

Michelle Lanteigne

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### **Beneath the Skull: The Impact of Concussions**

Teenagers are bullet proof; no one can stop them and nothing can slow them down. In their minds they are invincible, but in their brains they are more vulnerable than they think. Concussions are not just a myth. They are a real risk for young athletes. The underrated severity of concussions puts young athletes unknowingly at risk of neurological changes and long-term damage. Even mild concussions cause damage to the brain, which accumulates with each head injury. The brain itself is unable to fully repair this damage, therefore leaving permanent neurological aftermath of concussions. Considering they can have such severe consequences, athletes should have an understanding of what concussions are, what can be done to treat and heal them, and most importantly, what they can do to minimize their risk of sustaining a concussion. They should be reviewed and treated with extra caution, as compared to injuries to the rest of the body. Arms can be fixed, knees can be replaced, but each person gets only one brain. With this brain, athletes must learn to be smart about the way they play the game and the way they let themselves heal from injury.

Athletes who have sustained injuries usually have one short-term goal, which is to return to play as soon as possible. For many athletes, this means they will resume play when they are pain free, but other athletes will return when they can manage to play with the pain. This is a common situation in young athletes who like to feel heroic for making a remarkable recovery, or who think their bodies are invincible because they are young. Returning in situations like these “can increase the risk of re-injuring or developing a chronic problem that

will lead to a longer recovery” (Elizabeth Quinn, 2005). By trying to return too quickly, many athletes end up with more damage and a longer recovery phase in the end. Just because the pain is gone or is bearable does not mean the injury has healed completely. In actuality, it is probably only 70-75% recovered when the pain goes away (Elizabeth Quinn, 2005). Ideally, this is the point when moderate to intense training should begin. It is an unrealistic idea to put time frames on the healing progress of injuries. Each person has a different body, which reacts to change and injury in a unique way. Instead of waiting for a period of time before resuming play, the healing progress of each individual case must be assessed to determine the safe time to return. Experts suggest “only when the athlete is practicing hard without significant difficulty and the healing has progressed to the point where the likelihood of injury or harm is low, is the athlete ready to return to play” (Elizabeth Quinn, 2005). This is a good unwritten rule for most injuries, however situations like concussions, where re-injury can cause serious or permanent damage, require extra attentiveness and care.

Commonly referred to as a “bell ringer”, a “knock” or a “ding”, a concussion is defined as “any change in mental status that results when the brain is violently rocked back and forth inside the skull due to a blow to the head, neck, or upper body” (University of Pittsburgh Medical Centre, 2004). This rocking back and forth motion actually causes impact and injury in two areas of the brain, not only the area that was hit. As a result of each head injury being different, the symptoms will vary in number and severity from case to case, but can range from a headache and dizziness to loss of consciousness. Signs indicative of a concussion that can be monitored after a blow to the head are problems with brain function, speed of brain function, unusual behaviours, and problems with balance and coordination (Vito Perreillo, 2005). Even a slight blow to the head can cause a mild concussion and minor brain damage. These are more likely to go untreated because many people do not realize that a

concussion can occur so easily. The combination of the lack of information and awareness of minor concussions, and the constantly different and complicated symptoms of concussions often leads society to believe that only professional and highly competitive athletes sustain concussions. This is anything but true. An estimated “more than ten percent of high school athletes sustain concussions each season” (Elizabeth Quinn, 2004), although many of these are mild and left untreated because it was deemed that they just “got their bell rung”. In any case where a head injury has been sustained, the player should be taken out of play immediately to be evaluated for precautionary measures.

Although concussions are often referred to as having a specific grade of severity, there are no universal classification systems for concussions because each head injury is different. However, there is one protocol which should be followed for the safety of all athletes who suffer a concussion. A concussed athlete should never return to the game or practice where the concussion was sustained. Although they may feel fine, a brain injury may still be present. Subtle changes in behaviour are an indication of injury, so the athlete should be monitored closely. “Abnormalities of attention, processing speed, memory, balance, reaction time, and ability to think and analyze information appear to be the areas most likely to be involved and persist after a head injury” (Vito Perreillo, 2005). These areas should be monitored every few minutes, beginning directly after the concussion was sustained. Some symptoms may go away after a few minutes, while others may not even show up until days or weeks after the concussion was endured (Thomas A. Hammenke, 2001). Regardless of how long symptoms persist and how long the healing process takes, the athlete should have appropriate medical clearance before resuming competition. There is no such thing as taking too many precautions when dealing with concussions, since they are an indication of brain

damage. Failing to treat concussions promptly and properly can lead to long-term complications or permanent damage.

The effects of a concussion can last far longer than the headaches and other symptoms that are felt, although headaches can help to indicate damage to the brain. The University of Pittsburgh reports “any degree of post-concussion headache in high school athletes even one week after injury is likely associated with an incomplete recovery” (University of Pittsburgh Medical Centre, 2003). Generally, the longer the symptoms persist, as is the case with more serious concussions, the more severe the brain injury that was sustained. Research has shown that 60% of concussed athletes still have neurological problems one month after the injury (TW McAllister, 1994). It is apparent that the brain takes a long time to heal, but it is also important to emphasize that it does not return to the condition it had been in before the injury. It is more susceptible to future concussions and other serious injury. The University of Virginia concludes that athletes who have had one concussion are three times more likely to sustain a second one (Elana Farace, 2003). Meanwhile, research at the University of Pittsburgh has expanded on this statistic and found that “athletes with three or more concussions are nine times more likely to suffer more severe symptoms like loss of consciousness and memory” (Elizabeth Quinn, 2004). This kind of information is helpful in aiding athletes who have already suffered concussions, to prevent multiple episodes. But something must be done for the majority of young athletes, the ones who have not suffered concussions and want to protect themselves from doing so. Recently, research has shifted from what happens after a concussion is sustained, to what can be done before a concussion to assist in understanding and treating it more effectively.

Since all athletes, all brains, and all injuries are different, it is unrealistic to suggest that all brain injuries heal the same way and at the same rate. This is the reason behind post-

injury neurological assessment. It is deemed effective, but not entirely practical because the post-injury data cannot be directly compared to any other data, and therefore does not indicate the full scope of the injury. Now, pre-injury assessment is conducted and used as a baseline for comparing the post-injury functionality, which will be able to neurologically reveal the full scope of the injury. The assessment, usually done during the preseason, “evaluates attention and concentration, working memory, new learning and memory, and speed of information processing” (Thomas A. Hammenke, 2001). If a concussion occurs, the same assessment is done immediately after the injury and at several post-injury points to evaluate the trauma. Thus far, researchers have found “clinical evidence of injury for several days after the injury, which included alterations in general mental status, postural balance, and some impairment in recent verbal memory” (Thomas A. Hammenke, 2001). This assessment method is not only used for evaluating the severity of the injury, but is also used in rehabilitation planning and determining the readiness and safety of the injured player to return to play (University of Waterloo, 2000). If they are returned too quickly while the brain has not fully recovered, the athlete is at risk of sustaining a complication known as second-impact syndrome. This is a condition that can be devastating, yet entirely preventable.

Second-impact syndrome occurs when an athlete sustains a second concussion while they are still symptomatic and in the healing phase from a previous concussion (RC Cantu, 1998). It is likely to cause serious complications of brain swelling and other widespread damage, and can be fatal. Second-impact syndrome is a rare condition. There have been few reported cases of it, which makes it difficult to study. However, the McGill Reporter has stated “one of the theories is that it does lead to a rise in pressure inside the head which can be fatal” (Anna Bratulic, 2002). The story of Brandon Schultz, a high school football player in Washington, shows the devastating effects of second-impact syndrome. Brandon suffered a

concussion in a football game, but it was not diagnosed because the only symptom he had was a headache. The headache persisted for six days, but he continued to practice in order to qualify for another football team. In his next game he suffered another concussion, with his brain not fully healed from the first. He was in a coma for four days, underwent four brain surgeries, and completed six years of rehabilitation. Today he is partially blind, physically disabled, and unable to think quickly. Brandon is lucky that he is still alive, and his injury “changed the choices [he has] today. Each day is a challenge for [him]. [He uses] aids to help [him] with simple everyday activities – things that people do without thinking – like remembering what to do next and getting to class on time” (PBS News Hour, 2000). With proper guidelines for prevention and management of a concussion, cases like Brandon’s can be avoided. It is important for players, parents, and coaches to know not only the symptoms and severity of concussions, but to also understand that athletes need adequate time to recover from brain injuries.

The single most imperative aspect of managing a concussion is ensuring the athlete does not return to play before the brain has fully healed. The first and foremost recommendation, which is echoed by researchers and doctors around the world, is that a concussed athlete should not return to practice or play until they are asymptomatic, meaning they are free of symptoms. It is also suggested that the post-injury neurocognitive data should be compared to the athlete’s baseline data to determine if the athlete is truly asymptomatic (Elana Farace, 2003). There is one problem in this method, in the sense that not all high school or recreational athletes go through neurocognitive baseline testing. This is why a simple six-step return to play protocol has been established so that all athletes have a basic guideline to follow for returning. The first step is that the athlete must be asymptomatic before exertional activity can resume. Then low-impact activities such as walking and cycling

can begin. Next, aerobic activity like jogging or skating can be added, followed by sport specific skill drills that are non-contact. Then, after a medical check, full contact can be reintroduced in a practice setting. Finally, if the athlete still has no symptoms, he or she is allowed to return to play (Vito Perriello, 2005). When progressing through the steps, it is important that the athlete remains asymptomatic. If the symptoms recur, the athlete is required to return to the previous step. This protocol is meant to be a guideline, not the replacement of medical personnel. Athletes should receive medical clearance before returning to play instead of diagnosing themselves and their condition. It is also important to remember that recovery time varies with each individual, so each concussion should be evaluated and treated independently.

With sports comes the potential for injury, and with contact sports comes the potential for head injury. Concussions have been proven to leave behind permanent changes and long-term damage, which is why athletes should become educated on their consequences and prevention methods. Young athletes are especially at risk of these consequences, partially because the severity of concussions is underrated and often overlooked during competition. The most important steps to take for a concussion are to remove the athlete from play immediately, and ensure they have adequate recovery time before resuming play. Recovery time includes noting any changes in physical or mental status, abstaining from activity, and obtaining medical clearance to return to play. Failure to do so could result in a risk of second-impact syndrome, permanent changes in neurocognitive functionality, and other long-term complications. However, young athletes should not play with the fear of sustaining permanent brain damage. As long as athletes play smart, wear protective equipment properly and use proper technique, the risk of sustaining a concussion is severely reduced. For teenage athletes, realizing that they are in fact not bullet proof may be the difference between an athlete with a

lasting career and one who spends most of their life in a hospital bed, suffering from permanent, irreversible damage.

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