

Sports concussion: A return-to-play guide

These evaluative methods can help you optimize a patient's treatment and return to activity.

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PRACTICE RECOMMENDATIONS

➤ Prohibit sports participation as long as a patient exhibits concussive symptoms after a head injury. **C**

➤ Evaluate a patient's balance and cognitive function to help gauge the severity of concussion and the likely delay in a return to sports activity. **C**

➤ Use a stepwise protocol in returning an asymptomatic patient to full sports activity. **C**

Strength of recommendation (SOR)

- A** Good-quality patient-oriented evidence
- B** Inconsistent or limited-quality patient-oriented evidence
- C** Consensus, usual practice, opinion, disease-oriented evidence, case series

CASE ▶ KD is an 18-year-old high school basketball player who was knocked backwards during a game, hitting her head on the floor. She had immediate head and neck pain but no loss of consciousness; she was transported by EMS to the local emergency department (ED) for further evaluation. Results of head and neck CT scans were normal, and she was discharged home. Four days later, KD's parents brought her to our office because she was experiencing ongoing headache, phonophobia, nausea, light-headedness, poor balance, increased sleepiness, and irritability.

The Centers for Disease Control and Prevention estimate that approximately 300,000 sports concussions occur yearly in the United States,¹ and that 135,000 of these cases are treated in EDs.² These numbers have not gone unnoticed in the consumer press. Over the past 18 months, *Sports Illustrated*, *Newsweek*, and *Time*³⁻⁵ have published stories on sports-related concussion, helping to raise public awareness of its risks.

Recommendations for practitioners have changed.

In 1997, the American Academy of Neurology⁶ published one-size-fits-all guidelines on managing concussion, using levels of symptomatology and loss of consciousness to grade the severity of concussion from 1 to 3. These guidelines were similar to the Cantu and Colorado guidelines of the early 1990s.^{7,8} Since then, however, the diagnostic criteria and expert opinion about treatment and return to physical activity have changed. Indeed, several medical organizations⁹⁻¹² now recommend a more individualized approach to evaluation and management, which we describe here.

It begins with a definition

While there is no single agreed-upon characterization of "concussion," the 3rd International Conference on Concussion in Sport (ICCS)¹² provides this definition:

Concussion is defined as a complex pathophysiological

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History of concussion, retrograde or anterograde amnesia, younger age, and female sex may herald a longer period of recovery from a concussion.

process affecting the brain, induced by traumatic biomechanical forces. Several common features that incorporate clinical, pathologic, and biomechanical injury constructs that may be utilized in defining the nature of a concussive head injury include:

1. Concussion may be caused either by a direct blow to the head, face, or neck or a blow elsewhere on the body with an “impulsive” force transmitted to the head.
2. Concussion typically results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously.
3. Concussion may result in neuropathological changes but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.
4. Concussion results in a graded set of clinical symptoms that may or may not involve loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course. . . . In a small percentage of cases, however, postconcussive symptoms may be prolonged.
5. No abnormality on standard structural neuroimaging studies is seen in concussion.

Office evaluation

Obtain a thorough history and conduct a neurologic evaluation and musculoskeletal examination of the head and neck.

Clues to expected length of recovery

A patient with a concussion may lose consciousness after the impact, or have a brief convulsion that is not a seizure.¹³ In the period immediately after the injury, the patient may exhibit a constellation of such signs and symptoms as headache, confusion, a dazed look, dilated pupils, amnesia, poor balance, nausea, or vomiting. These features typically resolve over time, but may persist for weeks or months. Anterograde or retrograde amnesia may also occur. **TABLE 1** details a more complete list of concussion symptoms. If the patient is a child or young adult, it is useful to have a parent present at the office visit to describe the patient’s mood, sleep, appetite, and overall health after the injury.

Factors that may portend a longer re-

covery include a previous concussion, retrograde or anterograde amnesia, younger age, and female sex.¹⁴

■ Dire problems beyond concussion.

Complaints or historical elements inconsistent with concussion that should be considered red flags include any focal neurologic complaints, vomiting or headache that worsens after a period of improvement, or obtundation or disorientation that has worsened since the injury. With such findings, consider more serious head injuries and arrange for a more complete immediate neurologic work-up.

CASE ► Our neurologic examination yielded normal results. However, our patient was unable to balance correctly on one leg. The cognitive exam revealed a deficit in short-term memory. We diagnosed a concussion, advised her to refrain from sports, and prescribed cognitive rest. A return to school for half days would be considered once her symptoms began to resolve.

Options for the neurologic exam

With a simple concussion, expect a normal neurologic examination, with the possible exception of the ability to balance. Head imaging is not necessary in the setting of suspected concussion, because results of computed tomography (CT) and magnetic resonance imaging (MRI) will likely be normal.¹²

■ Balance testing can assist in the diagnosis of concussion and the monitoring of recovery from injury.¹⁵⁻¹⁷ The Balance Error Scoring System (BESS)¹⁵ is a validated and simple test that can be done in the office. The test involves 3 consecutive stances: (a) normal stance with feet comfortably apart and hands on hips, (b) with feet aligned heel to toe with the dominant leg in front, and (c) standing on the nondominant leg with the dominant leg flexed 30 degrees at the hip. Have the patient repeat each version of the test for 20 seconds with eyes closed, on a stable and then unstable surface (eg, foam mat).

It’s recommended that another staff member be present to spot the patient in case of a fall. A link to a complete description of the test and scoring details is provided in the Web resources box on page 326.

■ Assess cognitive function. One tool

TABLE 1

Signs and symptoms commonly associated with concussion

Headache "Pressure in head"	Sensitivity to light Sensitivity to noise	Fatigue or low energy Confusion
Neck pain	Feeling slowed down	Drowsiness
Nausea or vomiting	Feeling like "in a fog"	Trouble falling asleep
Dizziness	"Don't feel right"	Irritability
Blurred vision	Difficulty concentrating	Sadness
Balance problems	Difficulty remembering	Nervousness or anxiety

Adapted from SCAT2 in Appendix 1 of: McCrory P, Meeuwisse W, Johnston K, et al. *Br J Sports Med*. 2009;43(suppl 1):i76-i90.¹²

for assessing cognitive function is the Sports Concussion Assessment Tool 2 (SCAT2).¹² SCAT2 includes newer, as yet unvalidated sections and several sections that have been independently studied and proven useful in diagnosing concussion. Validated sections are the Maddocks questions, used only at the time and place of injury¹⁸; the modified BESS¹⁵; and the Standardized Assessment of Concussion (SAC).¹⁹ The SCAT2 and the SAC (which may be used separately) include questions that assist in evaluating short-term memory and attention, and are useful in the physician's office.

■ Do computer-based tools help? Another option for cognitive assessment is computer-based neuropsychologic testing developed specifically for use with suspected concussion. Any of these programs can be used in the office by a trained practitioner. Schools may also use the programs under the supervision of an athletic trainer or team physician. Available programs are *ImPACT*, developed by the University of Pittsburgh (<http://impacttest.com>); the *Cognitive Stability Index (CSI)*, by HeadMinder (<http://www.headminder.com/site/csi/home.html>); and the *Computerized Cognitive Assessment Tool (CCAT)*, by CogState/Axon Sports (<http://www.axonsports.com>). Multiple studies have shown such programs to be useful in diagnosing and monitoring recovery from sports concussion.²⁰⁻²³

However, among sports medicine practitioners, there seems to be a consensus that computer-based neuropsychologic testing is most useful when a baseline score exists. Baseline testing is usually done preseason on athletes in a healthy state. If a baseline score is not available, a patient's postinjury score is

compared with normative data produced by the developer of the individual test.

Few, if any, outcome studies have been conducted to determine whether computer-based neuropsychologic testing provides any meaningful improvement in the care of athletes who have suffered concussions. There is also concern that few studies by independent sources have replicated the data disseminated by developers of the tests.^{24,25} The most recent guidelines by the 3rd ICCS recommend using neuropsychologic testing only as an aid to an overall medical evaluation, not as the sole determinant of recovery from concussion.¹² Numerous studies now underway may help clarify the role of neuropsychologic testing in concussion.

CASE ► By the time of our follow-up exam 7 days later (11 days from injury), KD had returned to school for half days, but her phonophobia and headaches worsened at school and she had difficulty focusing on academic tasks. Neurologic, balance, and cognitive exams were all normal. We advised her to gradually return to school full time while abstaining from sporting activity.

At 16 days' follow-up (20 days from injury), KD had returned to school full time and said she felt more like herself, although she continued to have daily headaches and phonophobia. All exam results were normal. Sports were still off limits, and we told her to expect at least 7 more days of respite before any return to exercise would be allowed.

At 23 days' follow-up (27 days from injury), KD's symptoms had completely resolved, and all exam results were normal. We prescribed a stepwise return to athletic activity over the next 10 days and discussed this plan



Evaluate a patient using the Balance Error Scoring System, and, for cognitive function, the Standardized Assessment of Concussion or a similar tool.

with the school's athletic trainer, who would supervise her return to play.

Individualize management

The one-size-fits-all approach previously recommended⁶ is no longer the standard of care. In your initial encounter with the patient (and parents, as appropriate), explain the nature of the injury, expected course of recovery, and requirements for a return to play. Also discuss the possibility of postconcussive syndrome and the risk of rare sequelae such as second impact syndrome.

If the patient is symptomatic or exhibits examination findings consistent with concussion, recommend immediate cessation of sports activity.⁹⁻¹² With a school-aged athlete, if symptoms reported by the patient or parents are significant, consider prescribing cognitive rest, which can be provided through quiet accommodations at school or perhaps even time off from school or exams.^{12,24} In the early period of recovery, increased cognitive or physical activity can cause symptoms to worsen. With improvement, the patient may return to school half time to lessen the chance of a significant return of symptoms. If half days are tolerated, the patient may transition to full days. Make sure the diagnosis and expectations for recovery are communicated to the appropriate school officials so that necessary accommodations can be made. If symptoms after the initial office visit are mild, a one-week return to school is appropriate to evaluate the patient's recovery.

■ **Allowing a return to sports.** Once the patient is asymptomatic, and physical and cognitive test results are normal, discuss a return-to-play protocol with the patient (and with parents and athletic trainer or coach, as appropriate). Multiple sources^{10,11,26} now recommend a stepwise return to play, as detailed by the 3rd ICCS (TABLE 2).¹² Increase or decrease the length of the protocol depending on the patient and the specifics of the case.

There is little science to guide the treatment of children with concussion. However, given that their brains are still developing, it's prudent to be more conservative than with older adolescents or adults. Multiple sources

Web resources

American Academy of Neurology (AAN). Position Statement on Sports Concussion. <http://www.aan.com/globals/axon/assets/7913.pdf>

American Academy of Pediatrics (AAP). Sports-Related Concussion in Children and Adolescents. <http://pediatrics.aappublications.org/cgi/content/abstract/126/3/597>

The Balance Error Scoring System (BESS). <http://www.sportsconcussion.com/pdf/management/BESSProtocolNATA09.pdf>

Centers for Disease Control and Prevention. Concussion and Mild TBI. <http://www.cdc.gov/concussion/index.html>

Sport Concussion Assessment Tool 2 (SCAT2). <http://www.athletictherapy.org/en/pdf/SCAT2.pdf>

3rd International Conference on Concussion in Sport. http://bjsm.bmj.com/content/43/Suppl_1/i76.full

apart from the 3rd ICCS agree with this recommendation. Several authors suggest more cognitive rest and a longer return-to-play protocol in all cases.^{10,27} In fact, the ICCS committee additionally recommends observing a symptom-free waiting period for pediatric athletes before even starting a return-to-play protocol.

McCrorry et al²⁶ suggest that children under age 15 be treated more conservatively than those 15 and older. They suggest treating those 15 and older with the protocol for older adolescents. Specifying an age at which one should always make a decision for or against conservative care can be problematic. However, based on the recommendations above, it would seem reasonable to provide conservative treatment for children younger than high school age and perhaps even those in the early years of high school.

■ **Consider legal implications.** Become familiar with state laws that require certain steps in managing sports concussion. The Web site <http://www.sportsconcussions.org/laws.html>²⁸ lists states with sports concussion statutes, as well as states with bills working their way through the legislative system. Cur-

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If symptoms are significant, consider prescribing cognitive rest: quiet accommodations at school or time off from exams.

TABLE 2

Stepwise protocol for return to play

If symptoms recur at any step, have patient return to prior level

1. Light aerobic activity	Walking, swimming, exercise bike; keeping exertion <70% of maximum heart rate
2. Sport-specific exercises	Exertional drills in sport, eg, running drills in football/soccer, skating drills in hockey
3. Noncontact training drills	Progression to more complex noncontact drills, eg, passing/catching drills in football, shooting/passing in basketball, hitting drills in volleyball
4. Full-contact practice	Return to full practice if no recurrence of symptoms through first 3 steps and cleared by physician
5. Game activity	Return to full sport participation if no recurrence of symptoms with above steps

Adapted from: McCrory P, Meeuwisse W, Johnston K, et al. *Br J Sports Med*. 2009;43(suppl 1):i76-i90.¹²

rently, 29 states are listed with laws; 14 more and the District of Columbia have pending legislation.

Anticipate complications

Most patients with concussions who are managed appropriately do well. However, complications can occur. The most serious complication is second impact syndrome, which usually occurs when concussion is unrecognized or not well managed. While not well understood, this condition is thought to result from a sudden increase in intracranial pressure after a second head injury in an athlete already suffering from concussion symptoms. The injury typically results in serious long-term neurologic deficits, or even fatality.²⁹ Second impact syndrome has been documented as occurring in the same game after an initial injury, as well as in subsequent games.²⁹

A more common, but less serious, complication is postconcussion syndrome.³⁰ This is an ill-defined condition in which the patient suffers from concussive symptoms for an extended period of time, generally for more than 3 months.³⁰ As with acute concussion, the constellation of symptoms ranges from headache

to cognitive impairment. In cases of postconcussion syndrome, it is appropriate to consult with neuropsychologists, psychiatrists, or neurologists for assistance with symptoms and associated mood disorders. Similar to acute concussion management, it is generally recommended that athletes not be cleared to resume play while struggling with the symptoms of postconcussion syndrome.³⁰

There have also been recent reports of late-life sequelae in those who have sustained multiple concussions. Depression and dementia have been suggested in surveys of retired NFL players.^{31,32} There have also been studies both suggesting¹⁴ and questioning^{33,34} whether multiple concussions result in long-term cognitive deficits. While the evidence available at this time is not firm, there seems to be an increasing belief that multiple concussions can affect long-term cognitive abilities. For these reasons, use caution in making return-to-play decisions for patients with multiple concussions or concussions with long-lasting symptoms. **JFP**

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With symptom resolution and normal cognitive test results, discuss with patients and parents a stepwise return-to-play protocol.

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