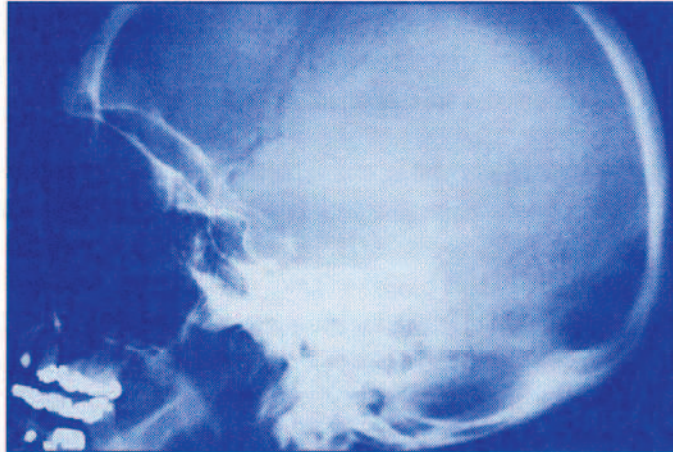


Concussions

2001 • Revised 2008

- ⊙ Even though most concussions are mild, all concussions are potentially serious and may result in complications that range from prolonged brain damage to death if not managed properly.
- ⊙ An athlete who has a head injury should not return to play without evaluation by medical personnel.
- ⊙ Do not allow any athlete to return to participation if he/she has any symptoms.
- ⊙ If an apparent head injury occurs, even if uncertainty exists about the severity of the injury and whether a true concussion occurred, that athlete should not return to action until medical clearance is obtained.
- ⊙ Even a seemingly minor head injury, often referred to as "a ding" or "bell ringer," is now considered a true concussion and must be managed as such to avoid potential long-term consequences.
- ⊙ Neither loss of consciousness, vomiting or amnesia is necessary for a head injury to be considered a concussion.



RECOGNITION

A concussion, by definition, means "to shake violently." A blow to the head that causes the brain to shake inside the skull and result in **EVEN A BRIEF AND MILD** alteration in brain function is considered a concussion. Although no obvious signs or symptoms may show up immediately, listed below are some of the symptoms that may suggest a concussion has occurred. Any of these should be taken seriously.

- | | |
|---|---|
| ⊙ Headache | ⊙ Forgets play responsibilities |
| ⊙ Dazed and vacant expression ("foggy") | ⊙ Double vision or blurred vision |
| ⊙ Confusion | ⊙ Increased sensitivity to light or noise |
| ⊙ Difficulty with balance and coordination skills | ⊙ Sleep difficulties |
| ⊙ Difficulty with concentration, memory and organizational skills | ⊙ Increased irritability |
| ⊙ Nausea and/or vomiting | ⊙ Hypersensitivity to light and noise |
| ⊙ Amnesia | ⊙ Abnormal vision, hearing, smell and/or taste |
| ⊙ Slurred and/or inappropriate speech | ⊙ Excessive fatigue |
| ⊙ Repeating the same questions or comments | ⊙ Abnormal sleep patterns |
| ⊙ Apparent loss of consciousness | ⊙ Ringing in the ears |
| ⊙ Moves slowly and/or clumsily | ⊙ Numbness and tingling |
| ⊙ Unsure of game, score or opponent | ⊙ Emotional problems, especially sadness and depression |

MANAGEMENT

Immediate or Sideline Management

- ⊙ Any athlete suspected of even a concussion should be removed from the game or practice immediately.
- ⊙ An athlete should not return to activity after an apparent head injury, regardless of how mild it seems or how quickly symptoms clear, without medical clearance.
- ⊙ For apparently minor injuries, close observation of the athlete should continue for a few hours.
- ⊙ The athlete should be sent for emergency care if symptoms seem serious, seem to worsen, or if other injuries are suspected.

PREVENTION

- ⊙ Make sure that helmets are fitted properly and are regularly sent for inspection or reconditioning.
- ⊙ Football players should be taught to not initiate contact with the helmet and all athletes should follow the rules of the sport.
- ⊙ Do not allow an athlete to return if he/she has any symptoms of concussion.
- ⊙ Follow current guidelines on return to play following injury.

RECOMMENDATIONS

- ⊙ All coaches, athletes, administrators and parents should be made aware of the signs and symptoms of concussions, post-concussion syndrome and second-impact syndrome. See "Heads-up" reference for free coach's tool kit.
- ⊙ Each school should have a standard policy in place regarding the management and return to play of the concussed athlete.
- ⊙ For athletes participating in high-risk sports or with a history of previous concussion, baseline testing to establish individual abilities in memory, brain function tests and balance-oriented testing by qualified medical personnel is recommended. This can then be used to assist in return-to-play decisions if an injury occurs.

Returning the Athlete to Participation

The International Conferences on Concussion at Vienna (2001) and Prague (2004), have significantly changed the thinking of proper management of head injuries in athletes. Some of the conclusions are highlighted below:

- ⊙ The grading systems for concussions previously utilized are no longer considered useful in determining how serious an injury may be or in determining when an athlete can safely return to play. No symptom(s) or signs (including loss of consciousness or amnesia) accurately predict the severity of the injury or help decide when an athlete can return to play.
- ⊙ New guidelines recommend monitoring the course of the symptoms and beginning a gradual return-to-play protocol when all symptoms have cleared. (See Table 8 – Sideline Decision-making and Table 9 – Return-to-play on page 79)
- ⊙ There are now objective, validated methods of evaluating brain function in athletes to help physicians determine with greater confidence when an athlete does seem to be clear of symptoms and can start through the graduated return-to-play regimen. These include questionnaires, various pencil-and-paper tests, balance tests, neurological and memory tasks, and computerized tests. Recognizing that athletes, with the mentality of "playing through the pain," are not always totally candid about admitting symptoms, guidelines now recommend the use of these more objective methods to evaluate how an athlete's brain is functioning. Tests requiring little cost like Sideline Assessment of Concussion (SAC), Sideline Concussion Checklist (SCC), and Sport Concussion Assessment Tool (SCAT) have been shown to be helpful. Newer computerized neuro-psychological screening like ImPACT, CRI and Sentinel have also been shown to be helpful for physicians making return-to-play decisions.

- ⊙ Guidelines further suggest that athletes playing high-risk or collision sports or with a history of previous concussions, should have these tests administered prior to the season to serve as a baseline in case an injury does occur.
- ⊙ Mental exertion appears to worsen and prolong concussion symptoms to the same degree as physical exertion. Therefore, the concept of “cognitive rest” should be adhered to in concussion management. This may involve a limited class schedule for several days following a concussion, or rescheduling tests. More severely concussed athletes may require more detailed and long-lasting special accommodations.
- ⊙ A requirement to begin the return-to-play protocol is that the athlete must have no symptoms. Then, gradual increase in mental activity as tolerated will be followed by a similar gradual return to full physical activity. If symptoms recur, then the athlete must regress to a previous level of performance. (See Tables 8 and 9 below)

Table 8. Sideline Decision-making

Sideline Decision-making	Medical Clearance RTP Protocol
<ol style="list-style-type: none"> 1. No athlete should return to play (RTP) after head injury even if clear in 15 minutes without medical clearance. 2. Any athlete removed from play for a head injury must have appropriate medical clearance before practice or competition may resume. 3. Close observation of athlete should continue for a few hours. 4. After medical clearance, RTP should follow a stepwise protocol with provisions for delayed RTP based on return of any signs or symptoms. 	<ol style="list-style-type: none"> 1. No exertional activity until asymptomatic. 2. When the athlete appears clear, begin low-impact activity such as walking, stationary bike, etc. 3. Initiate aerobic activity fundamental to specific sport such as skating, running, etc. 4. Begin non-contact skill drills specific to sport such as dribbling, ground balls, batting, etc. 5. Then full contact in practice setting. 6. If athlete remains without symptoms, he or she may return to play.
<p>A. Athlete must remain asymptomatic to progress to the next level. B. If symptoms recur, athlete must return to previous level. C. Medical check should occur before contact.</p>	

Table 9. Return-to-play

Return-to-play Medical Clearance Protocol
No mental or physical activity should occur until athlete's symptoms are gone. Avoid physical exertion but also avoid studying, school attendance, test taking, video games, computer use and TV until clear.
When clear, begin with short periods of reading, focusing and an abbreviated school day as tolerated.
When tolerating full day of school attendance, begin low-impact activity such as walking, stationary bike, etc. Gradually increase intensity and duration as tolerated.
Advance to aerobic activity fundamental to specific sport such as skating, running, etc.
Advance to non-contact skill drills sports specific such as dribbling, batting, shooting.
Full contact in practice setting.
If accomplishes all the above without return of signs and symptoms, may return to play following final clearance. Some athletes, especially if multiple previous concussions, should consider having a base-line computerized neuropsychological test performed because of the increased risk of concussions in those with previous ones.

More on Concussions

SIGNIFICANCE:

The initial recognition and management of concussions are particularly important in high school athletes in preventing two potential complications associated with concussions in this age group: post-concussion syndrome and second-impact syndrome (see page 81). Younger athletes may be at increased risk of cerebral swelling after a mild head injury with greater vulnerability for post-concussion symptoms for a longer period of time. Proper management should minimize the risk for these catastrophic results.

RECOGNITION OF CONCUSSIONS

Severity

The severity or seriousness of a concussion is primarily based on how long the symptoms last. The number and severity of symptoms may have some correlation but no specific symptoms are more likely to help determine severity. Restricting mental and physical activity immediately after the concussion seems to correlate with a quicker return to play.

Signs and Symptoms of Concussions

Coaches, administrators, officials, (See Table 10 below) parents and athletes need to be aware of the observable signs and reported symptoms of a concussion.

Table 10. Signs and Symptoms of Concussions

Signs observed by medical staff	Symptoms reported by athlete
Player appears dazed	Headache
Player has vacant facial expression	Nausea
Confusion about assignment	Balance problems or dizziness
Athlete forgets plays	Double or fuzzy vision
Disorientation to game, score, opposing team	Sensitivity to light or noise
Inappropriate emotional reaction (laughing, crying)	Feeling slowed down
Player displays incoordination or clumsiness	Feeling "foggy" or "not sharp"
Player is slow to answer questions	Change in sleep pattern
Loss of consciousness	Concentration or memory problems
Any change in typical behavior or personality	Irritability
Repeating the same questions or comments over and over again	Sadness
	Feeling more emotional

Complications Associated with Concussions

POST-CONCUSSION SYNDROME

Following a concussion, athletes may suffer a number of lingering symptoms for varying lengths of time. Below are listed some of the more common symptoms that may last for weeks or months. Again, no athlete with any symptom related to head injury should even begin the return-to-play protocol.

- ⊙ Impaired attention
- ⊙ Concentration and memory deficits
- ⊙ Dizziness
- ⊙ Tinnitus (ringing in the ears)
- ⊙ Prolonged or recurring headaches (especially with exertion)*
- ⊙ Fatigue
- ⊙ Irritability
- ⊙ Visual problems
- ⊙ Neurasthenia, weakness or numbness

*Often high school athletes may return to sport prematurely because the headache can mistakenly be seen as a common ailment. However, recent research has shown that athletes with residual headaches even a week post concussion do poorly on specialized tests such as reaction time and memory (Collins et al, 2003). It is imperative that even a seemingly non-significant headache not be dismissed as a common ailment prior to returning to sports.

SECOND-IMPACT SYNDROME

Second-impact syndrome is a rare event, which poses a significant concern for athletes who return too soon after suffering a previous concussion. Second-impact syndrome occurs when a second concussion occurs before a previous concussion has completely healed even if both of the injuries were very mild. Second-impact syndrome is characterized by an autoregulatory dysfunction that causes rapid and fatal brain swelling, and can result in death in as little as two to five minutes (McCrary, 1998). It is particularly important to note that **virtually all of the second-impact syndrome cases that have been reported have occurred in adolescent athletes**. The signs of second-impact syndrome are as follows:

- ⊙ Previous history of concussion
- ⊙ Visual, motor or sensory changes
- ⊙ Difficulty with memory and/or thought process
- ⊙ Collapse into coma
- ⊙ Neurological abnormalities in strength, range of motion or sensory feelings.

CUMULATIVE EFFECTS OF REPEATED CONCUSSIONS

A three-year, follow-up study shows that athletes having a previous history of at least one concussion are at an increased risk for further concussions. As the number of concussions increase, so do the risk for future injuries (Guskiewicz et al, 2003). It has also been shown that repeated concussions have been linked to longer recovery periods. Highlighting the importance of making sure athletes are symptom free prior to returning to competition from a previous MHI, research has shown that 1 in 15 athletes with a concussion have recurring concussions within 7-10 days from the first concussion. Because of these findings and the potential for complications resulting from MHIs, it is recommended that athletes sustaining more than one concussion should be referred for follow-up evaluation and assessment to determine any residual effects that might preclude participation in contact or collision sports. Cases of individuals suffering permanent brain damage from multiple concussions have been reported but no consensus on how many concussions are too many or what leads to that permanent damage.

MEDICAL CLEARANCE TO RETURN TO PARTICIPATION AFTER HEAD INJURY

There is unanimous agreement within the medical community that NO athlete who has signs and symptoms of post concussion should be returned to action. There is also unanimity that there is increased risk of significant damage from a concussion for a period of time after a preceding concussion and from cumulative damage of multiple head injuries. The more concussions an individual has, the greater is the risk of having additional concussions. The exact period of increased vulnerability or the number of concussions that is "too many" has not been determined. Traditionally, physicians have advised athletes not to return to action until they have been free of symptoms for a minimum of a week. (McCrea et al, 2003). Now, rather than discuss a length of time to be free of symptoms, guidelines suggest using the gradual return-to-play protocol shown above while monitoring the athlete for symptoms. This could be longer or shorter than a week. Research, utilizing some of the testing instruments mentioned above, is now revealing subtle residual effects of concussion not found by traditional evaluation. These identifiable deficits frequently persist after the obvious signs of concussion are gone and appear to have relevance to whether an athlete can return to action with relative safety.

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