THE PENNSYLVANIA STATE UNIVERSITY SPORTS MEDICINE CONCUSSION MANAGEMENT POLICY

Concussion Policy: Mission Statement

The Pennsylvania State University Department of Intercollegiate Athletics and Department of Sports Medicine are committed to the health and well-being of every student athlete. Part of that commitment is the safe participation in sport. The Penn State Concussion Policy is designed to provide the student athlete with a comprehensive approach to the clinical management of sports related mild traumatic brain injury or 'concussion'. This policy is in accordance with all aspects of 'NCAA Concussion Management Requirements', the 'Big Ten Concussion Management Policy' as well as international guidelines for the prevention, management and care of student athletes recovering from concussion. In general, we follow the guidelines outlined in the 'Consensus Statement on Concussion in Sport—the 5th International Conference on Concussion in Sport Held in Berlin, October 2016'. (See Appendix H)

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Concussion Education

Athletic Trainers will be responsible for coordination of all 'Concussion Education' materials to be presented to their student athletes and coaches at their respective team meeting or designated time prior to participation in college athletics.

Athletes, Coaches, Athletic Administration and Sports Medicine personnel education may include the following materials:

1. NCAA Concussion Education Handout (See Appendix C) – This form is provided to the student athletes, coaches, athletic administration and sports medicine personnel. It is a short review of what a concussion is and the common 'Signs and Symptoms' of a concussion. In addition, it provides a summary of the recommended management steps for athletes recovering from concussion.

2. 'Self-Reporting Acknowledgement Form' (See Appendix D) - This form will be presented to the student athletes. This form acknowledges that they have received a copy of the educational materials outlined above and provided by their athletic trainer. The signature of the student athlete acknowledges this receipt as well as the student athlete's responsibility to self-report concussive symptoms as well as to report teammates that are suspected of having a concussion based on the information discussed in the educational meeting.

3. 'Concussion Post-Injury Instruction Form' (See Appendix D) – This form will be discussed during the meeting and will be specifically addressed / given to any student athlete recovering from a concussion. This form gives the student athlete information on what to expect in the acute stage following their injury as well as instructions for short term management.

4. 'Return to Academics' Policy following concussion (See Page 8) – This process will be mentioned during the educational meeting and will be specifically addressed with any student athlete recovering from a concussion. This form gives the student athlete information regarding their injury as well as what they can expect from their healthcare provider.

5. 'Return to Practice' and competition following concussion (See Page 9) – This process will be mentioned in the educational meeting but will be specifically addressed with any athlete recovering from concussion. It should be noted that the 'Return to Play' procedure is a minimal standard guideline and can be modified by their healthcare provider based on their history, symptoms etc.

6. 'B1G Concussion Acknowledgement Form(s)' (See Appendix E, F & G) – These forms are reviewed by the coaching staff, athletic director, team physicians and athletic trainers and are presented by the Director(s) of Sports Medicine & Athletic Training. All groups listed above will be given the NCAA Concussion Educational Material as well as Penn State's Concussion Management Policy Manual and asked to review these materials. They will then acknowledge they have received a copy of the 'Concussion Management Policy Manual' and will be expected to report any athlete suspected of receiving a concussion. Signature of this document will acknowledge their understanding of the information provided.

Reducing Exposure to Head Injury

Reducing exposure to head Injury is part of the overall prevention strategy for attenuating sports related concussion. Penn State Sports Medicine takes an active role in the overall reduction of exposure to head injury on a daily basis using the following strategies:

1. Prevention:
    a. Education:

        Annual education of the student-athletes, coaches and sports administration on the signs, symptoms, diagnosis and management of concussions is performed by the Sports Medicine staff. Education remains a critical component in helping a student athlete recognize when they may have potentially sustained a concussion. Early recognition and management can help prevent the deleterious effects of secondary brain injury if left unrecognized by the student athlete.

    b. Technique:

        Proper coaching and instruction on safe techniques are paramount to reducing head injury risk in sports. One example of specific instruction in the sport of football is outlined by the Heads-Up Tackling™ technique instruction provided by the USA Football organization (See Appendix B).

    c. Maintenance & Inspection of Protective Gear:

        Protective equipment is designed to mitigate injurious forces and reduce overall injury to the student athlete participating in sport. Regular inspection of protective equipment is performed by athletic training staff and/or equipment staff to ensure equipment deemed necessary for the sport meets performance standards. Properly fitted and maintained protective equipment can reduce the likelihood of head injury.

    d. Research:
        i. Penn State University Sports Medicine is committed to understanding all aspects involved in sport related concussion and its effects and impact on the student athlete. In keeping with this Penn State Sports Medicine is highly involved in research in association with the Center for Sports Concussion Research and Service lab (http://concussion.psu.edu/) at Penn State University in the College of Health and Human Development. This laboratory is one of the nation's leading facilities focused on traumatic brain injury in athletics. An enhanced understanding of the physiologic underpinnings of concussion can broaden our understanding of the injury and lead to a reduced risk of repeat injury with the advanced diagnosis and management performed by the lab.

2. Post-Injury Management:
    a. ‘Return to Play’:

        A cautious approach to the diagnosis and conservative management of athletes recovering from concussion can help prevent patient risk of serious injury from repeated head trauma. A multidisciplinary diagnosis and management team can help detect any residual abnormalities and monitor their recovery before allowing the athlete to follow the ‘Return to Play’ protocol. Conservative management of the brain injured athlete will help reduce repeat exposure to head injury.

Concussion Baseline Testing & Follow-Up Testing

1. Team Physician - The team physician oversees concussion management, including pre-participation assessments. The team physician determines pre-participation clearance and determines if additional concussion consultation or testing is required.

2. Baseline Neuropsychological Testing - Current concussion management guidelines recommend the use of Neuropsychological (NP) baseline testing for student athletes participating in collegiate athletics. All athletes will utilize computerized baseline NP testing using ImPACT®, which includes symptom assessment. Baseline computerized NP measurements will be taken prior to participation in college athletics.

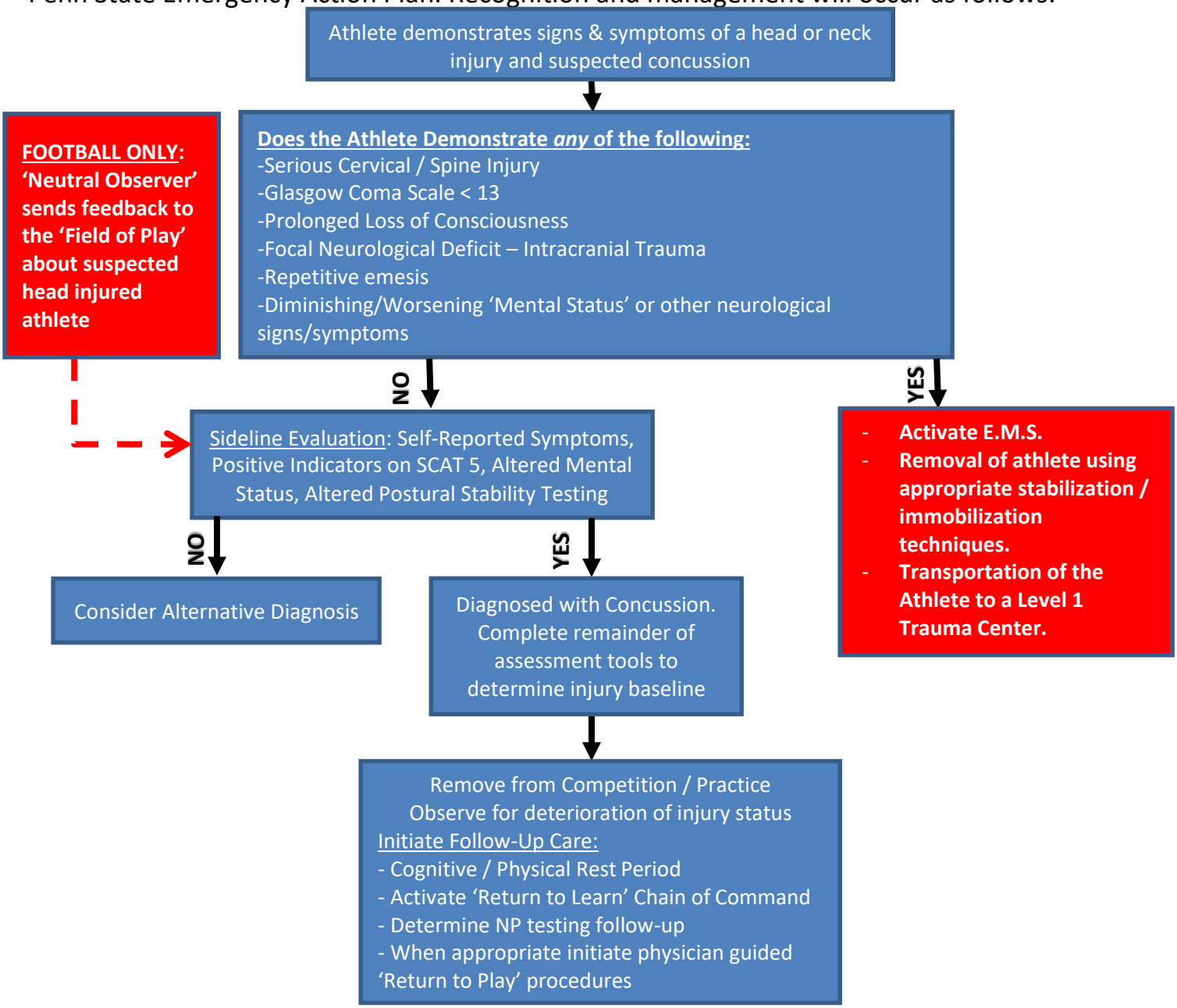
   In addition, in-coming student athletes with a disclosed history of mTBI may be referred for formal clinical neuropsychological evaluation by the supervising team physician to a licensed clinical neuropsychologist. Further, any student athlete suspected of / or diagnosed with a learning disability, history of mental illness or migraines may also be considered for formal clinical neuropsychological cognitive baseline testing. The supervising team physician will ultimately make pre-participation clearance decisions for sports related activity based on review of all relevant information.

3. Balance Testing - In accordance with evidence based management guidelines, all student athletes will perform baseline clinical balance measures using the balance error scoring system (BESS) as outlined in the SCAT5 (See Appendix I). Baseline clinical balance measures will be taken prior to participation in college athletics.

4. Repeating Computer Based NP / Clinical Testing (Post-Injury): All athletes suffering a concussion will retake computer based NP testing prior to full clearance back to competitive sport. The timeline that the testing is performed may vary. Typically, computer based NP testing will be performed after the patient is asymptomatic. There are some cases, when directed by the team physician, that computer based NP testing should be repeated earlier to help document severity of injury. In difficult or inconclusive cases, the evaluation by another formalized NP testing or additional expert consultation may be utilized when directed by the team physician.

Emergency Action Procedures for On / Off Field Recognition and Management:

On the field emergency management of athletes suspected of sustaining a concussion will be coordinated by the supervising sports medicine personnel who are present for all practice and competition sessions in accordance with the medical chain of command as outlined in the Penn State Emergency Action Plan. Recognition and management will occur as follows:



(Adapted from) *Scorza et.al. Current Concepts in Concussion Evaluation and Management American Family Physician, 2012 Jan 15; 85(2): 123-132.*

Medical personnel (Certified Athletic Trainers) with training in the diagnosis, treatment and initial management of acute concussion will be "present" at all NCAA varsity competitions in the following contact/collision sports: basketball; field hockey; football; ice hockey; lacrosse; pole vault; soccer; 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 (Certified Athletic Trainers) with training in the diagnosis, treatment and initial management of acute concussion will be “available” at all NCAA varsity practices in the following contact/collision sports: basketball; field hockey; football; ice hockey; lacrosse; pole vault; soccer; wrestling. 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.

Once it has been determined that a student athlete has sustained a concussion, by medical personnel with training in the diagnosis, treatment and management of acute concussion, that athlete ***is not eligible to return to athletic participation the same day***. The athlete must then be evaluated as soon as possible (preferably within 24 hours) by the supervising team physician or a physician trained in sports related concussion management. A plan for follow-up care will be determined and initiated by the supervising team physician and athletic trainer.

Post-Concussion Injury Management

1) **Return to Academics**: Concussion initiates a complex pathophysiologic injury cascade in the brain which adversely affects neural homeostatic mechanisms. Return to Academic guidelines assumes that both physical and cognitive activities require brain energy utilization, and that after a concussion, brain energy may not be available due to the complex pathophysiologic injury cascade. Return to learn should therefore be managed in a stepwise program that fits the needs of the individual and gradually introduces cognitive stress. Development of this individualized academic progression is done with guidance from the Director of Athletic Medicine, Assistant Athletic Director of Athletic Training Services and Director of Morgan Academic Support Center for Student-Athletes serving as points of contact. The academic progression is carried out in the context of a multi-disciplinary team that includes 1) Supervising team physician, 2) Supervising athletic trainer, and 3) Team academic advisor. (Please refer to ***Appendix K*** for the multi-disciplinary team direct points of contact listed by sport) In cases where recovery from concussion is complicated this team may also include 1) Psychologist/Counselor, 2) Learning Specialist 3) Neuropsychologist and 4) Neurologist.

   As the athlete recovers from their concussion they are exposed to a sub-symptom threshold cognitive stimulus. As such, the supervising team physician will indicate when the student athlete can initiate a stepwise 'Return to Academics' progression. An example of one such progression is provided in the table below. It is meant as a template for cognitive progression and not a rigid guideline. The athlete may be progressed faster or slower through cognitive exposure based on the presence or absence of symptoms. This process will be modified / monitored by their supervising team physician and/or athletic trainer.

Rehabilitation Stage	Cognitive Exposure at Each Stage of Recovery
1. No Activity	Complete Cognitive Rest — No school, no homework, no reading, no texting, no video games, no computer work.
2. Gradual Reintroduction of Cognitive Activity	Relax previous restrictions on activities and add back for short periods of time (5-15 minutes at a time).
3. Homework at home	Homework in longer increments (20-30 minutes at a time).
4. School Re-entry	Part day of school after tolerating 1-2 cumulative hours of homework at home.
5. Gradual Reintegration into school	Increase to full day of school

6. Resumption of full cognitive workload	Introduce testing, catch up with essential work.

** (Adapted from) *Master et.al. Importance of 'Return to Learn' in Pediatric and Adolescent Concussion, Pediatric Annals September. 2012, 41:9, 1-6. ***

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.

Supervising team physicians will give the student athlete an 'Academic Restriction Form' (See Appendix J). This form will be used to inform the student athlete's professor and academic support staff of their recent head injury as they recover from concussion. All academic considerations are consistent with provisions provided to students with documented brain injury under the Americans with Disabilities Act Amendments Act (ADAAA) of 2008 and were developed in consultation with the Office for Disability Services (ODS) at Penn State University. Furthermore, academic support staff working with the student athlete will be contacted to inform them of any temporary or long-term absence from class participation and to facilitate any additional referral/academic support services as needed. Communication between the team physician, athletic trainer, student athlete, academic counseling and professors is an essential component to the safe return of a student athlete to academic demands.

2) **Return to Play**: The athlete may begin the 'Return to Play' protocol when cleared by the supervising team physician. The typical progression for a 'Return to Play' protocol is outlined by the chart below which is consistent with International Guidelines from the Concussion in Sport Group.

   Differences between sports will exist when participating in sports specific drills and training but the guidelines or objective for each 'Rehabilitation Stage' should be the same for all athletes, independent of sport.

Return to Play Protocol: 24-hour minimum between stages outlined below

Rehabilitation Stage	Functional Exercise at Each Stage of Recovery
1. Symptom limited Activity	Daily Activities that do not provoke symptoms
2. Light Aerobic Exercise	Walking, stationary cycling keeping intensity <70% MPHR); No resistance training
3. Sports Specific Exercise	Examples: Skating in hockey, running in soccer; No head impact activities
4. Non-Contact Training Drills	Progression to more complex training drills (e.g. Passing drills in football and ice hockey). *****Progressive resistance exercise allowed. (See 'Strength Training Progression Table')***

5. Full Contact Training	Following medical clearance participate in normal training activities
6. Game Play	Full clearance / Normal Game Play

McCory et. al. Consensus statement on concussion in sport – the 5th International Conference on Concussion in Sport. British Journal of Sports Medicine. 2017:0-10

3) **Return to Strength Training**: When cleared to participate in strength training, the advancement of the strength training progression will be at the discretion of the athletic trainer and/or the team physician. An example is found below:

Strength Training Progression Table: 24 hour minimum between stages outlined below

Rehabilitation Stage	Functional Exercise at Each Stage of Recovery
1. Light Resistance	Medicine Ball, Bands and Body Weight exercises
2. Moderate Resistance	Progress Med Ball Intensity, Continue Band work, Increase to 50% Body Weight or less of pre-injury training loads with ≥ 1 minute rest between sets.
3. Full Resistance	Full weight training based on strength phase that corresponds with training cycle. Cut volume down ½ to ⅓ of protocol workout. Load should be 50-75% or less training loads. Med balls, bands and body weight exercises still okay. Rest should be 1 minute between sets.

**Note for all phases: Stop with any adverse signs or symptoms. Regular reps only (No forced reps/no SS-Negatives and no isometrics). Hydration / Flexibility (All Vertical) during rest periods with extra emphasis on proper breathing technique.*

4) **Prolonged Recovery:** Some athletes that continue to have prolonged symptoms will be serially evaluated by their supervising team physician to measure/monitor the deterioration or improvement of their symptoms. The physician will then determine when referral is needed to diagnose the presence of additional pathology. These additional diagnoses include but are not limited to: Post-concussion syndrome, Sleep dysfunction, Migraine or other headache disorders, Mood disorders such as anxiety/depression, Ocular or vestibular dysfunction. Consultation may include but is not limited to neurologist(s), neurosurgeon(s), neuropsychologist(s) or therapist(s) trained in neural or vestibular rehabilitation. In addition, the physician and sports medicine staff will coordinate academic accommodations / considerations given the length of time the athlete may have been restricted from cognitive efforts. These academic considerations will be consistent with all rules and regulations outlined by Penn State's Office of Disability Services and the Morgan Academic Support Center. A multidisciplinary approach to the diagnosis and management of these complicated patients are consistent with international guidelines for mild traumatic brain injury management.

5) **<u>Follow-Up Care:</u>** In some instances, concussion has been reported to result in long term health decrements. The team physician will determine what follow-up care is medically indicated based on the patient's history and examination. This may include additional formalized NP testing or additional expert consultations.

Concussion Policy Review Procedures

This Concussion Management Policy will be reviewed by a 'Concussion Committee' comprised of team physicians and athletic trainers on an annual basis appointed by the Director of Athletic Medicine and Assistant Athletic Director for Athletic Training Services. Renewed editions will be submitted and approved by the Director of Athletic Medicine and Assistant Athletic Director for Athletic Training Services before being finally reviewed and approved by the Director of Athletics for Penn State University in accordance with all NCAA and B1G mandates and requirements. (See Appendix L – Certificate of Compliance) All procedures must be completed prior to submission to the NCAA Concussion Safety Protocol Committee by May 1st annually.

Penn State Center for Sports Concussion Research & Service

As part of our efforts to better understand the short and long-term health effect of sports related concussion, Penn State Sports Medicine works closely with the Center for Sport Concussion Research and Service (http://concussion.psu.edu/) within the College of Health and Human Development. The research lab is currently home to one of the nation's leading facilities focused on traumatic brain injuries in athletics lead by Dr. Semyon Slobounov (Director) and Dr. Peter Arnett (Co-investigator).

Dr. Slobounov has developed the Virtual Reality (VR) facility which is designed to examine residual cognitive and motor abnormalities in patients suffering from concussion. Virtual reality is incorporated with brain imaging research (fMRI, DTI, MRS, EEG) to examine the alteration of brain functions/structures in concussed individuals. Dr. Arnett's primary focus is on the role of clinical neuropsychology and recovery of function following concussion. This multidisciplinary research and service are focused on both collegiate athletics and pediatric populations.

Student athletes participating in varsity & club level athletic teams are able to participate in research initiatives within the Center for Sports Concussion Research and Service lab and contribute to our growing body of knowledge on sports related concussion.

The lab is currently conducting research in the areas of:

- The effects of concussion on academic performance.
- The effects of hypothermia on brain function in the concussed athlete.
- The effects of anti-oxidant supplementation on brain function in the concussed athlete.
- The effects of concussion on generalized brain function as measured using virtual reality, functional MRI and EEG analysis.
- Neuropsychological predictors of outcome following concussion, including motivation at baseline, cognitive variability, premorbid personality characteristics, and cognitive reserve.
- Genetic factors that predict concussion outcome.

Appendix A: NCAA Constitution By-Law 3.2.4.17

By-Law 3.2.4.17 Concussion Management Plan – An active member institution shall have a concussion management plan for its student athletes. The plan shall include, but is not limited to, the following:

(a) An annual process that ensures student-athletes are educated about the signs and symptoms of concussions. Student-athletes must acknowledge that they have received information about the signs and symptoms of concussions and that they have a responsibility to report concussion-related injuries and illnesses to a medical staff member;

(b) A process that ensures a student-athlete who exhibits signs and symptoms or behaviors consistent with a concussion shall be removed from athletics activities (e.g. competition, practice, conditioning sessions) and evaluated by a medical staff member (e.g. sports medicine staff, team physician) with experience in the evaluation and management of concussions;

(c) A policy that precludes a student-athlete diagnosed with a concussion from returning to athletics activity (e.g. competition, practice, conditioning sessions) for at least the remainder of that calendar day; and

(d) A policy that requires medical clearance for a student-athlete diagnosed with a concussion to return to the athletics activity (e.g. competition, practice, conditioning sessions) as determined by a physician (e.g. team physician) or the physician's designee.

Appendix B: USA Football: Heads Up Tackling™ technique

Appendix C: CDC & NCAA Educational Handout

What is a concussion?

A concussion is a type of traumatic brain injury. It follows a force to the head or body and leads to a change in brain function. It is not typically accompanied by loss of consciousness.

How can I keep myself safe?

1. Know the symptoms.

You may experience …

- Headache or head pressure
- Nausea
- Balance problems or dizziness
- Double or blurry vision
- Sensitivity to light or noise
- Feeling sluggish, hazy or foggy
- Confusion, concentration or memory problems

2. Speak up.

- If you think you have a concussion, stop playing and talk to your coach, athletic trainer or team physician immediately.

3. Take time to recover.

- Follow your team physician and athletic trainer's directions during concussion recovery. If left unmanaged, there may be serious consequences.
- Once you've recovered from a concussion, talk with your physician about the risks and benefits of continuing to participate in your sport.

How can I be a good teammate?

1. Know the symptoms.

You may notice that a teammate …

- Appears dazed or stunned
- Forgets an instruction
- Is confused about an assignment or position
- Is unsure of the game, score or opponent
- Appears less coordinated
- Answers questions slowly
- Loses consciousness

2. Encourage teammates to be safe.

- If you think one of your teammates has a concussion, tell your coach, athletic trainer or team physician immediately.
- Help create a culture of safety by encouraging your teammates to report any concussion symptoms.

3. Support your injured teammates.

- If one of your teammates has a concussion, let him or her know you and the team support playing it safe and following medical advice during recovery.
- Being unable to practice or join team activities can be isolating. Make sure your teammates know they're not alone.

No two concussions are the same. New symptoms can appear hours or days after the initial impact.
If you are unsure if you have a concussion, talk to your athletic trainer or team physician immediately.

What happens if I get a concussion and keep practicing or competing?

- Due to brain vulnerability after a concussion, an athlete may be more likely to suffer another concussion while symptomatic from the first one.
- In rare cases, repeat head trauma can result in brain swelling, permanent brain damage or even death.
- Continuing to play after a concussion increases the chance of sustaining other injuries too, not just concussion.
- Athletes with concussion have reduced concentration and slowed reaction time. This means that you won't be performing at your best.
- Athletes who delay reporting concussion take longer to recover fully.

What are the long-term effects of a concussion?

- We don't fully understand the long-term effects of a concussion, but ongoing studies raise concerns.
- Athletes who have had multiple concussions *may* have an increased risk of degenerative brain disease and cognitive and emotional difficulties later in life.

What do I need to know about repetitive head impacts?

- Repetitive head impacts mean that an individual has been exposed to repeated impact forces to the head. These forces may or may not meet the threshold of a concussion.
- Research is ongoing but emerging data suggest that repetitive head impact also may be harmful and place a student-athlete at an increased risk of neurological complications later in life.

Did you know?

- NCAA rules require that team physicians and athletic trainers manage your concussion and injury recovery independent of coaching staff, or other non-medical, influence.
- We're learning more about concussion every day. To find out more about the largest concussion study ever conducted, which is being led by the NCAA and U.S. Department of Defense, visit ncaa.org/concussion.

CONCUSSION TIMELINE

Baseline Testing
Balance, cognitive and neurological tests that help medical staff manage and diagnose a concussion.

Concussion
If you show signs of a concussion, NCAA rules require that you be removed from play and medically evaluated.

Recovery
Your school has a concussion management plan, and team physicians and athletic trainers are required to follow that plan during your recovery.

Return to Learn
Return to school should be done in a step-by-step progression in which adjustments are made as needed to manage your symptoms.

Return to Play
Return to play only happens after you have returned to your preconcussion baseline and you've gone through a step-by-step progression of increasing activity.

For more information, visit ncaa.org/concussion.

Appendix D: PSU Concussion Self-Reporting Acknowledgement Form

THE PENNSYLVANIA STATE UNIVERSITY DEPARTMENT OF INTERCOLLEGIATE ATHLETICS

STUDENT-ATHLETE CONCUSSION, INJURY AND ILLNESS SELF-REPORTING ACKNOWLEDGEMENT FORM

About Concussions:

• A concussion is a traumatic brain injury that is caused by a blow to the head or body, and results in an alteration in mental status, with or without loss of consciousness.
• Concussions can range from mild to severe, and may present differently in each student-athlete.
• Symptoms of concussion include: amnesia / loss of memory, confusion, headache, loss of consciousness, groggy, feeling irritable, concentration or memory problems, and slowed reaction time.

Treatment and Reporting of Concussion and Other Injury or Illness:

• A student-athlete who exhibits signs or symptoms of a possible concussion should be removed from practice or competition and assessed by a certified athletic trainer and/or team physician of the Penn State sports medicine staff.
• A student-athlete who has suffered a concussion may not return to practice or competition until symptoms have resolved and he or she has received medical clearance.
• The Penn State sports medicine staff cannot evaluate and treat a student-athlete who may have suffered a concussion, or any other type of injury or illness, unless the student-athlete discloses his or her symptoms.
• Failure of a student-athlete to advise the sports medicine staff about symptoms of a head injury, concussion, or other injury or significant illness could result in serious and permanent harm.

I hereby acknowledge: (1) that I have read and understand the above information; (2) that I have received educational materials about concussions and the opportunity to ask questions on the subject; and (3) that my participation in my sport may result in a head injury, concussion, or other injury or illness.

I accept responsibility for reporting all head injuries, symptoms of concussion, injuries of any kind, and significant illness to the sports medicine staff.

_____ _____

Printed Name of Student-Athlete Sport

_____ Date: _____

Signature of Student-Athlete

If Student-Athlete is under the age of 18, the signature of a parent or guardian is also required.

I certify that I am the Student-Athlete's parent or legal guardian, and that I have read this form, Understand the provisions hereof, and agree to be bound by the terms set forth herein, on behalf of the Student-Athlete and on my own behalf.

_____

Printed Name of Parent or Guardian

_____ Date: _____

Signature of Parent or Guardian

Appendix D: B1G Injury and Illness Reporting Form

Big Ten Injury and Illness Reporting Acknowledgement Form

I,_____, acknowledge that I have to be an active participant in my own healthcare. As such, I have the direct responsibility for reporting all of my injuries and illnesses to the sports medicine staff of my institution (e.g., team physician, athletic training staff). I recognize that my true physical condition is dependent upon my accurate medical history and a full disclosure of any symptoms, complaints, prior injuries and/or disabilities experienced. I hereby affirm that I have fully disclosed in writing any prior medical conditions and will also disclose any future conditions to the sports medicine staff at my institution.

I further understand that there is a possibility that participation in my sport may result in a head injury and/or concussion. I have been provided with education on head injuries and understand the importance of immediately reporting symptoms of a head injury/concussion to my sports medicine staff.

By signing below, I acknowledge that my institution has provided me with educational materials on what a concussion is and given me an opportunity to ask questions about areas and issues that are not clear to me on this issue.

I,_____have read the above and agree that the statements are accurate.
Student-athlete's name

_____ _____
Signature of student-athlete Date

_____ _____
Name of person obtaining consent Signature of person consenting

Appendix E: Concussion Post-Injury Instruction Form

CONCUSSION POST-INJURY INSTRUCTION FORM

Name:_____ Date: _____

You have sustained a mild traumatic brain injury (concussion), which is a very serious injury and needs to be monitored. There are various signs and symptoms of a mild head injury that may show up immediately or several hours since initial injury. The following were signs and symptoms that you had during the initial evaluation:

HEADACHE	NAUSEA
VOMITING	BALANCE PROBLEMS / DIZZINESS
FATIGUE	SENSITIVITY TO LIGHT / NOISE
ALTERED EMOTION/BEHAVIOR	RINGING IN THE EARS
NUMBNESS/TINGLING	FEELING SLOWED DOWN
FEELING IN A "FOG"	DIFFICULTY CONCENTRATING
DIFFICULTY REMEMBERING	CONFUSION / DISORIENTATION
DELAYED VERBAL / MOTOR SKILLS	SLURRED / INCOHERENT SPEECH
SLOWING OF PULSE	CONVULSIONS / TREMORS
BLURRED VISION	SADNESS
CLEAR FLUID DRAINAGE FROM EAR/NOSE	BREATHING DIFFICULTY
AMNESIA (ANTEGRADE/RETROGRADE)	CONTINUED DOUBLE VISION
BLOOD/FLUID FROM THE EARS OR NOSE	WEAKNESS IN EITHER ARM OR LEG
VOMITING MORE THAN ONCE OR TWICE	UNCONTROLLABLE EYE MOVEMENTS

Please remember to report back to the Athletic Training Room tomorrow morning at_____for a follow up evaluation. Please review the marked symptoms above.

If these symptoms worsen, or if any of the additional symptoms appear, report them to the Athletic Trainer/Team Physician immediately. *

Otherwise, follow the instructions below:

***It is OK to**:*

-Use Acetaminophen for headaches ***with approval*** from Team Physician. **(No medications before your appointment)**
-Use ice pack on neck and/or head for comfort.
- Go to sleep at a decent hour (8hrs sleep)
- Cognitive and Physical Rest for the first 24 hours after injury.
- After 24 hours: You can walk to and attend class, and do homework as permitted by the health care provider.

***DO NOT**:*

-Take aspirin/Ibuprofen (Advil/Motrin) for headaches
-Do any physical or cognitively strenuous activity
-Drink alcohol
-Drink more caffeinated beverages than normal
-Stay up late
-Watch TV, play video games, sit at a computer or listen to loud music for long periods of time
-Text/play on your phone
-Drive vehicle when impaired
-Attend large group functions or parties

Emergency Phone Numbers

Department of Public Safety	(814) 337-6911
Athletic Trainer	_____
On Call Physician	(814) 865-3566

Appendix F: B1G Concussion Education Acknowledgement Form

Big Ten Coaches Concussion Acknowledgement Form

I,_____, acknowledge that as a member of the athletic department at, Pennsylvania State University, I accept responsibility for supporting our sports medicine department's policy on concussion management.

I understand that my student-athletes may have a risk of head injury and/or concussion. I also understand the importance of them reporting any such symptoms of a head injury/concussion to the sports medicine staff (e.g., team physician, head athletic trainer). I also accept responsibility for reporting to the sports medicine staff any signs or symptoms that I may witness.

By signing below, I acknowledge that my institution has provided me with educational materials on what a concussion is and given me an opportunity to ask questions about areas and issues that are not clear to me on this issue.

I,_____have read the above and agree that the statements are accurate.

_____ _____

Signature of Coach Date

_____ _____

Name of person obtaining acknowledgement Signature of such person

Appendix G: B1G Concussion Education Acknowledgement Form

B1G Concussion Acknowledgement Form

I,_____, acknowledge that as Director of the Athletic Department at, Pennsylvania State University, I accept responsibility for supporting our Sports Medicine Department's 'Concussion Management Policy'.

I understand that my student-athletes may have a risk of head injury and/or concussion. I also understand the importance of them reporting any such symptoms of a head injury/concussion to the sports medicine staff (e.g., team physician, head athletic trainer).

By signing below, I acknowledge that Pennsylvania State University has provided me with educational materials on what a concussion is and given me an opportunity to ask questions about areas that are not clear to me on this issue.

I,_____have read the above and agree that the statements are accurate.

_____ _____

Signature of Director of Athletics Date

_____ _____

Name of person obtaining acknowledgement Signature of such person

Appendix H: B1G Concussion Education Acknowledgement Form

B1G Concussion Acknowledgement Form – Sports Medicine

I,_____, acknowledge that as a member of the Sports Medicine department at, Pennsylvania State University, I accept responsibility for supporting our Sports Medicine Department's 'Concussion Management Policy'.

I understand that my student-athletes may have a risk of head injury and/or concussion. I also understand the importance of them reporting any such symptoms of a head injury/concussion to our sports medicine staff (e.g., team physician, head athletic trainer).

By signing below, I acknowledge that Pennsylvania State University has provided me with educational materials on what a concussion is and given me an opportunity to ask questions about areas that are not clear to me on this issue.

I,_____have read the above and agree that the statements are accurate.

_____ _____

Signature of Sports Medicine Personnel Date

_____ _____

Name of person obtaining acknowledgement Signature of such person

Appendix I: Consensus Statement on Concussion in Sport (2016)

Consensus statement on concussion in sport—the 5th international conference on concussion in sport held in Berlin, October 2016

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PREAMBLE

The 2017 Concussion in Sport Group (CISG) consensus statement is designed to build on the principles outlined in the previous statements[1–4] and to develop further conceptual understanding of sport-related concussion (SRC) using an expert consensus-based approach. This document is developed for physicians and healthcare providers who are involved in athlete care, whether at a recreational, elite or professional level. While agreement exists on the principal messages conveyed by this document, the authors acknowledge that the science of SRC is evolving and therefore individual management and return-to-play decisions remain in the realm of clinical judgement.

This consensus document reflects the current state of knowledge and will need to be modified as new knowledge develops. It provides an overview of issues that may be of importance to healthcare providers involved in the management of SRC. This paper should be read in conjunction with the systematic reviews and methodology paper that accompany it. First and foremost, this document is intended to guide clinical practice; however, the authors feel that it can also help form the agenda for future research relevant to SRC by identifying knowledge gaps.

A series of specific clinical questions were developed as part of the consensus process for the Berlin 2016 meeting. Each consensus question was the subject of a specific formal systematic review, which is published concurrently with this summary statement. Readers are directed to these background papers in conjunction with this summary statement as they provide the context for the issues and include the scope of published research, search strategy and citations reviewed for each question. This 2017 consensus statement also summarises each topic and recommendations in the context of all five CISG meetings (that is, 2001, 2004, 2008, 2012 as well as 2016). Approximately 60 000 published articles were screened by the expert panels for the Berlin meeting. The details of the search strategies and findings are included in each of the systematic reviews.

The details of the conference organisation, methodology of the consensus process, question development and selection on expert panellists and observers is covered in detail in an accompanying paper in this issue.[5] A full list of scientific committee members, expert panellists, authors, observers and those who were invited but could not attend are detailed is at the end of the summary document. The International Committee of Medical Journal Editors conflict of interest declaration for all authors is provided in Appendix 1.

Medical legal considerations

The consensus statement is not intended as a clinical practice guideline or legal standard of care, and should not be interpreted as such. This document is only a guide, and is of a general nature, consistent with the reasonable practice of a healthcare professional. Individual treatment will depend on the facts and circumstances specific to each individual case. It is intended that this document will be formally reviewed and updated before 31 December 2020.

SRC AND ITS MANAGEMENT

The paper is laid out following the CISG's 11 'R's of SRC management to provide a logical flow of

clinical concussion management. *The new material recommendations determined at the Berlin 2016 meeting are italicised*, and any background material or unchanged recommendations from previous meetings are in normal text.

The sections are: Recognise; Remove; Re-evaluate; Rest; Rehabilitation; Refer; Recover; Return to sport; Reconsider; Residual effects and sequelae; Risk reduction.

Recognise

What is the definition of SRC?

In the broadest clinical sense, SRC is often defined as representing the immediate and transient symptoms of traumatic brain injury (TBI). Such operational definitions, however, do not give any insights into the underlying processes through which the brain is impaired, nor do they distinguish different grades of severity, nor reflect newer insights into the persistence of symptoms and/or abnormalities on specific investigational modalities. This issue is clouded not only by the lack of data, but also by confusion in definition and terminology. Often the term mild traumatic brain injury (mTBI) is used interchangeably with concussion; however, this term is similarly vague and not based on validated criteria in this context.

One key unresolved issue is whether concussion is part of a TBI spectrum associated with lesser degrees of diffuse structural change than are seen in severe TBI, or whether the concussive injury is the result of reversible physiological changes. The term concussion, while useful, is imprecise, and because disparate author groups define the term differently, comparison between studies is problematic. In spite of these problems, the CISG has provided a consistent definition of SRC since 2000.[1]

The Berlin expert panel modified the previous CISG definition as follows:

Sport related concussion is a traumatic brain injury induced by biomechanical forces. Several common features that may be utilised in clinically defining the nature of a concussive head injury include:

- *SRC 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.*
- *SRC typically results in the rapid onset of short-lived impairment of neurological function that resolves spontaneously. However, in some cases, signs and symptoms evolve over a number of minutes to hours.*
- *SRC may result in neuropathological changes, but the acute clinical signs and symptoms largely reflect a functional disturbance rather than a structural injury and, as such, no abnormality is seen on standard structural neuroimaging studies.*
- *SRC results in a range of clinical signs and symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive features typically follows a sequential course. However, in some cases symptoms may be prolonged.*

The clinical signs and symptoms cannot be explained by drug, alcohol, or medication use, other injuries (such as cervical injuries, peripheral vestibular dysfunction, etc) or other comorbidities (eg, psychological factors or coexisting medical conditions).

Do the published biomechanical studies inform us about the definition of SRC?

Many studies have reported head-impact-exposure patterns for specific sports—for example, American football, ice hockey and Australian football. Those studies report head-impact characteristics including frequency, head kinematics, head-impact location, and injury outcome. In these studies, the use of instrumented helmets has provided information on head-impact exposures, although there remains some debate about the accuracy and precision of the head kinematic measurements. To quantify head impacts, studies have used helmet-based systems, mouthguard/headband/skin sensors and videometric studies; however, reported mean peak linear and rotational acceleration values in concussed players vary considerably.

Although current helmet-based measurement devices may provide useful information for collision sports, these systems do not yet provide data for other (non-collision) sports, limiting the value of this approach. Furthermore, accelerations detected by a sensor or video-based systems do not necessarily reflect the impact to the brain itself, and values identified vary considerably between studies. The use of helmet-based or other sensor systems to clinically diagnose or assess SRC cannot be supported at this time.

Sideline evaluation

It is important to note that SRC is an evolving injury in the acute phase, with rapidly changing clinical signs and symptoms, which may reflect the underlying physiological injury in the brain. SRC is considered to be among the most complex injuries in sports medicine to diagnose, assess and manage. The majority of SRCs occur without loss of consciousness or frank neurological signs. At present, there is no perfect diagnostic test or marker that clinicians can rely on for an immediate diagnosis of SRC in the sporting environment. Because of this evolving process, it is not possible to rule out SRC when an injury event occurs associated with a transient neurological symptom. In all suspected cases of concussion, the individual should be removed from the playing field and assessed by a physician or licensed healthcare provider as discussed below.

Sideline evaluation of cognitive function is an essential component in the assessment of this injury. Brief neuropsychological (NP) test batteries that assess attention and memory function have been shown to be practical and effective. Such tests include the SCAT5, which incorporates the Maddocks' questions[6 7] and the Standardised Assessment of Concussion (SAC).[8–10] It is worth noting that standard orientation questions (eg, time, place, person) are unreliable in the sporting situation when compared with memory assessment.[7 11] It is recognised, however, that abbreviated testing paradigms are designed for rapid SRC screening on the sidelines and are not meant to replace a comprehensive neurological evaluation; nor should they be used as a standalone tool for the ongoing management of SRC.

A key concept in sideline assessment is the rapid screening for a suspected SRC, rather than the definitive diagnosis of head injury. Players manifesting clear on-field signs of SRC (eg, loss of consciousness, tonic posturing, balance disturbance) should immediately be removed from sporting participation. Players with a suspected SRC following a significant head impact or with symptoms can proceed to sideline screening using appropriate assessment tools—for example, SCAT5. Both groups can then proceed to a more thorough diagnostic evaluation, which should be performed in a distraction-free environment (eg, locker room, medical room) rather than on the sideline.

In cases where the physician may have been concerned about a possible concussion, but after the sideline assessment (including additional information from the athlete, the assessment itself and/or inspection of videotape of the incident) concussion is no longer suspected, then the physician can

Table 1 Graduated return-to-sport (RTS) strategy

Stage	Aim	Activity	Goal of each step
1	Symptom-limited activity	Daily activities that do not provoke symptoms	Gradual reintroduction of work/school activities
2	Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training	Increase heart rate
3	Sport-specific exercise	Running or skating drills. No head impact activities	Add movement
4	Non-contact training drills	Harder training drills, eg, passing drills. May start progressive resistance training	Exercise, coordination and increased thinking
5	Full contact practice	Following medical clearance, participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6	Return to sport	Normal game play	

NOTE: An initial period of 24–48 hours of both relative physical rest and cognitive rest is recommended before beginning the RTS progression.
There should be at least 24 hours (or longer) for each step of the progression. If any symptoms worsen during exercise, the athlete should go back to the previous step.
Resistance training should be added only in the later stages (stage 3 or 4 at the earliest). If symptoms are persistent (eg, more than 10–14 days in adults or more than 1 month in children), the athlete should be referred to a healthcare professional who is an expert in the management of concussion.

determine the disposition and timing of return to play for that athlete.

We acknowledge that many contact sports are played at a fast pace in a disorganised environment, where the view of on-field incidents is often obscured and the symptoms of SRC are diverse, all of which adds to the challenge of the medical assessment of suspected SRC. Furthermore, evolving and delayed-onset symptoms of SRC are well documented and highlight the need to consider follow-up serial evaluation after a suspected SRC regardless of a negative sideline screening test or normal early evaluation.

The recognition of suspected SRC is therefore best approached using multidimensional testing guided via expert consensus. The SCAT5 currently represents the most well-established and rigorously developed instrument available for sideline assessment. There is published support for using the SCAT and Child SCAT in the evaluation of SRC. The SCAT is useful immediately after injury in differentiating concussed from non-concussed athletes, but its utility appears to decrease significantly 3–5 days after injury. The symptom checklist, however, does demonstrate clinical utility in tracking recovery. Baseline testing may be useful, but is not necessary for interpreting post-injury scores. If used, clinicians must strive to replicate baseline testing conditions. Additional domains that may add to the clinical utility of the SCAT tool include clinical reaction time, gait/balance assessment, video-observable signs and oculomotor screening.

The addition of sideline video review offers a promising approach to improving identification and evaluation of significant head-impact events, and a serial SRC evaluation process appears to be important to detect delayed-onset SRC. Other tools show promise as sideline screening tests but require adequately powered diagnostic accuracy studies that enrol a representative sample of athletes with suspected SRC. Collaboration between sporting codes to rationalise multimodal diagnostic sideline protocols may help facilitate more efficient application and monitoring. Current evidence does not support the use of impact sensor systems for real-time SRC screening.

Symptoms and signs of acute SRC

Recognising and evaluating SRC in the adult athlete on the field is a challenging responsibility for the healthcare provider. Performing this task often involves a rapid assessment in the midst of competition with a time constraint and the athlete eager to play. A standardised objective assessment of injury that excludes more serious injury is critical in determining disposition decisions for the athlete. The sideline evaluation is based on recognition of injury, assessment of symptoms, cognitive and cranial nerve function, and balance. Serial assessments are often necessary. Because SRC is often an evolving injury, and signs and symptoms may be delayed, erring on the side of caution (ie, keeping an athlete out of participation when there is any suspicion of injury) is important.

The diagnosis of acute SRC involves the assessment of a range of domains including clinical symptoms, physical signs, cognitive impairment, neurobehavioral features and sleep/wake disturbance. Furthermore, a detailed concussion history is an important part of the evaluation both in the injured athlete and when conducting a pre-participation examination.

The suspected diagnosis of SRC can include one or more of the following clinical domains:

a. Symptoms: somatic (eg, headache), cognitive (eg, feeling like in a fog) and/or emotional symptoms (eg, lability)
b. Physical signs (eg, loss of consciousness, amnesia, neurological deficit)
c. Balance impairment (eg, gait unsteadiness)
d. Behavioural changes (eg, irritability)
e. Cognitive impairment (eg, slowed reaction times)
f. Sleep/wake disturbance (eg, somnolence, drowsiness)

If symptoms or signs in any one or more of the clinical domains are present, an SRC should be suspected and the appropriate management strategy instituted. It is important to note, however, that these symptoms and signs also happen to be non-specific to concussion, so their presence simply prompts the inclusion of concussion in a differential diagnosis for further evaluation, but the symptom is not itself diagnostic of concussion.

Remove

When a player shows any symptoms or signs of an SRC:

a. The player should be evaluated by a physician or other licensed healthcare provider on site using standard emergency management principles, and particular attention should be given to excluding a cervical spine injury.
b. The appropriate disposition of the player must be determined by the treating healthcare provider in a timely manner. If no healthcare provider is available, the player should be safely removed from practice or play and urgent referral to a physician arranged.
c. Once the first aid issues are addressed, an assessment of the concussive injury should be made using the SCAT5 or other sideline assessment tools.
d. The player should not be left alone after the injury, and serial monitoring for deterioration is essential over the initial few hours after injury.
e. A player with diagnosed SRC should not be allowed to return to play on the day of injury.

Table 2 Graduated return-to-school strategy

Stage	Aim	Activity	Goal of each step
1	Daily activities at home that do not give the child symptoms	Typical activities of the child during the day as long as they do not increase symptoms (eg, reading, texting, screen time). Start with 5–15 min at a time and gradually build up	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 increased breaks during the day	Increase academic activities
4	Return to school full time	Gradually progress school activities until a full day can be tolerated	Return to full academic activities and catch up on missed work

When a concussion is suspected, the athlete should be removed from the sporting environment and a multimodal assessment should be conducted in a standardised fashion (eg, the SCAT5). Sporting bodies should allow adequate time to conduct this evaluation. For example, completing the SCAT alone typically takes 10 min. Adequate facilities should be provided for the appropriate medical assessment both on and off the field for all injured athletes. In some sports, this may require rule changes to allow an appropriate off-field medical assessment to occur without affecting the flow of the game or unduly penalising the injured player's team. The final determination regarding SRC diagnosis and/or fitness to play is a medical decision based on clinical judgement.

Re-evaluate

An athlete with SRC may be evaluated in the emergency room or doctor's office as a point of first contact after injury or may have been referred from another care provider. In addition to the points outlined above, the key features of follow-up examination should encompass:

a. A medical assessment including a comprehensive history and detailed neurological examination including a thorough assessment of mental status, cognitive functioning, sleep/wake disturbance, ocular function, vestibular function, gait and balance.
b. Determination of the clinical status of the patient, including whether there has been improvement or deterioration since the time of injury. This may involve seeking additional information from parents, coaches, teammates and eyewitnesses to the injury.
c. Determination of the need for emergent neuroimaging to exclude a more severe brain injury (eg, structural abnormality).

Neuropsychological assessment

Neuropsychological assessment (NP) has been previously described by the CISG as a 'cornerstone' of SRC management. Neuropsychologists are uniquely qualified to interpret NP tests and can play an important role within the context of a multifaceted—multimodal and multidisciplinary approach to managing SRC. SRC management programmes that use NP assessment to assist in clinical decision-making have been instituted in professional sports, colleges and high schools.

The application of NP testing in SRC has clinical value and contributes significant information in SRC evaluation.[12–17] Although in most cases, cognitive recovery largely overlaps with the time course of symptom recovery, cognitive recovery may occasionally precede or lag behind clinical symptom resolution, suggesting that the assessment of cognitive function should be an important component in the overall assessment of SRC and, in particular, any return-to-play protocol.[18 19] It must be emphasised, however, that NP assessment should not be the sole basis of management decisions. Rather, it provides an aid to the clinical decision-making process in conjunction with a range of assessments of different clinical domains and investigational results.

It is recommended that all athletes should have a clinical neurological assessment (including evaluation of mental status/cognition, oculomotor function, gross sensorimotor, coordination, gait, vestibular function and balance) as part of their overall management. This will normally be performed by the treating physician, often in conjunction with computerised NP screening tools.

Brief computerised cognitive evaluation tools are a commonly utilised component of these assessments worldwide given the logistical limitation in accessing trained neuropsychologists. However, it should be noted that these are not substitutes for complete NP assessment.

Baseline or pre-season NP testing was considered by the panel and was not felt to be required as a mandatory aspect of every assessment; however, it may be helpful or add useful information to the overall interpretation of these tests. It also provides an additional educative opportunity for the healthcare provider to discuss the significance of this injury with the athlete.

Post-injury NP testing is not required for all athletes. However, when this is considered necessary, the assessment should optimally be performed by a trained and accredited neuropsychologist. Although neuropsychologists are in the best position to interpret NP tests by virtue of their background and training, the ultimate return-to-play decision should remain a medical one in which a multidisciplinary approach, when possible, has been taken. In the absence of NP and other testing, a more conservative return-to-play approach may be appropriate.

Post-injury NP testing may be used to assist return-to-play decisions and is typically performed when an athlete is clinically asymptomatic. However, NP assessment may add important information in the early stages after injury.[20 21] There may be particular situations where testing is performed early to assist in determining aspects of management—for example, return to school in a paediatric athlete. This will normally be best determined in consultation with a trained neuropsychologist.[22 23]

Concussion investigations

Over the past decade, we have observed major progress in clinical methods for evaluation of SRC and in determining the natural history of clinical recovery after injury. Critical questions remain, however, about the acute neurobiological effects of SRC on brain structure and function, and the eventual time course of physiological recovery after injury. Studies using advanced neuroimaging techniques have demonstrated that SRC is associated with changes in brain structure and function, which

correlate with post-concussive symptoms and performance in neurocognitive testing during the acute post-injury phase.

The assessment of novel and selective fluid (eg, blood, saliva and cerebrospinal fluid) biomarkers and genetic testing for TBI has rapidly expanded in parallel with imaging advances, but this currently has limited application to the clinical management of SRC. Extending from the broader TBI literature, there is also increasing interest in the role of genetics in predicting risk of (i) initial injury, (ii) prolonged recovery and long-term neurological health problems associated with SRC, and (iii) repetitive head-impact exposure in athletes.

Clinically, there is a need for diagnostic biomarkers as a more objective means to assess the presence/severity of SRC in athletes. Beyond the potential diagnostic utility, there is also keen interest in the development of prognostic biomarkers of recovery after SRC. Imaging and fluid biomarkers that reliably reflect the extent of neuronal, axonal and glial damage and/or microscopic pathology could conceivably diagnose and predict clinical recovery outcome and/or determine risk of potential cumulative impairments after SRC.

Advanced neuroimaging, fluid biomarkers and genetic testing are important research tools, but require further validation to determine their ultimate clinical utility in evaluation of SRC.

Rest

Most consensus and agreement statements for managing SRC recommend that athletes rest until they become symptom-free. Accordingly, prescribed rest is one of the most widely used interventions in this population. The basis for recommending physical and cognitive rest is that rest may ease discomfort during the acute recovery period by mitigating post-concussion symptoms and/or that rest may promote recovery by minimising brain energy demands following concussion.

There is currently insufficient evidence that prescribing complete rest achieves these objectives. After a brief period of rest during the acute phase (24–48 hours) after injury, patients can be encouraged to become gradually and progressively more active while staying below their cognitive and physical symptom-exacerbation thresholds (ie, activity level should not bring on or worsen their symptoms). It is reasonable for athletes to avoid vigorous exertion while they are recovering. The exact amount and duration of rest is not yet well defined in the literature and requires further study.

Rehabilitation

This summary statement regarding the potential for concussion rehabilitation must be read in conjunction with the systematic review paper, which details the background, search strategy, citations and reasoning for this statement. As 'Rehabilitation' did not exist as a separate section in the previous Consensus Statements, this section is all in italics.

SRCs can result in diverse symptoms and problems, and can be associated with concurrent injury to the cervical spine and peripheral vestibular system. The literature has not evaluated early interventions, as most individuals recover in 10–14 days. A variety of treatments may be required for ongoing or persistent symptoms and impairments following injury. The data support interventions including psychological, cervical and vestibular rehabilitation.

In addition, closely monitored active rehabilitation programmes involving controlled sub-symptom-threshold, submaximal exercise have been shown to be safe and may be of benefit in facilitating recovery. A collaborative approach to treatment, including controlled cognitive stress, pharmacological treatment, and school accommodations, may be beneficial.

Further research evaluating rest and active treatments should be performed using high-quality designs that account for potential confounding factors, and have matched controls and effect modifiers to best inform clinical practice and facilitate recovery after SRC.

Refer

Persistent symptoms

A standard definition for persistent post-concussive symptoms is needed to ensure consistency in clinical management and research outcomes. The Berlin expert consensus is that use of the term 'persistent symptoms' following SRC should reflect failure of normal clinical recovery—that is, symptoms that persist beyond expected time frames (ie, >10–14 days in adults and >4 weeks in children).

'Persistent symptoms' does not reflect a single pathophysiological entity, but describes a constellation of non-specific post-traumatic symptoms that may be linked to coexisting and/or confounding factors, which do not necessarily reflect ongoing physiological injury to the brain. A detailed multimodal clinical assessment is required to identify specific primary and secondary pathologies that may be contributing to persisting post-traumatic symptoms. At a minimum, the assessment should include a comprehensive history, focused physical examination, and special tests where indicated (eg, graded aerobic exercise test). Currently, while there is insufficient evidence for investigations, such as EEG, advanced neuroimaging techniques, genetic testing and biomarkers, to recommend a role in the clinical setting, their use in the research setting is encouraged.

Treatment should be individualised and target-specific medical, physical and psychosocial factors identified on assessment. There is preliminary evidence supporting the use of:

a. *an individualised symptom-limited aerobic exercise programme in patients with persistent post-concussive symptoms associated with autonomic instability or physical deconditioning, and*
b. *a targeted physical therapy programme in patients with cervical spine or vestibular dysfunction, and*
c. *a collaborative approach including cognitive behavioural therapy to deal with any persistent mood or behavioural issues.*

Currently, there is limited evidence to support the use of pharmacotherapy. If pharmacotherapy is used, then an important consideration in return to sport is that concussed athletes should not only be free from concussion-related symptoms, but also should not be taking any pharmacological agents/medications that may mask or modify the symptoms of SRC. Where pharmacological therapy may be begun during the management of an SRC, the decision to return to play while still on such medication must be considered carefully by the treating clinician.

Overall, these are difficult cases that should be managed in a multidisciplinary collaborative setting, by healthcare providers with experience in SRC.

Recovery

There is tremendous interest in identifying factors that might influence or modify outcome from SRC. Clinical recovery is defined functionally as a return to normal activities, including school, work and sport, after injury. Operationally, it encompasses

a resolution of post-concussion-related symptoms and a return to clinically normal balance and cognitive functioning.

It is well established that SRCs can have large adverse effects on cognitive functioning and balance in the first 24–72 hours after injury. Injured athletes report diverse physical, cognitive and emotional symptoms during the initial days after injury, and a greater number and severity of symptoms after an SRC predict a slower recovery in some studies.

For most injured athletes, cognitive deficits, balance and symptoms improve rapidly during the first 2 weeks after injury. Many past studies, particularly those published before 2005, concluded that most athletes recover from SRC and return to sport within 10 days. This is generally true, but that conclusion should be tempered by the fact that many studies reported group-level findings only, not clinical outcomes from individual athletes, and group statistical analyses can obscure subgroup results and individual differences. There is also historical evidence that some athletes returned to play while still symptomatic, well before they were clinically recovered. Moreover, during the past 10 years, there has been a steadily accumulating literature that a sizeable minority of youth, high-school and collegiate athletes take much longer than 10 days to clinically recover and return to sport.

Some authors have suggested that the longer recovery times reported in more recent studies partially reflects changes in the medical management of SRC, with adoption of the gradual return-to-play recommendations from the CISG statements. This seems likely because these return-to-play recommendations include no same-day return to play and a sequential progression through a series of steps before medical clearance for return to sport. Longer recovery times reported by some studies are also significantly influenced by ascertainment bias—that is, studies that rely, or report data, on clinical samples have a major selection bias and will report longer recovery times than those reported from truly incident cohort studies that provide a more accurate estimate of recovery time.

At present, it is reasonable to conclude that the large majority of injured athletes recover, *from a clinical perspective*, within the first month of injury. Neurobiological recovery might extend beyond clinical recovery in some athletes. Clinicians know that some student athletes report persistent symptoms for many months after injury, that there can be multiple causes for those symptoms, and that those individuals are more likely to be included in studies conducted at specialty clinics. There is a growing body of literature indicating that psychological factors play a significant role in symptom recovery and contribute to risk of persistent symptoms in some cases.

Researchers have investigated whether pre-injury individual differences, initial injury severity indicators, acute clinical effects, or subacute clinical effects or comorbidities influence outcome after SRC. Numerous studies have examined whether genetics, sex differences, younger age, neurodevelopmental factors such as attention deficit hyperactivity disorder or learning disability, personal or family history of migraine, or a personal or family history of mental health problems are predictors or effect modifiers of clinical recovery from SRC. Having a past SRC is a risk factor for having a future SRC, and having multiple past SRCs is associated with having more physical, cognitive and emotional symptoms before participation in a sporting season. Therefore, it is not surprising that researchers have studied whether having prior SRCs is associated with slower recovery from an athlete's next SRC. There have been inconsistent findings regarding whether specific *injury severity characteristics*, such as loss of consciousness, retrograde amnesia, or post-traumatic amnesia, are associated with greater acute effects or prolonged recovery. Numerous *post-injury clinical factors*, such as the initial severity of cognitive deficits, the development of post-traumatic headaches or migraines, experiencing dizziness, difficulties with oculomotor functioning, and experiencing symptoms of depression have all been associated with worse outcomes in some studies.

The strongest and most consistent predictor of slower recovery from SRC is the severity of a person's initial symptoms in the first day, or initial few days, after injury. Conversely, and importantly, having a low level of symptoms in the first day after injury is a favourable prognostic indicator. The development of subacute problems with migraine headaches or depression are likely risk factors for persistent symptoms lasting more than a month. Children, adolescents and young adults with a pre-injury history of mental health problems or migraine headaches appear to be at somewhat greater risk of having symptoms for more than 1 month. Those with attention deficit hyperactivity disorder or learning disabilities might require more careful planning and intervention regarding returning to school, but they do not appear to be at substantially greater risk of persistent symptoms beyond a month. Very little research to date has been carried out on children under the age of 13. There is some evidence that the teenage years, particularly the high-school years, might be the most vulnerable time period for having persistent symptoms—with greater risk for girls than boys.

Establishing time of recovery for SRC

Establishing the time of recovery after an SRC is a difficult task for healthcare providers. These determinations have been limited by lack of a gold standard as well as subjective symptom scores and imperfect clinical and NP testing. In addition, patients frequently experience more persistent symptoms, including, but not limited to, chronic migraines, anxiety, post-traumatic stress disorder (PTSD), attention problems and sleep dysfunction. Clinicians must determine whether these are premorbid maladies, downstream effects of SRC, or unrelated challenges while being mindful of the potential for repeat injuries when returning patients to sport too early. Providers are often left in a quandary with limited data to make decisions. Moreover, recent literature suggests that the physiological time of recovery may outlast the time for clinical recovery. The consequence of this is as yet unknown, but one possibility is that athletes may be exposed to additional risk by returning to play while there is ongoing brain dysfunction.

In a research context, modalities that measure physiological change after SRC can be categorised into the following:

- *functional MRI (fMRI)*
- *diffusion tensor imaging (DTI)*
- *magnetic resonance spectroscopy (MRS)*
- *cerebral blood flow (CBF)*
- *electrophysiology*
- *heart rate*
- *measure of exercise performance*
- *fluid biomarkers*
- *transcranial magnetic stimulation (TMS).*

Owing to differences in modalities, time course, study design and outcomes, it is not possible to define a single 'physiological time window' for SRC recovery. Multiple studies suggest that physiological dysfunction may outlast current clinical measures of recovery, supporting a 'buffer zone' of gradually increasing activity before full contact risk. Future studies need to use generalisable populations, longitudinal designs following

to physiological and clinical recovery, and careful correlation of neurobiological modalities with clinical measures. At this stage, these modalities, while useful as research tools, are not ready for clinical management.

Return to sport

Graduated return to sport

The process of recovery and then return to sport participation after an SRC follows a graduated stepwise rehabilitation strategy, an example of which is outlined in table 1. This table has been modified from previous versions to improve clarity.

After a brief period of initial rest (24–48 hours), symptom-limited activity can be begun while staying below a cognitive and physical exacerbation threshold (stage 1). Once concussion-related symptoms have resolved, the athlete should continue to proceed to the next level if he/she meets all the criteria (eg, activity, heart rate, duration of exercise, etc) without a recurrence of concussion-related symptoms. Generally, each step should take 24 hours, so that athletes would take a minimum of 1 week to proceed through the full rehabilitation protocol once they are asymptomatic at rest. However, the time frame for RTS may vary with player age, history, level of sport, etc, and management must be individualised.

In athletes who experience prolonged symptoms and resultant inactivity, each step may take longer than 24 hours simply because of limitations in physical conditioning and recovery strategies outlined above. This specific issue of the role of symptom-limited exercise prescription in the setting of prolonged recovery is discussed in an accompanying systematic review.[24] If any concussion-related symptoms occur during the stepwise approach, the athlete should drop back to the previous asymptomatic level and attempt to progress again after being free of concussion-related symptoms for a further 24 hour period at the lower level.

Reconsider

The CISG also considered whether special populations should be managed differently and made recommendations for elite and young athletes.

Elite and non-elite athletes

All athletes, regardless of level of participation, should be managed using the same management principles noted above.

The child and adolescent athlete

The management of SRC in children requires special paradigms suitable for the developing child. The paucity of studies that are specific to children, especially younger children, needs to be addressed as a priority, with the expectation that future CISG consensus meetings will have sufficient studies to review that are age-specific, of high quality, and with a low risk of bias.

We recommend that child and adolescent guidelines refer to individuals 18 years or less. Child-specific paradigms for SRC should apply to children aged 5–12 years, and adolescent-specific paradigms should apply to those aged 13–18 years. The literature does not adequately address the question of age groups in which children with SRC should be managed differently from adults. No studies have addressed whether SRC signs and symptoms differ from adults. The expected duration of symptoms in children with SRC is up to 4 weeks, and further research is required to identify predictors of prolonged recovery. It is recommended that age-specific validated symptom-rating scales be used in SRC assessment, and further research is required to establish the role and utility of computerised NP testing in this age group. Similar to adults, a brief period of physical and cognitive rest is advised after SRC followed by symptom-limited resumption of activity.

Schools are encouraged to have an SRC policy that includes education on SRC prevention and management for teachers, staff, students and parents, and should offer appropriate academic accommodation and support to students recovering from SRC. Students should have regular medical follow-up after an SRC to monitor recovery and help with return to school, and students may require temporary absence from school after injury.

Children and adolescents should not return to sport until they have successfully returned to school. However, early introduction of symptom-limited physical activity is appropriate.

An example of the return-to-school progression is in table 2.

Residual effects and sequelae

This summary statement regarding the potential for long-term sequelae following recurrent head trauma must be read in conjunction with the systematic review paper, which details the background, search strategy, citations and reasoning for this statement.[25]

The literature on neurobehavioral sequelae and long-term consequences of exposure to recurrent head trauma is inconsistent. Clinicians need to be mindful of the potential for long-term problems such as cognitive impairment, depression, etc in the management of all athletes. However, there is much more to learn about the potential cause-and-effect relationships of repetitive head-impact exposure and concussions. The potential for developing chronic traumatic encephalopathy (CTE) must be a consideration, as this condition appears to represent a distinct tauopathy with an unknown incidence in athletic populations. A cause-and-effect relationship has not yet been demonstrated between CTE and SRCs or exposure to contact sports. As such, the notion that repeated concussion or subconcussive impacts cause CTE remains unknown.

The new US National Institutes of Neurological Disease and Stroke (NINDS) and National Institute of Biomedical Imaging and Bioengineering (NIBIB) consensus criteria provide a standardised approach for describing the neuropathology of CTE. More research on CTE is needed to better understand the incidence and prevalence, the extent to which the NP findings cause specific clinical symptoms, the extent to which the neuropathology is progressive, the clinical diagnostic criteria, and other risk or protective factors. Ideally, well-designed case–control or cohort studies can begin to answer these important questions.

Risk reduction

Role of pre-participation SRC evaluation

Acknowledging the importance of an SRC history, and appreciating the fact that many athletes will not recognise all the SRCs they may have suffered in the past, a detailed SRC history is of value.[26–29] Such a history may identify athletes who fit into a high-risk category and provides an opportunity for the healthcare provider to educate the athlete as to the significance of concussive injury.

A structured SRC history should include specific questions as to previous symptoms of an SRC and length of recovery, not just the perceived number of past SRCs. Note that dependence on the recall of concussive injuries by teammates or coaches is unreliable.[26] The clinical history should also include information about all previous head, face or cervical spine injuries, as these may also have clinical relevance. In the setting of maxillofacial and cervical spine injuries, coexistent concussive injuries

may be missed unless specifically assessed. Questions pertaining to disproportionate impact versus symptom-severity matching may alert the clinician to a progressively increasing vulnerability to injury. As part of the clinical history, the health practitioner should seek details regarding protective equipment used at the time of injury for both recent and remote injuries.

There is an additional and often unrecognised benefit of the pre-participation physical examination insofar as the evaluation provides an educative opportunity with the player concerned, as well as consideration of modification of playing behaviour if required.

Prevention

While it is impossible to eliminate all concussion in sport, concussion-prevention strategies can reduce the number and severity of concussions in many sports. Until the past decade, there has been a relative paucity of scientifically rigorous evaluation studies examining the effectiveness of concussion-prevention strategies in sport.

The evidence examining the protective effect of helmets in reducing the risk of SRC is limited in many sports because of the nature of mandatory helmet regulations. There is sufficient evidence in terms of reduction of overall head injury in skiing/snowboarding to support strong recommendations and policy to mandate helmet use in skiing/snowboarding. The evidence for mouthguard use in preventing SRC is mixed, but meta-analysis suggests a non-significant trend towards a protective effect in collision sports, and rigorous case–control designs are required to further evaluate this finding.

The strongest and most consistent evidence evaluating policy is related to body checking in youth ice hockey (ie, disallowing body checking under age 13), which demonstrates a consistent protective effect in reducing the risk of SRC. This evidence has informed policy change in older age groups in non-elite levels, which requires further investigation.

There is minimal evidence to support individual injury-prevention strategies addressing intrinsic risk factors for SRC in sport. However, there is some promise that vision training in collegiate American football players may reduce SRC. Limiting contact in youth football practices has demonstrated some promising results in reducing the frequency of head contact, but there is no evidence to support the translation of these findings to a reduction in SRC. Evaluation of fair play rules in youth ice hockey, tackle training without helmets and shoulder pads in youth American football, and tackle technique training in professional rugby do not lead to a reduction in SRC risk. A recommendation for stricter rule enforcement of red cards for high elbows in heading duels in professional soccer is based on evidence supporting a reduced risk of head contacts and concussion with such enforcement.

Despite a myriad of studies examining SRC-prevention interventions across several sports, some findings remain inconclusive because of conflicting evidence, lack of rigorous study design, and inherent study biases. A clear understanding of potentially modifiable risk factors is required to design, implement and evaluate appropriate prevention interventions to reduce the risk of SRC. In addition, risk factors should be considered as potential confounders or effect modifiers in any evaluation. Biomechanical research (eg, video-analysis) to better understand injury risk behaviour and mechanisms of injury associated with rules will better inform practice and policy decisions. In addition, psychological and sociocultural factors in sport play a significant role in the uptake of any injury-prevention strategy and require consideration.

Knowledge translation

The value of knowledge translation (KT) as part of SRC education is increasingly becoming recognised. Target audiences benefit from specific learning strategies. SRC tools exist, but their effectiveness and impact require further evaluation. The media is valuable in drawing attention to SRC, but efforts need to ensure that the public is aware of the right information, including uncertainties about long-term risks of adverse outcomes. Social media is becoming more prominent as an SRC education tool. Implementation of KT models is one approach organisations can use to assess knowledge gaps, identify, develop and evaluate education strategies, and use the outcomes to facilitate decision-making. Implementing KT strategies requires a defined plan. Identifying the needs, learning styles and preferred learning strategies of target audiences, coupled with evaluation, should be a piece of the overall SRC education puzzle to have an impact on enhancing knowledge and awareness.

As the ability to treat or reduce the effects of concussive injury after the event is an evolving science, education of athletes, colleagues and the general public is a mainstay of progress in this field. Athletes, referees, administrators, parents, coaches and healthcare providers must be educated regarding the detection of SRC, its clinical features, assessment techniques and principles of safe return to play. Methods to improve education, including web-based resources, educational videos and international outreach programmes, are important in delivering the message. Fair play and respect for opponents are ethical values that should be encouraged in all sports and sporting associations. Similarly, coaches, parents and managers play an important part in ensuring these values are implemented on the field of play.[30–43]

In addition, the support and endorsement of sporting bodies such as the International Ice Hockey Federation, Fédération Internationale de Football Association (FIFA) and the International Olympic Committee who initiated this endeavour, as well as organisations that have subsequently supported the CISG meetings, including World Rugby, the International Equestrian Federation and the International Paralympic Committee, should be commended.

CONCLUSION

Since the 1970s, clinicians and scientists have begun to distinguish SRC from other causes of concussion and mTBI, such as motor vehicle crashes. While this seems like an arbitrary separation from other forms of TBI, which account for 80% of such injuries,[44 45] it is largely driven by sporting bodies that see the need to have clear and practical guidelines to determine recovery and safe return to play for athletes with an SRC.

In addition, sports participation provides unique opportunities to study SRC and mTBI, given the detailed SRC phenotype data that are typically available in many sports.[46] Having said that, it is critical to understand that the lessons derived from non-sporting mTBI research informs the understanding of SRC (and vice versa), and this arbitrary separation of sporting versus non-sporting TBI should not be viewed as a dichotomous or exclusive view of TBI. One of the standout features of the Berlin CISG meeting was the engagement by experts from the TBI, dementia, imaging and biomarker world in the process and as coauthors of the systematic reviews, which are published in issue 10 of the *British Journal of Sports Medicine* (Volume 51, 2017).

This consensus document reflects the current state of knowledge and will need to be modified according to the development of new knowledge. It should be read in conjunction with the systematic reviews and methodology papers that accompany this document (*British Journal of Sports Medicine*, issues 9 and 10, 2017). This document is first and foremost intended to inform clinical practice; however, it must be remembered that, while agreement exists on the principal messages conveyed by this document, the authors acknowledge that the science of concussion is incomplete and therefore management and return-to-play decisions lie largely in the realm of clinical judgement on an individualised basis.

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APPENDIX 1

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APPENDIX J: SCAT-5 FORM

SCAT5©

SPORT CONCUSSION ASSESSMENT TOOL – 5TH EDITION

DEVELOPED BY THE CONCUSSION IN SPORT GROUP

FOR USE BY MEDICAL PROFESSIONALS ONLY

supported by

Patient details

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date of Injury: _____ Time: _____

WHAT IS THE SCAT5?

The SCAT5 is a standardized tool for evaluating concussions designed for use by physicians and licensed healthcare professionals[1]. The SCAT5 cannot be performed correctly in less than 10 minutes.

If you are not a physician or licensed healthcare professional, please use the Concussion Recognition Tool 5 (CRT5). The SCAT5 is to be used for evaluating athletes aged 13 years and older. For children aged 12 years or younger, please use the Child SCAT5.

Preseason SCAT5 baseline testing can be useful for interpreting post-injury test scores, but is not required for that purpose.Detailed instructions for use of the SCAT5 are provided on page 7. Please read through these instructions carefully before testing the athlete. Brief verbal instructions for each test are given in italics. The only equipment required for the tester is a watch or timer.

Recognise and Remove

A head impact by either a direct blow or indirect transmission of force can be associated with a serious and potentially fatal brain injury. If there are significant concerns, including any of the red flags listed in Box 1, then activation of emergency procedures and urgent transport to the nearest hospital should be arranged.

Key points

- Any athlete with suspected concussion should be REMOVED FROM PLAY, medically assessed and monitored for deterioration. No athlete diagnosed with concussion should be returned to play on the day of injury.
- If an athlete is suspected of having a concussion and medical personnel are not immediately available, the athlete should be referred to a medical facility for urgent assessment.
- Athletes with suspected concussion should not drink alcohol, use recreational drugs and should not drive a motor vehicle until cleared to do so by a medical professional.
- Concussion signs and symptoms evolve over time and it is important to consider repeat evaluation in the assessment of concussion.
- The diagnosis of a concussion is a clinical judgment, made by a medical professional. The SCAT5 should NOT be used by itself to make, or exclude, the diagnosis of concussion. An athlete may have a concussion even if their SCAT5 is "normal".

Remember:

- The basic principles of first aid (danger, response, airway, breathing, circulation) should be followed.
- Do not attempt to move the athlete (other than that required for airway management) unless trained to do so.
- Assessment for a spinal cord injury is a critical part of the initial on-field assessment.
- Do not remove a helmet or any other equipment unless trained to do so safely.

Davis GA, *et al*. *Br J Sports Med* 2017;**0**:1–8. doi:10.1136/bjsports-2017-097506SCAT5

1

IMMEDIATE OR ON-FIELD ASSESSMENT

The following elements should be assessed for all athletes who are suspected of having a concussion prior to proceeding to the neurocognitive assessment and ideally should be done on-field after the first first aid / emergency care priorities are completed.

If any of the "Red Flags" or observable signs are noted after a direct or indirect blow to the head, the athlete should be immediately and safely removed from participation and evaluated by a physician or licensed healthcare professional.

Consideration of transportation to a medical facility should be at the discretion of the physician or licensed healthcare professional.

The GCS is important as a standard measure for all patients and can be done serially if necessary in the event of deterioration in conscious state. The Maddocks questions and cervical spine exam are critical steps of the immediate assessment; however, these do not need to be done serially.

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

STEP 1: RED FLAGS

RED FLAGS:

- **Neck pain or tenderness**
- **Double vision**
- **Weakness or tingling/ burning in arms or legs**
- **Severe or increasing headache**
- **Seizure or convulsion**
- **Loss of consciousness**
- **Deteriorating conscious state**
- **Vomiting**
- **Increasingly restless, agitated or combative**

STEP 2: OBSERVABLE SIGNS

Witnessed ☐ Observed on Video ☐

Lying motionless on the playing surface	Y	N
Balance / gait difficulties / motor incoordination: stumbling, slow / laboured movements	Y	N
Disorientation or confusion, or an inability to respond appropriately to questions	Y	N
Blank or vacant look	Y	N
Facial injury after head trauma	Y	N

STEP 3: MEMORY ASSESSMENT MADDOCKS QUESTIONS[2]

"I am going to ask you a few questions, please listen carefully and give your best effort. First, tell me what happened?"

_____

_____

Mark Y for correct answer / N for incorrect

What venue are we at today?	Y	N
Which half is it now?	Y	N
Who scored last in this match?	Y	N
What team did you play last week / game?	Y	N
Did your team win the last game?	Y	N

Note: Appropriate sport-specific questions may be substituted.

STEP 4: EXAMINATION GLASGOW COMA SCALE (GCS)[3]

Time of assessment			
Date of assessment			
Best eye response (E)			
No eye opening	1	1	1
Eye opening in response to pain	2	2	2
Eye opening to speech	3	3	3
Eyes opening spontaneously	4	4	4
Best verbal response (V)			
No verbal response	1	1	1
Incomprehensible sounds	2	2	2
Inappropriate words	3	3	3
Confused	4	4	4
Oriented	5	5	5
Best motor response (M)			
No motor response	1	1	1
Extension to pain	2	2	2
Abnormal flexion to pain	3	3	3
Flexion / Withdrawal to pain	4	4	4
Localizes to pain	5	5	5
Obeys commands	6	6	6
Glasgow Coma score (E + V + M)			

CERVICAL SPINE ASSESSMENT

Does the athlete report that their neck is pain free at rest?	Y	N
If there is NO neck pain at rest, does the athlete have a full range of ACTIVE pain free movement?	Y	N
Is the limb strength and sensation normal?	Y	N

In a patient who is not lucid or fully conscious, a cervical spine injury should be assumed until proven otherwise.

OFFICE OR OFF-FIELD ASSESSMENT

Please note that the neurocognitive assessment should be done in a distraction-free environment with the athlete in a resting state.

STEP 1: ATHLETE BACKGROUND

Sport / team / school: _____

Date / time of injury: _____

Years of education completed: _____

Age: _____

Gender: M / F / Other

Dominant hand: left / neither / right

How many diagnosed concussions has the athlete had in the past?: _____

When was the most recent concussion?: _____

How long was the recovery (time to being cleared to play) from the most recent concussion?: _____ (days)

Has the athlete ever been:

Hospitalized for a head injury?	Yes	No
Diagnosed / treated for headache disorder or migraines?	Yes	No
Diagnosed with a learning disability / dyslexia?	Yes	No
Diagnosed with ADD / ADHD?	Yes	No
Diagnosed with depression, anxiety or other psychiatric disorder?	Yes	No

Current medications? If yes, please list:

_____

_____

_____

_____

_____

_____

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

2

STEP 2: SYMPTOM EVALUATION

The athlete should be given the symptom form and asked to read this instruction paragraph out loud then complete the symptom scale. For the baseline assessment, the athlete should rate his/her symptoms based on how he/she typically feels and for the post injury assessment the athlete should rate their symptoms at this point in time.

Please Check: ☐ **Baseline** ☐ **Post-Injury**

Please hand the form to the athlete

	none	mild		moderate		severe	
Headache	0	1	2	3	4	5	6
"Pressure in head"	0	1	2	3	4	5	6
Neck Pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like "in a fog"	0	1	2	3	4	5	6
"Don't feel right"	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or Anxious	0	1	2	3	4	5	6
Trouble falling asleep (if applicable)	0	1	2	3	4	5	6

Total number of symptoms:	of 22
Symptom severity score:	of 132
Do your symptoms get worse with physical activity?	Y N
Do your symptoms get worse with mental activity?	Y N
If 100% is feeling perfectly normal, what percent of normal do you feel?	

If not 100%, why?

_____

_____

_____

Please hand form back to examiner

STEP 3: COGNITIVE SCREENING

Standardised Assessment of Concussion (SAC)[4]

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

ORIENTATION

What month is it?	0	1
What is the date today?	0	1
What is the day of the week?	0	1
What year is it?	0	1
What time is it right now? (within 1 hour)	0	1
Orientation score		of 5

IMMEDIATE MEMORY

The Immediate Memory component can be completed using the traditional 5-word per trial list or optionally using 10-words per trial to minimise any ceiling effect. All 3 trials must be administered irrespective of the number correct on the first trial. Administer at the rate of one word per second.

Please choose EITHER the 5 or 10 word list groups and circle the specific word list chosen for this test.

I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order. For Trials 2 & 3: I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before.

List	Alternate 5 word lists					Score (of 5) Trial 1	Trial 2	Trial 3
A	Finger	Penny	Blanket	Lemon	Insect			
B	Candle	Paper	Sugar	Sandwich	Wagon			
C	Baby	Monkey	Perfume	Sunset	Iron			
D	Elbow	Apple	Carpet	Saddle	Bubble			
E	Jacket	Arrow	Pepper	Cotton	Movie			
F	Dollar	Honey	Mirror	Saddle	Anchor			
					Immediate Memory Score			of 15
					Time that last trial was completed			

List	Alternate 10 word lists					Score (of 10) Trial 1	Trial 2	Trial 3
G	Finger Candle	Penny Paper	Blanket Sugar	Lemon Sandwich	Insect Wagon			
H	Baby Elbow	Monkey Apple	Perfume Carpet	Sunset Saddle	Iron Bubble			
I	Jacket Dollar	Arrow Honey	Pepper Mirror	Cotton Saddle	Movie Anchor			
					Immediate Memory Score			of 30
					Time that last trial was completed			

CONCENTRATION

DIGITS BACKWARDS

Please circle the Digit list chosen (A, B, C, D, E, F). Administer at the rate of one digit per second reading DOWN the selected column.

I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7.

Concentration Number Lists (circle one)					
List A	List B	List C			
4-9-3	5-2-6	1-4-2	Y	N	0
6-2-9	4-1-5	6-5-8	Y	N	1
3-8-1-4	1-7-9-5	6-8-3-1	Y	N	0
3-2-7-9	4-9-6-8	3-4-8-1	Y	N	1
6-2-9-7-1	4-8-5-2-7	4-9-1-5-3	Y	N	0
1-5-2-8-6	6-1-8-4-3	6-8-2-5-1	Y	N	1
7-1-8-4-6-2	8-3-1-9-6-4	3-7-6-5-1-9	Y	N	0
5-3-9-1-4-8	7-2-4-8-5-6	9-2-6-5-1-4	Y	N	1
List D	List E	List F			
7-8-2	3-8-2	2-7-1	Y	N	0
9-2-6	5-1-8	4-7-9	Y	N	1
4-1-8-3	2-7-9-3	1-6-8-3	Y	N	0
9-7-2-3	2-1-6-9	3-9-2-4	Y	N	1
1-7-9-2-6	4-1-8-6-9	2-4-7-5-8	Y	N	0
4-1-7-5-2	9-4-1-7-5	8-3-9-6-4	Y	N	1
2-6-4-8-1-7	6-9-7-3-8-2	5-8-6-2-4-9	Y	N	0
8-4-1-9-3-5	4-2-7-9-3-8	3-1-7-8-2-6	Y	N	1
		Digits Score:			of 4

MONTHS IN REVERSE ORDER

Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November. Go ahead.

Dec - Nov - Oct - Sept - Aug - Jul - Jun - May - Apr - Mar - Feb - Jan	0 1
Months Score	of 1
Concentration Total Score (Digits + Months)	of 5

4

STEP 4: NEUROLOGICAL SCREEN

See the instruction sheet (page 7) for details of test administration and scoring of the tests.

Can the patient read aloud (e.g. symptom check-list) and follow instructions without difficulty?	Y	N
Does the patient have a full range of pain-free PASSIVE cervical spine movement?	Y	N
Without moving their head or neck, can the patient look side-to-side and up-and-down without double vision?	Y	N
Can the patient perform the finger nose coordination test normally?	Y	N
Can the patient perform tandem gait normally?	Y	N

BALANCE EXAMINATION

Modified Balance Error Scoring System (mBESS) testing[5]

Which foot was tested (i.e. which is the non-dominant foot) ☐ Left ☐ Right

Testing surface (hard floor, field, etc.) _____

Footwear (shoes, barefoot, braces, tape, etc.) _____

Condition	Errors
Double leg stance	of 10
Single leg stance (non-dominant foot)	of 10
Tandem stance (non-dominant foot at the back)	of 10
Total Errors	of 30

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

5

STEP 5: DELAYED RECALL:

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section. Score 1 pt. for each correct response.

Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order.

Time Started

Please record each word correctly recalled. Total score equals number of words recalled.

_____

_____

_____

Total number of words recalled accurately: of 5 or of 10

6

STEP 6: DECISION

Domain	Date & time of assessment:		
Symptom number (of 22)			
Symptom severity score (of 132)			
Orientation (of 5)			
Immediate memory	of 15 of 30	of 15 of 30	of 15 of 30
Concentration (of 5)			
Neuro exam	Normal Abnormal	Normal Abnormal	Normal Abnormal
Balance errors (of 30)			
Delayed Recall	of 5 of 10	of 5 of 10	of 5 of 10

Date and time of injury: _____

If the athlete is known to you prior to their injury, are they different from their usual self?
☐ Yes ☐ No ☐ Unsure ☐ Not Applicable
(If different, describe why in the clinical notes section)

Concussion Diagnosed?
☐ Yes ☐ No ☐ Unsure ☐ Not Applicable

If re-testing, has the athlete improved?
☐ Yes ☐ No ☐ Unsure ☐ Not Applicable

I am a physician or licensed healthcare professional and I have personally administered or supervised the administration of this SCAT5.

Signature: _____

Name: _____

Title: _____

Registration number (if applicable): _____

Date: _____

SCORING ON THE SCAT5 SHOULD NOT BE USED AS A STAND-ALONE METHOD TO DIAGNOSE CONCUSSION, MEASURE RECOVERY OR MAKE DECISIONS ABOUT AN ATHLETE'S READINESS TO RETURN TO COMPETITION AFTER CONCUSSION.

CLINICAL NOTES:

Name: _____

DOB: _____

Address: _____

ID number: _____

Examiner: _____

Date: _____

CONCUSSION INJURY ADVICE

(To be given to the person monitoring the concussed athlete)

This patient has received an injury to the head. A careful medical examination has been carried out and no sign of any serious complications has been found. Recovery time is variable across individuals and the patient will need monitoring for a further period by a responsible adult. Your treating physician will provide guidance as to this timeframe.

If you notice any change in behaviour, vomiting, worsening headache, double vision or excessive drowsiness, please telephone your doctor or the nearest hospital emergency department immediately.

Other important points:

Initial rest: Limit physical activity to routine daily activities (avoid exercise, training, sports) and limit activities such as school, work, and screen time to a level that does not worsen symptoms.

1) Avoid alcohol

2) Avoid prescription or non-prescription drugs without medical supervision. Specifically:

   a) Avoid sleeping tablets

   b) Do not use aspirin, anti-inflammatory medication or stronger pain medications such as narcotics

3) Do not drive until cleared by a healthcare professional.

4) Return to play/sport requires clearance by a healthcare professional.

Clinic phone number: _____

Patient's name: _____

Date / time of injury: _____

Date / time of medical review: _____

Healthcare Provider: _____

Contact details or stamp

INSTRUCTIONS

Words in *Italics* throughout the SCAT5 are the instructions given to the athlete by the clinician

Symptom Scale

The time frame for symptoms should be based on the type of test being administered. At baseline it is advantageous to assess how an athlete "typically" feels whereas during the acute/post-acute stage it is best to ask how the athlete feels at the time of testing.

The symptom scale should be completed by the athlete, not by the examiner. In situations where the symptom scale is being completed after exercise, it should be done in a resting state, generally by approximating his/her resting heart rate.

For total number of symptoms, maximum possible is 22 except immediately post injury, if sleep item is omitted, which then creates a maximum of 21.

For Symptom severity score, add all scores in table, maximum possible is 22 x 6 = 132, except immediately post injury if sleep item is omitted, which then creates a maximum of 21x6=126.

Immediate Memory

The Immediate Memory component can be completed using the traditional 5-word per trial list or, optionally, using 10-words per trial. The literature suggests that the Immediate Memory has a notable ceiling effect when a 5-word list is used. In settings where this ceiling is prominent, the examiner may wish to make the task more difficult by incorporating two 5–word groups for a total of 10 words per trial. In this case, the maximum score per trial is 10 with a total trial maximum of 30.

Choose one of the word lists (either 5 or 10). Then perform 3 trials of immediate memory using this list.

Complete all 3 trials regardless of score on previous trials.

"I am going to test your memory. I will read you a list of words and when I am done, repeat back as many words as you can remember, in any order." The words must be read at a rate of one word per second.

Trials 2 & 3 MUST be completed regardless of score on trial 1 & 2.

Trials 2 & 3:

"I am going to repeat the same list again. Repeat back as many words as you can remember in any order, even if you said the word before."

Score 1 pt. for each correct response. Total score equals sum across all 3 trials. Do NOT inform the athlete that delayed recall will be tested.

Concentration

Digits backward

Choose one column of digits from lists A, B, C, D, E or F and administer those digits as follows:

Say: *"I am going to read a string of numbers and when I am done, you repeat them back to me in reverse order of how I read them to you. For example, if I say 7-1-9, you would say 9-1-7."*

Begin with first 3 digit string.

If correct, circle "Y" for correct and go to next string length. If incorrect, circle "N" for the first string length and read trial 2 in the same string length. One point possible for each string length. Stop after incorrect on both trials (2 N's) in a string length. The digits should be read at the rate of one per second.

Months in reverse order

"Now tell me the months of the year in reverse order. Start with the last month and go backward. So you'll say December, November ... Go ahead"

1 pt. for entire sequence correct

Delayed Recall

The delayed recall should be performed after 5 minutes have elapsed since the end of the Immediate Recall section.

"Do you remember that list of words I read a few times earlier? Tell me as many words from the list as you can remember in any order."

Score 1 pt. for each correct response

Modified Balance Error Scoring System (mBESS)[5] testing

This balance testing is based on a modified version of the Balance Error Scoring System (BESS)[5]. A timing device is required for this testing.

Each of 20-second trial/stance is scored by counting the number of errors. The examiner will begin counting errors only after the athlete has assumed the proper start position. The modified BESS is calculated by adding one error point for each error during the three 20-second tests. The maximum number of errors for any single condition is 10. If the athlete commits multiple errors simultaneously, only one error is recorded but the athlete should quickly return to the testing position, and counting should resume once the athlete is set. Athletes that are unable to maintain the testing procedure for a minimum of five seconds at the start are assigned the highest possible score, ten, for that testing condition.

OPTION: For further assessment, the same 3 stances can be performed on a surface of medium density foam (e.g., approximately 50cm x 40cm x 6cm).

Balance testing – types of errors

1. Hands lifted off iliac crest
2. Opening eyes
3. Step, stumble, or fall
4. Moving hip into > 30 degrees abduction
5. Lifting forefoot or heel
6. Remaining out of test position > 5 sec

"I am now going to test your balance. Please take your shoes off (if applicable), roll up your pant legs above ankle (if applicable), and remove any ankle taping (if applicable). This test will consist of three twenty second tests with different stances."

(a) Double leg stance:

"The first stance is standing with your feet together with your hands on your hips and with your eyes closed. You should try to maintain stability in that position for 20 seconds. I will be counting the number of times you move out of this position. I will start timing when you are set and have closed your eyes."

(b) Single leg stance:

"If you were to kick a ball, which foot would you use? [This will be the dominant foot] *Now stand on your non-dominant foot. The dominant leg should be held in approximately 30 degrees of hip flexion and 45 degrees of knee flexion. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."*

(c) Tandem stance:

"Now stand heel-to-toe with your non-dominant foot in back. Your weight should be evenly distributed across both feet. Again, you should try to maintain stability for 20 seconds with your hands on your hips and your eyes closed. I will be counting the number of times you move out of this position. If you stumble out of this position, open your eyes and return to the start position and continue balancing. I will start timing when you are set and have closed your eyes."

Tandem Gait

Participants are instructed to stand with their feet together behind a starting line (the test is best done with footwear removed). Then, they walk in a forward direction as quickly and as accurately as possible along a 38mm wide (sports tape), 3 metre line with an alternate foot heel-to-toe gait ensuring that they approximate their heel and toe on each step. Once they cross the end of the 3m line, they turn 180 degrees and return to the starting point using the same gait. Athletes fail the test if they step off the line, have a separation between their heel and toe, or if they touch or grab the examiner or an object.

Finger to Nose

"I am going to test your coordination now. Please sit comfortably on the chair with your eyes open and your arm (either right or left) outstretched (shoulder flexed to 90 degrees and elbow and fingers extended), pointing in front of you. When I give a start signal, I would like you to perform five successive finger to nose repetitions using your index finger to touch the tip of the nose, and then return to the starting position, as quickly and as accurately as possible."

References

1. McCrory et al. Consensus Statement On Concussion In Sport – The 5th International Conference On Concussion In Sport Held In Berlin, October 2016. British Journal of Sports Medicine 2017 (available at www.bjsm.bmj.com)
2. Maddocks, DL; Dicker, GD; Saling, MM. The assessment of orientation following concussion in athletes. Clinical Journal of Sport Medicine 1995; 5: 32-33
3. Jennett, B., Bond, M. Assessment of outcome after severe brain damage: a practical scale. Lancet 1975; i: 480-484
4. McCrea M. Standardized mental status testing of acute concussion. Clinical Journal of Sport Medicine. 2001; 11: 176-181
5. Guskiewicz KM. Assessment of postural stability following sport-related concussion. Current Sports Medicine Reports. 2003; 2: 24-30

CONCUSSION INFORMATION

Any athlete suspected of having a concussion should be removed from play and seek medical evaluation.

Signs to watch for

Problems could arise over the first 24-48 hours. The athlete should not be left alone and must go to a hospital at once if they experience:

- Worsening headache
- Drowsiness or inability to be awakened
- Inability to recognize people or places
- Repeated vomiting
- Unusual behaviour or confusion or irritable
- Seizures (arms and legs jerk uncontrollably)
- Weakness or numbness in arms or legs
- Unsteadiness on their feet.
- Slurred speech

Consult your physician or licensed healthcare professional after a suspected concussion. Remember, it is better to be safe.

Rest & Rehabilitation

After a concussion, the athlete should have physical rest and relative cognitive rest for a few days to allow their symptoms to improve. In most cases, after no more than a few days of rest, the athlete should gradually increase their daily activity level as long as their symptoms do not worsen. Once the athlete is able to complete their usual daily activities without concussion-related symptoms, the second step of the return to play/sport progression can be started. The athlete should not return to play/sport until their concussion-related symptoms have resolved and the athlete has successfully returned to full school/learning activities.

When returning to play/sport, the athlete should follow a stepwise, **medically managed exercise progression, with increasing amounts of exercise.** For example:

Graduated Return to Sport Strategy

Exercise step	Functional exercise at each step	Goal of each step
1. Symptom-limited activity	Daily activities that do not provoke symptoms.	Gradual reintroduction of work/school activities.
2. Light aerobic exercise	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate.
3. Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement.
4. Non-contact training drills	Harder training drills, e.g., passing drills. May start progressive resistance training.	Exercise, coordination, and increased thinking.
5. Full contact practice	Following medical clearance, participate in normal training activities.	Restore confidence and assess functional skills by coaching staff.
6. Return to play/sport	Normal game play.	

In this example, it would be typical to have 24 hours (or longer) for each step of the progression. If any symptoms worsen while exercising, the athlete should go back to the previous step. Resistance training should be added only in the later stages (Stage 3 or 4 at the earliest).

Written clearance should be provided by a healthcare professional before return to play/sport as directed by local laws and regulations.

Graduated Return to School Strategy

Concussion may affect the ability to learn at school. The athlete may need to miss a few days of school after a concussion. When going back to school, some athletes may need to go back gradually and may need to have some changes made to their schedule so that concussion symptoms do not get worse. If a particular activity makes symptoms worse, then the athlete should stop that activity and rest until symptoms get better. To make sure that the athlete can get back to school without problems, it is important that the healthcare provider, parents, caregivers and teachers talk to each other so that everyone knows what the plan is for the athlete to go back to school.

Note: If mental activity does not cause any symptoms, the athlete may be able to skip step 2 and return to school part-time before doing school activities at home first.

Mental Activity	Activity at each step	Goal of each step
1. Daily activities that do not give the athlete symptoms	Typical activities that the athlete does during the day as long as they do not increase symptoms (e.g. reading, texting, screen time). Start with 5-15 minutes at a time and gradually build up.	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 school-work. May need to start with a partial school day or with increased breaks during the day.	Increase academic activities.
4. Return to school full-time	Gradually progress school activities until a full day can be tolerated.	Return to full academic activities and catch up on missed work.

If the athlete continues to have symptoms with mental activity, some other accomodations that can help with return to school may include:

- Starting school later, only going for half days, or going only to certain classes
- More time to finish assignments/tests
- Quiet room to finish assignments/tests
- Not going to noisy areas like the cafeteria, assembly halls, sporting events, music class, shop class, etc.
- Taking lots of breaks during class, homework, tests
- No more than one exam/day
- Shorter assignments
- Repetition/memory cues
- Use of a student helper/tutor
- Reassurance from teachers that the child will be supported while getting better

The athlete should not go back to sports until they are back to school/learning, without symptoms getting significantly worse and no longer needing any changes to their schedule.

Appendix K: Return to Academics–Academic Restriction Form

Penn State University Concussion Program

Patient Name:_____ Date of Evaluation: _____

Please excuse the patient named above from school today due to a medical appointment. The student named above has suffered a concussion / mild traumatic brain injury and is currently under the care of this clinic. Individuals with this type of injury may suffer from physical symptoms such as headaches, fatigue, dizziness and light sensitivity. They may also have difficulty with cognitive functioning such as concentration, short term memory, problem solving and multi-tasking. In addition, some will have difficulty with mood such as poor impulse control, anger and anxiety and depression. Each injury needs to be individualized and the below recommendations are based on our evaluation.

_____No Physical Activity Class

_____Restricted Physical Activity Class: Student should not participate in activities that would place the student at risk for a head injury. Should not participate in team sports such as basketball, soccer, dodge ball, softball, floor hockey, volleyball, etc. and all racquet sports. May participate in fitness such as running, riding a stationary bike, swimming, aerobics and weight training. The student should stop activity immediately with any return of symptoms.

_____Consideration of the following academic accommodation to help mitigate symptoms:

- ☐ Extended time on exams/quizzes
- ☐ Exams/quizzes in quiet location
- ☐ Limit one exam per day
- ☐ Due dates/assignment extensions
- ☐ Use of a reader for exams/quizzes
- ☐ Permission to record lectures/note-taking assistance
- ☐ Absence from class due to scheduled rest periods
- ☐ Frequent breaks from class if symptomatic
- ☐ Late arrival or need to leave prior to the end of class
- ☐ Other: _____

_____Documentation of current functional limitations/physical symptoms provided to Learning Specialist for referral to ODS.

_____Full Neuropsychological evaluation requested and referral has been made. Additional recommendations will be provided, as applicable, once report is completed.

Please feel free to contact me with any questions. Thank you for your attention and consideration.

_____Date:_____Date:_____

Player Signature Team Physician Signature

_____ _____

Player Name - Printed Team Physician - Printed

_____Date:_____

Academic Advisor

_____

Academic Advisor - Printed

Appendix L: Return to Academics Team - Point of Contact by Sport

Team	Physician	Athletic Trainer	Academic Advisor
Baseball	Gregory Billy, MD Dov Bader, MD	Ben Kmetz, MS, ATC	Joey Ianiero
Men's Basketball	Gregory Billy, MD Wayne Sebastianelli, MD	Jonathan Salazer, MS, ATC	Kellynn Wilson
Men's Cross Country	Roberta Millard, MD Paul Sherbondy, MD	Michael Gay, PhD, ATC; Alex Dailey, MEd, ATC	Kaleena Davidson
Men's Fencing	Kathryn Gloyer, MD Dov Bader, MD	Juliana Jimenez, MEd, ATC	Neil Rager
Football	Peter Seidenberg, MD Wayne Sebastianelli, MD	Andy Mutnan, MEd, ATC Ray Champagne, MEd, ATC Matt Peragine, MS, ATC Tesa Johns, MS, ATC	Todd Kulka
Men's Golf	Gregory Billy, MD Paul Sherbondy, MD	Justin Rogers, MEd, ATC	Mark Hinish
Men's Gymnastics	Kathryn Gloyer, MD Dov Bader, MD	Allison Roark- Witzgall, MEd, ATC	Jim Weaver
Men's Ice Hockey	Phil Bosha, MD Dov Bader, MD	Justin Rogers, MEd, ATC	Mark Hinish
Men's Lacrosse	Gregory Billy, MD Paul Herrickhoff, MD	Cameron Patria, MEd, ATC	Jim Weaver
Men's Soccer	Kathryn Gloyer, MD Wayne Sebastianelli, MD	Matthew Armistead, ATC	Joe Ianiero
Men's Swimming & Diving	Phil Bosha, MD Paul Herrickhoff, MD	Kelly Saxton, MS, ATC Claire Geyer, MS, ATC	Joey Ianiero
Men's Tennis	Kathryn Gloyer, MD Paul Sherbondy, MD	Bruin Armwald, ATC	Neil Rager
Men's Track & Field	Roberta Millard, MD Paul Sherbondy, MD	Michael Gay, PhD, ATC Alex Dailey, MEd, ATC	Kaleena Davidson
Men's Volleyball	Roberta Millard, MD Wayne Sebastianelli, MD	Scott Campbell, MS, ATC Mark Colapietro, MS, ATC	Jim Weaver
Wrestling	Phil Bosha, MD Paul Sherbondy, MD	Dan Monthley, MS, ATC	Mark Hinish
Women's Basketball	Roberta Millard, MD Wayne Sebastianelli, MD	Caren Walls, MS, ATC	Kellynn Wilson
Women's Cross Country	Roberta Millard, MD Paul Sherbondy, MD	Michael Gay, PhD, ATC Alex Dailey, MEd, ATC	Kaleena Davidson

Women's Fencing	Kathryn Gloyer, MD Dov Bader, MD	Juliana Jimenez, MEd, ATC	Neil Rager
Field Hockey	Phil Bosha, MD Paul Herrickhoff, MD	Maddie Torretta, MAT, ATC	Kaleena Davidson
Women's Golf	Kathryn Gloyer, MD Paul Sherbondy, MD	Emily Stoeckel, MS, ATC	Mark Hinish
Women's Gymnastics	Kathryn Gloyer, MD Dov Bader, MD	Sarah Thompson, MS, ATC	Kellyn Wilson
Women's Ice Hockey	Kathryn Gloyer, MD Dov Bader, MD	Emily Stoeckel, MS, ATC	Mark Hinish
Women's Lacrosse	Kathryn Gloyer, MD Paul Herrickhoff, MD	Brandon Hall, MS, ATC	Mark Hinish
Women's Soccer	Roberta Millard, MD Wayne Sebastianelli, MD	Andra Thomas, MS, ATC	Jim Weaver
Softball	Peter Seidenberg, MD Dov Bader, MD	Thomas Cameron, ATC	Neil Rager
Women's Swimming & Diving	Phil Bosha, MD Paul Herrickhoff, MD	Claire Geyer, MS, ATC Kelly Saxton, MS, ATC	Joey Ianiero
Women's Tennis	Kathryn Gloyer, MD Paul Sherbondy, MD	Bruin Armwald, ATC	Neil Rager
Women's Track & Field	Roberta Millard, MD Paul Sherbondy, MD	Michael Gay, PhD, ATC Alex Dailey, MEd, ATC	Kaleena Davidson
Women's Volleyball	Roberta Millard, MD Wayne Sebastianelli, MD	Scott Campbell, MS, ATC Mark Colapeitro, MeD, ATC	Jim Weaver

Appendix M: Certificate of Compliance – Athletic Director

PENN STATE UNIVERSITY ● INTERCOLLEGIATE ATHLETICS DEPARTMENT

Certificate of Compliance – Concussion Safety Protocol

The Pennsylvania State University hereby certifies its compliance with the requirements of NCAA Bylaws 3.2.4.17 and 3.2.4.17.1, as documented in the attached concussion safety protocol, which is available for review at any time.

The attached concussion safety protocol contains the following information:

- Concussion management plan, as required by NCAA Bylaw 3.2.4.17;
- Procedures for pre-participation baseline testing of each student-athlete;
- Procedures for reducing exposure to head injuries;
- Procedures for educating about concussions;
- A policy that addresses return-to-learn;
- Procedures for ensuring that student-athletes who suffer a concussion receive proper and appropriate concussion management that is consistent with best practices; and
- Procedures for annual review of the process of identifying, removing from game or practice, and assessing a student-athlete for a possible concussion.

Further, this document hereby certifies the following:

- All student-athletes are treated in accordance with the standards and procedures captured in the attached concussion safety protocol; and
- All sports medicine staff members are provided the information contained within the attached concussion safety protocol.

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Director of Athletics Signature **Date**

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Director of Athletic Medicine Signature **Date**

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Assistant AD of Athletic Training Services Signature **Date**