Issue No. 04, October 2013

St. Joseph Health
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Sports Concussion – An Update

By: David Kruse, MD

Orange County has an active youth sport and recreation culture that encompasses a variety of year-round activities. Unfortunately, injury is a reality of sports participation and concussion represents 10% of all injuries. Rates are highest in football for males and soccer for females. In the past decade, emergency department visits for concussion have increased by 60%.

Legislation to Prevent Injuries

Due to the increase in concussion rates, as well as our growing knowledge of unfortunate sequelae from repetitive head injury in sports, laws have been passed to help protect our youth athletes. Both the California Interscholastic Federation (governing body for high school sports) and the state of California have passed concussion-specific legislation. In fact, 45 states have active or pending legislation. California Assembly Bill 25 states that an athlete suspected of sustaining a concussion should be immediately removed from play. It also states that the athlete "shall not be permitted to return to activity until he or she is evaluated by a licensed health care provider, trained in the management of concussions, acting within the scope of his or her practice."

The goal of this legislation is to prevent both acute and long-term physical, cognitive or emotional sequelae of traumatic brain injury in a high-risk youth population. This population is statistically more likely to have repetitive mild traumatic brain injuries. The pediatric athlete also has a higher risk of significant morbidity and mortality following a concussion event, and can predictably take longer to recover from these injuries.

Management of a Concussion

A concussion occurs when a direct or indirect force to the head changes the chemical balance of brain cells. This can lead to a variety of symptoms. With physical and cognitive rest, the immediate effects of a concussion on average will go away within seven to 10 days.

It is true that some athletes will resolve symptoms after a few days if they rest on their own, but if these athletes do not seek formal evaluation there may be other manifestations of their concussion that go unrecognized. These may include: abnormal neurologic exam (pupil reaction, eye tracking, vestibular-ocular deficits), balance abnormalities, and neurocognitive deficits. It is important to note that athletes may downplay their symptoms but they cannot hide these objective deficits. If an athlete returns to play without ensuring full resolution of all manifestations of their concussion, significant negative consequences can occur. These can include: worsening of symptoms, permanent deficits or symptoms, more lengthy recovery, and second impact syndrome. Second impact syndrome is an acute intracranial edematous event that occurs when an athlete takes a second hit to the head when not fully recovered from an initial hit. This condition is usually fatal. It is best for the athlete to seek care within the first 24-48 hours after a concussion event to ensure proper evaluation, acute treatment, efficient and safe recovery, and appropriate return to sport.

There have been four international conferences on concussion in sport, the most recent being in Zurich last year. The conferences have established our current guidelines for concussion care and have been instrumental in directing how we manage concussion. Important points from these conferences include:

- Full physical and cognitive rest is needed until symptom resolution.
- Graded Physical Progression – All athletes, once symptom free, should complete a graded physical progression to ensure successful return to non-contact activity without return of symptoms. (Table 1)
- Neurocognitive assessment is an important aspect of concussion management.
- Academic accommodations are often required during the recovery phase.

One aspect of concussion care that is often neglected is the athlete's ability to return to scholastic activities successfully. For many high school and collegiate athletes, this can become the most challenging aspect of their concussion recovery. It is important to recognize this early and to be proactive with academic accommodations to help facilitate their recovery.

Neurocognitive testing can now be routinely used in the evaluation of sports concussion and computer-based assessment tools are available. It is one component of a comprehensive concussion approach and serves as a tool

to add objective data regarding an athlete's neurocognitive recovery from concussion. A concussion can affect many parts of the brain resulting in a varied clinical presentation. The athlete can present with a spectrum of symptoms, academic intolerance, balance abnormalities, activity intolerance, as well as neurocognitive deficiencies. Neurocognitive testing can assess multiple cognitive domains including: attention and concentration, memory retrieval for both visual and verbal information, reaction time, and executive functioning. This testing is most useful if a baseline assessment is performed for each athlete. Post-concussion testing can then be compared to the individual athlete's baseline.

Clearance After a Concussion

Based on consensus guidelines, I promote four main criteria for athlete clearance following a concussion event:

1. Athlete is consistently symptom-free with normal physical exam (including balance testing).
2. Athlete is tolerating all school activities successfully without symptoms and to their normal ability.
3. Athlete has completed a graded return to physical and sport-specific activities without return of symptoms.
4. Athlete's neurocognitive testing is back to baseline (if applicable).

Table 1: Graduated return to play protocol

Rehabilitation Stage	Functional Exercise at each stage of rehabilitation	Objective of each stage
1. No activity	Symptom limited physical and cognitive rest	Recovery
2. Light aerobic exercise	Walking, swimming, or stationary cycling keeping intensity <70% maximum permitted heart rate No resistance training	Increase HR
3. Sport-specific exercise	Skating drills in ice hockey, running drills in soccer No head impact activities	Add movement
4. Non-contact training drills	Progression to more complex training drills, e.g., passing drills in football and ice hockey May start progressive resistance training	Exercise, coordination and cognitive load
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	Normal game play	

Conclusion

The management of concussion can be challenging and time-consuming. Concussion can affect athletes across many sports (football, soccer, water polo, lacrosse, hockey, etc.). Increased awareness, education and research have been essential in the progression of how we care for an athlete who has sustained a concussion.

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Dr. Kruse serves as a sports concussion consultant for 15 local high school and collegiate sports programs, as well as for general community referrals. He is a credentialed ImPACT Consultant and has been interviewed for multiple radio and TV programs regarding sports concussion, including ESPN Radio and Fox Television.

Dr. Kruse currently practices with the Orthopaedic Specialty Institute (OSI). Before joining OSI, Dr. Kruse was on faculty for four years at the University of California, Irvine, as an Assistant Clinical Professor in the Departments of Orthopaedic Surgery and Family Medicine. He maintains a Volunteer Faculty position with UC Irvine.

Dr. Kruse holds two board certifications, sports medicine and family medicine, and practices as a primary care sports medicine specialist. After completing his undergraduate studies at the University of California, Berkeley, Dr. Kruse attended medical school at the University of California, San Diego and thereafter completed a residency in family medicine at Long Beach Memorial Medical Center. Following residency, Dr. Kruse completed fellowship training in sports medicine at the University of Notre Dame.

Dr. Kruse's clinical expertise includes sports concussion, non-operative orthopedics and sports medicine, general medical needs of the athlete, and musculoskeletal procedures including joint and tissue injections.

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