or teammate's/player's signs and symptoms, and the health risks associated with not reporting symptoms. The following documents will be referenced: The National Collegiate Athletic Association Sports Science Institute (NCAA SSI) Concussion Safety-student athletes (Appendix I), the NCAA SSI Concussion Safety-coaches (Appendix II) and the NCAA SSI Concussion Safety-faculty (Appendix III).
- Each student-athlete will initial and sign the Student Athlete Injury and Illness Responsibility Statement (Appendix IV), which is disseminated, collected, and stored by the Department of Athletics.
- Varsity athletics administrators, coaches, and other pertinent associated personnel will sign the Stakeholder Concussion Education Statement (Appendix V), which is disseminated, collected, and stored by the Department of Athletics.

Reducing Exposure to Head Trauma

Athletic Training Services will work with the Department of Athletics, the Department of Physical Education, Recreation & Dance, and the Department of Reserve Officers' Training Corps to emphasize ways to minimize head trauma exposure. The *Interassociation Recommendations: Preventing Catastrophic Injury and Death in Collegiate* Athletes, *Consensus statement on concussion in sport: 6th International Conference on Concussion in Sport – Amsterdam, October* 2022, contemporary literature on reducing exposure to head trauma, and injury trends at Boston University will guide efforts to reduce exposure to head trauma. Action steps to minimize head trauma exposure may include but are not limited to:

- Ensuring all practices and competitions adhere to existing ethical standards.
- Prohibiting the use of playing or protective equipment (including the helmet) as a weapon during all practices and competitions.
- Prohibiting the deliberate intent to inflict injury on another player during all practices and competitions.
- Ensuring all playing and protective equipment (including helmets), as applicable, meets relevant equipment safety standards and related certification requirements.
- All contact/collision, helmeted practices and competitions adhere to keeping the head out of blocking and tackling
- Emphasizing education of proper technique to reduce head impact exposure for all contact and collision sports, with a special emphasis in the pre-season.
- Limit the number and duration of contact and collision in practices, intensity of contact in practices, and promote strategies restricting collision time in practices in contact-collision sports.
- Adherence to policy and rules in sport that reduce collisions.
- Consideration or participation in neuromuscular training warm-up programs.
- Participating in quality improvement and quality assurance projects.

Baseline Assessments

- All Boston University varsity student-athletes will complete baseline assessments prior to their first physical activity (practice, game, or conditioning session) of their first season with the team. Boston University student-athletes participating in club basketball, cheerleading, dance, club ice hockey, club rugby, and club soccer will complete the same baseline assessment process.
- Baseline assessments shall be conducted in an area designated by the Department of Athletic Training Services. All reasonable steps will be taken to ensure assessments are conducted in a non-distracting environment.
- Elements of the baseline process may include, but are not limited to:
    - A personal review of their history of concussion(s) and head injury including concussion symptom evaluation, neurological disorders, mental health symptoms and disorders
    - Sport Concussion Assessment Tool, 6th Edition (SCAT6©) (Appendix VI) **designed and supported by the Consensus Statement on Concussion in Sport: the 6th International Conference on Concussion in Sport (Amsterdam 2022)*
    - Computerized neurocognitive assessment using the Immediate Post-Concussion Assessment and Cognitive Testing Program (ImPACT®)
    - Postural control using the Biodex Balance System™ SD
    - Computerized neurocognitive and postural control assessment applications using Sway Medical
    - Vestibulospinal and/or vestibular-ocular assessment

- Baseline assessments may be conducted for any individual participating in varsity sports, club sports, or ROTC who meet the following conditions:
    - History of head injury or diagnosed concussion
    - History of loss of consciousness or “blackouts”
    - History of “getting dinged,” “having their bell rung,” “feeling foggy” or experiencing remarkable symptoms lasting longer than 20 minutes following a mechanism for head injury
    - History of cranial surgery
    - History of seizures
- Baseline assessment results will be reviewed with the medical history and physical examination component of the Pre-Participation Examination process to inform medical clearance for participation.

Recognition and Diagnosis of Head Injury

Sport and City Specific Healthcare Coverage Polices

- In accordance with the City of Boston legislation, *An Ordinance Creating a College Athlete Head Injury Gameday Safety Protocol*, (Appendix VII) all varsity ice hockey and men's lacrosse competitions hosted by Boston University will be staffed with an on-site Neurotrauma Consultant. The Neurotrauma Consultant shall be a physician who is board certified or board eligible in neurology, neurological surgery, emergency medicine, physical medicine and rehabilitation, or a primary care sports medicine certified physician (holding a Certificate of Added Qualification in Sports Medicine – CAQSM). The Neurotrauma Consultant shall be present at the level of the event's playing surface, and with full access to the benches and/or sidelines of any participating athletic program.
- Medical personnel with training in the diagnosis, treatment and initial management of acute concussion and other injuries must be "present" at all NCAA practices and competitions in the following contact/collision sports: acrobatics and tumbling, baseball, basketball, beach volleyball, diving, equestrian, field hockey, football, gymnastics, ice hockey, lacrosse, pole vault, rugby, skiing, soccer, softball, volleyball, water polo, and wrestling. To be present means to be on site at the campus or arena of the competition. Medical personnel may be from either team or may be independently contracted for the event.
- Medical personnel with training in the diagnosis, treatment, and initial management of acute concussion and other injuries must be "available" at all NCAA practices and competitions in all sports not listed above. To be available means that, at a minimum, medical personnel can be contacted at any time during the practice via telephone, messaging, email, beeper, or other immediate communication means. Further, the case can be discussed through such communication, and immediate arrangements can be made for the athlete to be evaluated.

Initial Assessment

- Any patient that exhibits signs/symptoms/behaviors consistent with concussion (or other head injury including stroke, and other traumatic brain injuries) will be removed from practice/competition for evaluation.
    - Signs that warrant immediate removal from the field include actual or suspected loss of consciousness, seizure, tonic posturing, ataxia, poor balance, confusion, behavioral changes, and amnesia.
- This evaluation must be completed by an athletic trainer or team physician (or physician designee) with concussion experience. Ample time will be allowed (up to 10-15 minutes) when conducting a multimodal screen.
    - This initial evaluation will be conducted in accordance with the *Consensus Statement on Concussion in Sport: the 6th Internation Conference on Concussion in Sport (Amsterdam 2022).*

    - This initial evaluation should encompass a symptom assessment, physical and neurological exam, cognitive assessment, balance exam, and clinical assessment for cervical spine trauma, skull fracture, intracranial bleed, and catastrophic injury.
- If the result of the evaluation is the confirmation or suspicion of concussion (or any of the other previously identified conditions), the patient will be removed from practice/play for minimally that calendar day.
    - The patient may only return to play the same day if concussion is no longer suspected after evaluation.
- A more comprehensive evaluation will be conducted for patients who, for any amount of time, become unconscious following a suspected head injury.
- The results of all evaluations will be reported to the Head Team Physician and, if the patient is diagnosed with a concussion, the treating clinician will follow the Concussion Management Checklist (Appendix IX).
- The patient may only return to play the same day if concussion (or any of the other previously identified conditions) is no longer suspected.
    - All return to activity decisions will be made by either a licensed athletic trainer or team physician.

Concussion Emergency Action Plan

In certain circumstances a higher prioritization of care may need to occur. Should any of the following be identified upon examination the Emergency Action Plan will be activated for further immediate medical care and possible transport to a local hospital/trauma center:

- Cervical spine injury with neck pain or tenderness (e.g., Canadian C-Spine Rules)
- Seizure or convulsions
- Double vision
- Loss of consciousness
- Weakness or tingling/burning in more than one arm or in the legs
- Deteriorating conscious state
- Vomiting
- Severe or increasing headache
- Increasingly restless, agitated or combative disposition
- Glasgow Coma Scale <15
- Visible deformity of the skull

Management of Concussion in Absence of an Athletic Trainer

- In the event that a team is off-campus without an athletic trainer and a student-athlete is suspected of having a concussion, the student-athlete should be withheld from activity until the team physician or athletic trainer has evaluated them.
- The above procedure will be used too when a student-athlete sustains a concussion unrelated to sports participation.

Post-Injury Management

Acute Management (0-72 hours post-injury)

- If a patient is determined unable to return to participation in an event due to head injury, they will be monitored serially throughout the remainder of the event, same day, and up to 72 hours for changes in health status and referred to emergency medical services if warranted as mentioned above (see "Initial Assessment" and "Concussion Emergency Action Plan").
- All patients will be provided with an Informational Handout (Appendix X) about their injury with recommendations for them to review.
- During periods of academic responsibility, Cognitive Rest Letters (Appendix XI) will be provided and may be presented to their instructors. These letters outline the importance of cognitive rest including, but not limited to, classroom activity on the day of injury.
    - It is the recommendation of Athletic Training Services that the patient avoid all symptom-provoking cognitive stressors, which include, but are not limited to; reading, extended time in front of computers/television, video games, cell phone use, etc. until deemed fit to progress by Athletic Training Services.
- Athletic Training Services will document oral and/or written care guidelines presented to both the patient and another responsible adult, when available, following diagnosis.
- This injury will be recorded in the Electronic Health Record (EHR) and entered into the disease management module within the EHR to ensure that healthcare providers in Primary Care and Behavioral Medicine at Student Health Services (SHS) can assist in monitoring the patient's condition.
- Other relevant stakeholders (e.g., Head Team Physician, athletics staff members, and the NCAA reporting structure) will be updated on the patient's diagnosis and injury status.

Sub-Acute Management (72 hours+ post-injury)

- A comprehensive follow up evaluation may occur every 24 hours following injury. This may occur more or less frequently at the discretion of Athletic Training Services to consider additional diagnoses and best management options.
    - Components of this evaluation may investigate a symptom burden, immediate and delayed memory, concentration, orthostatic vital signs, cervical spine status, neurological status, balance, tandem gait, and the vestibular-ocular-motor system.
    - Expertly developed and accepted clinical tools such as the SCAT6© (Appendix VI), Buffalo Concussion Treadmill/Bike Test (Appendix XII), Vestibular-Oculomotor Screening (Appendix XIII), Sport Concussion Office Assessment Tool 6 (SCOAT6) (Appendix XIV), and/or other clinically relevant assessment tools can be utilized during these evaluations.
    - Screenings for sleep disturbance, fear, anxiety, depression, or other mental health issues should also be considered as clinically indicated.
    - The exact timing of the implementation of these assessments will be determined on a case-by-case basis.

- Information gathered from these assessment tools will aid in the development of individualized care plans targeted to each patient's specific clinical trajectory to introduce symptom-limited, light aerobic physical activity and therapeutic exercise/intervention.
    - Symptom-limited, light aerobic physical activity can begin within 24-48 hours post-injury.
- All treatment decisions will be rendered based on clinical discretion with approval from the Head Team Physician and/or their appropriately licensed designee.
- Athletic Training Services, the Head Team Physician, and/or team physicians may at any time during the rehabilitation process refer the patient to a neuro-psychological specialist if deemed appropriate.

Persistent Symptom Management (> 4 weeks post-injury)

- For patients with prolonged recovery and/or atypical presentation, evaluation by a physician will be completed to consider additional diagnosis and best management options including but not limited to fatigue and/or sleep disorder, migraine or other headache disorders, mental health symptoms and disorders, ocular dysfunction, cervical and vestibular dysfunction, cognitive impairment, autonomic dysfunction (including orthostatic intolerance and postural orthostatic tachycardia syndrome), and pain.

Return to Learn

- The patient will be responsible for all academic requirements and coordinating any missed class time or assignments with their instructors.
- With patient consent, Athletic Training Services will notify Student-Athlete Support Services following the diagnosis of a head injury (if occurring during periods of academic responsibility) to identify a point-person to navigate the return to learn process with all patients that are members of varsity teams.
- Specific recommendations and modifications for return to learn progressions will be made by a collaborative care team on an individual basis and based on the Graduated Return to School Strategy (see the table at the end of the section). The collaborative care team may include the Head Team Physician, athletic trainers, team physicians, psychologist, counselors, neuropsychologists, faculty athletics representatives, academic counselors, course instructors, college administrators, Office of Disability Services representatives, and coaches.
    - The individualized initial plan should include a return to classroom/studying as tolerated and avoid complete rest and isolation. The plan may address environment, physical, curriculum, and/or testing adjustments.
- In cases that require modifications beyond 10 days and cannot be managed through schedule modification/academic accommodations alone, patients will be referred to engage with campus resources that are consistent with ADAAA and will include one or more of the following: the Office of Disability Services, learning specialists, or the ADAAA office.
- Continued or worsening symptoms (especially for 2 weeks or greater) with light cognitive activity and a gradual return to classroom/studying will prompt a re-evaluation by the coordinating team physician to determine if further schedule/academic accommodations are needed.
- All recommendations will be made in compliance with Americans with Disabilities Act Amendments Act (ADAAA).

Graduated Return to School Strategy

Step	Aim	Activity Examples	Goal of Each Step
1	Daily activities at home that do not result in more than a mild and brief exacerbation* of symptoms related to the current concussion.	Typical activities of the student during the day (e.g., reading) while minimizing screen time. Start with 5-15 minutes at a time and increase gradually.	Gradual return to typical activities
2	School activities	Homework, reading or other cognitive activities outside of the classroom.	Increase tolerance to cognitive work
3	Return to school part-time	Gradual introduction of schoolwork. May need to start with a partial school day or with greater access to rest breaks during the day.	Increase academic activities
4	Return to school full-time	Gradually progress in school activities until a full day can be tolerated without more than mild and brief symptom exacerbation*.	Return to full academic activities and catch up on missed work

**Mild and brief exacerbation of symptoms is defined as an increase of no more than 2 points on a 0–10-point scale (with 0 representing no symptoms and 10 the worst symptoms imaginable) for less than an hour when compared with the baseline value reported prior to cognitive activity.*

Return to Sport

- The timetable for a return to sport will be individualized and dependent on numerous factors. At minimum, it will be in accordance with the Graduated Return to Sport Strategy, located at the end of this section.
    - Each patient with a concussion must undergo a supervised, stepwise progression management plan overseen by a team physician or licensed athletic trainer with expertise in concussion. It is typical for each step to last at least 24 hours.
- Patients will rate their symptoms after completing each activity step to determine whether they are eligible to advance to the next step.
    - Patients who describe a mild and brief increase in symptoms (or less) will be eligible to advance to the next step.
        - Mild is defined as an increase of no more than 2 points on a 0–10-point scale when compared with the pre-exercise resting value.
        - Brief is defined as less than one hour.
- If a patient reports more than mild and brief symptom exacerbation during Steps 1-3 of the Graduated Return to Sport Strategy, they should stop activity and re-attempt the next day.
- Patients should proceed to Step 4 only after resolution of signs and symptoms related to the current concussion, including with and after physical exertion.
    - Team physician clearance for formal sport integration and concussion assessments (ImPACT, Biodex, Sway) must be performed/acknowledged by a team physician before continuing to Step 4.
- Patients experiencing concussion-related symptoms during Steps 4-6 should return to Step 3 to establish full resolution of symptoms with exertion before engaging in at-risk activities.
- After a patient completes the Graduated Return to Sport Strategy, the Head Team Physician or their appropriate licensed designee will determine whether the patient is medically cleared for unrestricted return to sport.
- At minimum, the following standards must be met:
    - The patient has tolerated the Gradual Return to School Strategy without symptom provocation or re-occurrence (if occurring during periods of academic responsibility).
    - The patient has returned to pre-injury symptom profile.
    - The patient should meet or exceed their previous baseline assessment(s). If not available, national normative data may be used as a reference point.
    - The patient does not report any symptom provocation with cognitive and physical activity.
    - The patient has tolerated the Graduated Return to Sport Strategy without symptom provocation or re-occurrence.
- If the patient is a varsity student-athlete, the Director of Athletics will be notified in writing from Athletic Training Services when the patient has been medically cleared by the Head Team Physician, or their appropriately licensed designee, to return to full and unrestricted athletic participation.

Graduated Return to Sport Strategy

Step	Aim	Activity Examples	Goal of each step
1	Symptom-limited activity	Daily activities that do not exacerbate symptoms (e.g., walking)	Gradual reintroduction of work/school activities
2	Aerobic exercise with light resistance training **2A-Light** (up to ~55% maxHR) **THEN** **2B-Moderate** (up to ~70% maxHR)	Stationary cycling or walking at slow to medium pace. May start light resistance training that does not result in more than mild and brief exacerbation* of concussion symptoms.	Increase heart rate
3	Individual sport-specific exercise Note: If sport-specific training involves any risk of inadvertent head impact, medical clearance must occur prior to Step 3.	Sport-specific training away from the team environment (e.g., running, change of direction and/or individual training drills away from the team environment). No activities at risk of head impact.	Add movement, change direction
Steps 4-6 should begin after the full resolution of associated symptoms, abnormalities in cognitive function, and any other clinical findings related to current concussion, including with and after physical exertion.			
Team physician clearance for formal sport integration and concussion assessments (ImPACT, Biodex, Sway) must be performed/acknowledged by a team physician before continuing to the next step.			
4	Non-contact training drills with progressive resistance training	Exercise to high intensity including more challenging training drills (e.g., passing drills, multiplayer training) can integrate into a team environment. Progress resistance training as tolerated.	Resume initial intensity of exercise, coordination, and increased thinking
5	Unrestricted practice or training	Participate in normal training activities.	Restore confidence and assess functional skills
6	Unrestricted return to sport	Normal game play	Full return

**Mild and brief exacerbation of symptoms is defined as an increase of no more than 2 points on a 0–10-point scale (with 0 representing no symptoms and 10 the worst symptoms imaginable) for less than an hour when compared with the baseline value reported prior to physical activity.*

Concussion Management Team

- A multi-disciplinary team will be responsible for employing the protocols outlined in this document. Everyone on the team is assigned respective roles in mild traumatic brain injury/concussion management.
    - Head Team Physician: Will serve as the final authority on patients' return to learn and return to sport
    - Team Physicians: Clearance for return to play and learn, as well as oversight of care plans
    - Sport Neurologist: Consultation for persistent symptoms or patients with unique/pre-existing comorbidities
    - Athletic Training Neurology Fellow: Maintain quality improvement initiatives and mentorship around concussion cases
    - Neurology Trained Athletic Training Staff: Consult on complex and atypical presentation of concussions and other traumatic brain injury cases
    - Non-Neurology Trained Athletic Training Staff: Recognize and treat mild traumatic brain injury, will refer patients to team physician if they show symptoms of concussion, can provide final clearance for return to play if aligned with physician assessment
    - Student-Athlete Academic Services: Providence guidance and assistance with cognitive activity for varsity patients
    - Office of Disability Services: Provide academic adjustments/accommodations for patients' classroom activities

Independent Medical Care

- Decisions related to returning to play lie solely with Boston University's Head Team Physician, Team Physicians, and Athletic Trainers.
- Boston University's Head Team Physician, Team Physicians, and Athletic Trainers have unchallengeable authority to stop any athletic activity deemed unsafe for the patient.
- While patients may pursue additional or independent medical care at their own expense, and while any such input provided will be considered by medical staff, return to Boston University athletic participation decisions reside solely with the Boston University Head Team Physician or their appropriately licensed designee.
- Athletic Training Services is a department of Boston University's Student Health Services, separate from the Department of Athletics, and separate from the Department of Physical Education, Recreation, and Dance. The *Inter-Association Consensus: Independent Medical Care for College Student-Athletes Best Practices* and the *Inter-Association Consensus Statement on Best Practices for Sports Medicine Management for Secondary Schools and Colleges* support this administrative structure.

Appendix Resources

Appendix 1: NCAA SSI Concussion Safety – student-athletes
Appendix 2: NCAA SSI Concussion Safety – coaches
Appendix 3: NCAA SSI Concussion Safety – faculty/staff
Appendix 4: Student-Athlete Injury and Illness Responsibility Statement
Appendix 5: Stakeholder Concussion Education Statement
Appendix 6: Sport Concussion Assessment Tool, 6th Edition (SCAT6)
Appendix 7: Ordinance Creating a College Athlete Head Injury Gameday Safety Protocol; City of Boston, Boston Public Health Commission
Appendix 8: Consensus Statement on Concussion in Sport: the 6th International Conference on Concussion in Sport held in Amsterdam, 2022
Appendix 9: Clinician Concussion Management Checklist
Appendix 10: Informational Handout
Appendix 11: Cognitive Rest Letter
Appendix 12: Buffalo Concussion Treadmill Test (BCTT)
Appendix 13: Vestibular Oculo-Motor Screening (VOMS)
Appendix 14: Sport Concussion Office Assessment Tool 6 (SCOAT6)