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Adolescent Sports Concussion
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Introduction

The interest in sports concussion injuries has skyrocketed over the last decade among both the general population and medical professionals. Part of this increased interest is fueled by a better understanding of the risks and potential long-term problems associated with concussions, as well as by a number of high profile professional athletes who have had their careers cut short by concussion injuries. This article will attempt to educate the reader on the definition of concussion, its cause, predictors of outcome, and treatment.

Concussion: Definition

The U.S. Centers for Disease Control and Prevention (CDC) defines concussion as a mild traumatic brain injury (MTBI) that leads to altered physiologic processing caused by a direct or indirect force to the head. MTBI typically causes a constellation of symptoms including emotional (nervous, sad), sleep-related, physical (balance, visual changes or sensitivity), and cognitive (difficult with memory, concentrating) symptoms. Interestingly, this disturbance in brain function is usually associated with normal imaging (normal CT or MRI scans of the brain). The disturbance in brain functioning, rather, lies at the cellular level. A concussion results in a “mismatch” in energy demand of the brain cells. After concussion, the brain cells have been show to have an increased energy demand that is not met by the body. This causes the brain to be “stressed” and lead to concussive symptoms.

Predictors of Outcome

For much of the past few decades, the symptom thought to be most related to the severity (and therefore length of recovery) from a concussion was loss of consciousness (LOC). However, research over the past decade has show that LOC correlates very poorly with both the severity of the concussion and the length of recovery. Multiple studies have shown that the symptoms most predictive of a poor or prolonged recovery after concussion are amnesia, prolonged headaches, and cognitive deficits.

Amnesia is defined as a loss of memory. This may include retrograde amnesia (forgetting things that happened before the concussion), or anterograde amnesia (forgetting things that happened after the concussion). Both types of amnesia are associated with more prolonged symptoms and slower recovery.

Headaches are the most frequent symptom after a concussion, with greater than 85% of athletes reporting a headache after concussion. Research has shown that the longer the headaches last after concussion, the slower the recovery. Specifically, migraine type headaches, which involve sensitivity to light and sound as well as nausea and vomiting, are associated with more severe concussions and longer recovery.

Cognitive defects, such as difficulty concentrating or thinking, are also a marker of concussion severity. If school work increases other concussive symptoms such as headaches or nausea, these athletes have also been shown to have a slower recovery.

Age has also been shown to be an important factor in recovery. Children and adolescents are more vulnerable to the effects of concussion. Their brains are still maturing, and they appear to be especially sensitive to the “stressed” brain state present after concussion. Thus, children and adolescents often recover slower when compared to similar adult athletes who have sustained similar concussions.

Additionally, athletes who have sustained previous concussions have been shown to have slower recovery times. In athletes with 3 or more concussions, the chance of permanent neurologic impairment significantly increases.

Treatment

Any athlete who experiences a concussion should be removed from the game. All athletes, but particularly adolescent athletes, should not be permitted to return to the same game. They should be closely monitored on the sideline by a medical professional (athletic trainer or physician), and their return-to-play should be under the direction of a physician. If there is any concern about any additional brain injury such as a fracture or bleeding, a CT or MRI scan may be obtained.

Resolution of symptoms should be closely followed over the next few weeks. Approximately 80% of athletes will have returned to normal (no physical or cognitive symptoms) within 3 weeks. The 20% who do not often have the aforementioned symptoms associated with prolonged recovery.

Once an athlete has resolution of his concussive symptoms at rest, they are entered into a progressive exercise program. This program starts with light aerobic exercise, then sport specific exercise, following by non-contact sport drills, and proceeding to full contact drills. If the athlete experiences any return of symptoms at any point, they should return to the previous exertion level at which they were asymptomatic.

A new area of research and treatment involves what is called neurocognitive testing (NCT). In NCT, an athlete is tested on various cognitive processes (verbal and visual memory, reaction times, processing speed, and tasks that require complex attention and thought). This typically involves either a paper/pencil type test or a computer based test. NCT has been shown to be most helpful in returning athletes safely back to sports when their testing shows a return to their normal baseline. This can be done by comparing an athlete to established norms for his/her age, or by comparing the athlete to their pre-concussive baseline. The latter requires that athletes be tested in the pre-season and their normal baseline cognitive function established. NCT can be quite expensive, and requires that most athletes be screened in the pre-season. Thus, this has not been widely established at the high school level, but is common at the collegiate and professional levels.

Conclusion

The recognition and proper treatment of adolescent athletes who sustain concussions has rapidly evolved in the past decade. The signs and symptoms of

concussion are now better understood and recognized. Proper treatment involves recognizing important symptoms that predict concussion severity, as allowing all symptoms to resolve before starting a gradual progressive exercise program. Neurocognitive testing is a new advancement that can also help guide the decision of when to safely return an athlete to competition.

Table 1: Signs and Symptoms of Concussion

<u>Signs observed</u>	<u>Symptoms reported by athlete</u>
Dazed or stunned	headache
Confused about their assignment	nausea
Forgets the play, score, opponent	balance/dizziness issues
Answers questions slowly	fuzzy/blurry vision
Loses consciousness	feels sluggish or foggy
Personality changes	memory/concentration problems
Amnesia	feels tired

Dr. Honkamp specializes in treatment of sports injuries, including shoulder and knee injuries at DMOS – West. Dr. Honkamp is also skilled in joint replacements. For more information or to schedule an appointment please call 515-224-5205.