SUGGESTED GUIDELINES FOR MANAGEMENT OF CONCUSSION IN SPORTS

National Federation of State High School Associations (NFHS)
Sports Medicine Advisory Committee (SMAC)

Introduction

A concussion is a type of traumatic brain injury that impairs the function of the brain. It occurs when the brain moves within the skull as a result of a blow to the head or body. What may appear to be only a mild jolt or blow to the head or body can result in a concussion or other serious brain injury.

The understanding of sports-related concussion continues to evolve. We now know that young athletes are particularly vulnerable to the effects of a concussion. Once considered a "ding" to the head, it is now understood that a concussion has the potential to result in a variety of short- or long-term changes in brain function and, rarely, death.

What is a concussion?

A concussion is a traumatic brain injury that interferes with the normal function of the brain. Simply stated – a concussion results from an injury to the brain, and there is no such thing as a minor brain injury! Concussions should never be referred to as a "ding" or a "bell-ringer." Any suspected concussion must be taken very seriously.

An athlete does not need to lose consciousness (be "knocked-out") to suffer a concussion. In fact, less than 5% of concussed athletes suffer a loss of consciousness.

What happens to the brain during a concussion is not completely understood. It is a complex process, primarily affecting the function of the brain. The sudden movement of the brain causes stretching and tearing of brain cells, damaging the cells and creating chemical changes in the brain. Once this injury occurs, the brain is vulnerable to further injury and very sensitive to any increase in stress, such as another head injury, until it fully recovers.

Common sports injuries such as torn ligaments and broken bones are structural injuries that can be seen on x-rays or MRI. A concussion, however, is an injury that interferes with how the brain works and cannot be seen on MRI or CT scans. Therefore, even though the brain is injured, the brain looks normal on these tests.

Recognition and Management

If an athlete exhibits any signs, symptoms, or behaviors that make you suspicious of a concussion, the athlete **must** be removed from sport and not be allowed to return to sport until they are evaluated and cleared by a health-care professional. Failure to remove the athlete from activity puts them at risk for sustaining another head injury while concussed, which can lead to worsening concussion symptoms, increased risk for further injury, and, sometimes even death.

Parents/guardians and coaches are not expected to "diagnose" a concussion. However, everyone involved in athletics must be aware of the signs, symptoms and behaviors associated with a concussion. If you suspect that an athlete may have a concussion, then the athlete must be **immediately removed** from all physical activity.

Signs That May Be Observed

- **Dazed, vacant or stunned appearance.**
- **Confusion about assignment or position.**
- **Forgetfulness.**
- **Uncertainty of game, score, or opponent.**
- **Clumsy movements.**
- **Slow response to questions.**
- **Mood, behavior or personality changes.**
- **Can't recall events prior to or after hit or fall.**

Symptoms Reported by Athlete

- **Headache or "pressure" in head.**
- **Neck pain.**
- **Dizziness.**
- **Nausea.**
- **Balance problems or dizziness.**
- **Double or blurry vision.**
- **Sensitivity to light or noise.**
- **Feeling sluggish, hazy, or mentally foggy.**
- **Concentration or memory problems.**
- **Confusion.**
- **Emotions of "not feeling right" or "feeling down".**

When in doubt, sit them out!

If you suspect that a player has a concussion, we recommend following the Action Plan.

1. Remove the athlete from sport.
2. Ensure the athlete is evaluated by an appropriate health-care professional.
3. Inform the athlete's parents/guardians about the possible concussion and give them information on concussion.
4. Prohibit the athlete from driving.
5. Keep the athlete out of sport the day of the injury, and until an appropriate health-care professional **has given written clearance** consistent with applicable law, that the athlete is symptom-free and may return to activity.

The signs and symptoms associated with a concussion are not always apparent immediately after a blow or jolt to the head or body and may develop over a few hours or longer. However, until an athlete is evaluated by an appropriate health-care professional, they should be closely watched following a suspected concussion and should not be left alone.

Athletes should never try to "tough out" a concussion. Teammates, parents/guardians, and coaches should never encourage an athlete to "play through" the symptoms of a concussion. In addition, there should never be an attribution of bravery or courage to athletes who play despite having concussion signs and/or symptoms. The risks of such behavior must be emphasized to all members of the team, as well as coaches and parents.

If an athlete returns to activity before being fully healed from an initial concussion, their reaction time and reflexes may be compromised, placing the athlete at greater risk for sustaining another head injury. A second injury that occurs before the brain has a chance to recover from the initial concussion will delay recovery and increase the chance for long-term problems. In rare cases, a repeat head injury can result in severe swelling and bleeding in the brain that can be fatal.

What Are Some Danger Signs to Look Out For?

In rare cases, a dangerous collection of blood (hematoma) may form between the brain and skull after a blow or jolt to the head or body. The pressure from this blood can squeeze the brain within the skull. Call 9-1-1 for any athlete that demonstrates any of the following signs or symptoms after a blow or jolt to the head or body for transport to the emergency department:

- One pupil larger than the other.
- Drowsiness or inability to wake up.
- A headache that gets worse and does not go away.
- Slurred speech, weakness, numbness, or decreased coordination.
- Repeated vomiting or nausea
- Convulsions or seizures (shaking or twitching).
- Unusual behavior, increased confusion, restlessness, or agitation.
- Loss of consciousness (passed out/knocked out). Even a brief loss of consciousness should be taken seriously.

Management Until Recovery

Relative Rest

The first step in recovering from a concussion is relative rest. Rest is essential to help the brain heal. Athletes with a concussion need rest from physical and mental activities that require concentration and attention as these activities may worsen symptoms and delay recovery. Exposure to loud noises, bright lights, computers, video games, television and phones all may worsen the symptoms of concussion. Athletes typically require 24-48 hours of *relative rest*, which include activities of daily living and reduced screen time.

Symptom Limited Activity

"Strong evidence exists regarding the benefits of physical activity and aerobic exercise treatment as early interventions."[2] Individuals can return to light-intensity aerobic activity, such as walking that does not more than mildly exacerbate symptoms, during the initial 24-48 hours following a concussion.

Return-to-Learn (RTL)

Following a concussion, many athletes may have difficulty in school. These problems may last from days to weeks and often involve difficulties with short- and long-term memory, concentration, and organization. To minimize academic and social disruption during the return-to-learn strategy, avoid complete rest and isolation, even for the initial 24-48 hours, and instead recommend a period of relative rest. Early return to activities of daily living, should be encouraged provided that symptoms are no more than mildly and briefly increased. Decreasing the stress to the brain in the early phase after a concussion may lessen symptoms and shorten the recovery time. *Not all athletes will need an RTL strategy or academic support. If symptom*

exacerbation occurs during cognitive activity or screen time, difficulties with reading, concentration or memory or other aspects of learning are reported, clinicians should consider the implementation of an RTL strategy at the time of diagnosis and during the recovery process.[2] Additional academic adjustments may include decreasing homework, allowing extra time for assignments/tests, and taking breaks during class. Such academic adjustments are best made using a team approach collaborating with teachers, counselors, and school nurses. Return-to-learn (RTL) after a sport related concussion follows a graduated, stepwise strategy, as outlined in **Table 1**:

Table 1 Return-to-learn (RTL) strategy

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

Following an initial period of relative rest (24–48 hours following an injury at Step 1), athletes can begin a gradual and incremental increase in their cognitive load. Progression through the strategy for students should be slowed when there is more than a mild and brief symptom exacerbation.
*Mild and brief exacerbation of symptoms is defined as an increase of no more than 2 points on a 0–10 point scale (with 0 representing no symptoms and 10 the worst symptoms imaginable) for less than an hour when compared with the baseline value reported prior to cognitive activity.

Patricios JS, et.al.

Return-to-Sport (RTS)

After suffering a concussion, **no athlete should return to sport or practice on that same day**. Return-to-sport (RTS) participation after sport-related concussion follows a graduated stepwise strategy, as outlined in **Table 2:** Return-to-sport strategy.

Table 2 Return-to-sport (RTS) strategy—each step typically takes a minimum of 24 hours

Step	Exercise strategy	Activity at each step	Goal
1	Symptom-limited activity	Daily activities that do not exacerbate symptoms (eg, walking).	Gradual reintroduction of work/school
2	Aerobic exercise **2A—Light** (up to approximately 55% maxHR) **then** **2B—Moderate** (up to approximately 70% maxHR)	Stationary cycling or walking at slow to medium pace. May start light resistance training that does not result in more than mild and brief exacerbation* of concussion symptoms.	Increase heart rate
3	Individual sport-specific exercise Note: If sport-specific training involves any risk of inadvertent head impact, medical clearance should occur prior to Step 3	Sport-specific training away from the team environment (eg, running, change of direction and/or individual training drills away from the team environment). No activities at risk of head impact.	Add movement, change of direction
Steps 4–6 should begin after the resolution of any symptoms, abnormalities in cognitive function and any other clinical findings related to the current concussion, including with and after physical exertion.			
4	Non-contact training drills	Exercise to high intensity including more challenging training drills (eg, passing drills, multiplayer training) can integrate into a team environment.	Resume usual intensity of exercise, coordination and increased thinking
5	Full contact practice	Participate in normal training activities.	Restore confidence and assess functional skills by coaching staff
6	Return to sport	Normal game play.	

*Mild and brief exacerbation of symptoms (ie, an increase of no more than 2 points on a 0–10 point scale for less than an hour when compared with the baseline value reported prior to physical activity). Athletes may begin Step 1 (ie, symptom-limited activity) within 24 hours of injury, with progression through each subsequent step typically taking a minimum of 24 hours. If more than mild exacerbation of symptoms (ie, more than 2 points on a 0–10 scale) occurs during Steps 1–3, the athlete should stop and attempt to exercise the next day. Athletes experiencing concussion-related symptoms during Steps 4–6 should return to Step 3 to establish full resolution of symptoms with exertion before engaging in at-risk activities. Written determination of readiness to RTS should be provided by an HCP before unrestricted RTS as directed by local laws and/or sporting regulations.
HCP, healthcare professional; maxHR, predicted maximal heart rate according to age (ie, 220-age).

Patricios JS, et.al.

While the RTL and RTS strategies can occur in parallel, student-athletes should complete full RTL before unrestricted RTS.[2]

Summary of Suggested Concussion Management

1. **No athlete should return-to-sport (RTS) or practice on the same day of a concussion.**
2. **Any athlete suspected of having a concussion should be evaluated by an appropriate health-care professional.**
3. **Any athlete diagnosed with a concussion should have written clearance from an appropriate health-care professional prior to resuming participation in any practice or competition.**
4. **After medical clearance, RTL and RTS should follow a step-wise protocol as outlined above with provisions for delayed RTS based upon return of any signs or symptoms.**

References:

1. Halstead ME, Walter KD, Moffatt K; COUNCIL ON SPORTS MEDICINE AND FITNESS. Sport-Related Concussion in Children and Adolescents. Pediatrics. 2018 Dec;142(6). pii: e20183074. doi: 10.1542/peds.2018-3074. Epub 2018 Nov 12.

2. Patricios JS, Schneider KJ, Dvorak J, Ahmed OH, Blauwet C, Cantu RC, Davis GA, Echemendia RJ, Makdissi M, McNamee M, Broglio S, Emery CA, Feddermann-Demont N, Fuller GW, Giza CC, Guskiewicz KM, Hainline B, Iverson GL, Kutcher JS, Leddy JJ, Maddocks D, Manley G, McCrea M, Purcell LK, Putukian M, Sato H, Tuominen MP, Turner M, Yeates KO, Herring SA, Meeuwisse W. Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport-Amsterdam, October 2022. Br J Sports Med. 2023 Jun;57(11):695-711. doi: 10.1136/bjsports-2023-106898. PMID: 37316210.

Additional Resources:

Concussion in Sports- What you need to know.
https://nfhslearn.com/courses/61151/concussion-in-sports

Heads Up: Concussion in High School Sports
https://www.cdc.gov/headsup/schoolprofessionals/training/

REAP Concussion Management Program.
https://reapconcussion.com/

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