

TerranearPMC Safety Share

Week of September 23, 2013 – Football Helmets and Concussions

A few weeks ago, the National Football League (NFL) reached a settlement in the combined lawsuits of 4,500 former players: The NFL will pay out up to \$766 million (plus legal fees) to help retirees whose brains were damaged by concussions. The terms apply to every retiree who presents medical evidence of severe cognitive impairment, dementia, Alzheimer's or ALS, or to those players' families.

Concussion, from the Latin *concutere* ("to shake violently") or *concussus* ("action of striking together"), is the most common type of traumatic brain injury that, in many cases, can alter the way the brain functions. Frequently defined as a head injury with a temporary loss of brain function, concussions can cause a variety of physical, cognitive, and emotional symptoms, which may not be recognized if subtle. Today, there is a lot of evidence supporting the long-term effects on athletes that are repeatedly subject to head injuries, as they are at high risk of a diminished capacity of memory and cognitive thought processing.

While helmets are the main protective measure in football, it has become apparent that head protection by itself, is not an effective measure to prevent head injuries to those that play this sport. Whether one is in Pop Warner, high school, college or the NFL, those that play are at great risk of a concussion.

According Kevin Guskiewicz, a professor of sports science at North Carolina and an expert on football helmets, helmets certainly help to mitigate forces that are distributed by impact to the skull and the intracranial cavity and the brain; but the brain is still going to move inside the cranial cavity regardless of whether there's a helmet on or not. With improved soft materials inside its hard outer shell, a modern helmet can lessen the effect of a straight-ahead, "linear" impact, but can't do much to prevent the effects of the head rotating from the impact. And while helmets do dissipate some of the contact forces, they cannot reduce them to the degree necessary to manage the energy for preventing concussions.

Concussions are often caused by a combination of what are called linear and rotational accelerations. In linear acceleration, the head is moving in a straight line when it suddenly stops, as in many car accidents. During rotational acceleration, the head is twisting or struck from one side, which can cause a shearing effect on the brain. While it is known that rotational acceleration may be more correlated with concussion, it is not known just how much will cause a concussion. Without a threshold it's impossible to create a test that will measure the risk of concussion.

Football helmets are a type of personnel protective equipment (PPE), and as such, should be used as the last resort to protect people. Engineering hazards and administrative controls should always come first. Unfortunately, when it comes to football, past practices relied almost solely on protective gear to prevent serious injuries.

Probably the first administrative control to be used in football was being penalized for grabbing the facemask; a practice that could cause a very serious injury. Later came penalties for unnecessary roughness and roughing the passer. A number of years ago, quarterbacks were protected via the in the grasp rule. However, football fans believed this rule was used too much, resulting in many plays being stopped just as it looked like the quarterback was about to escape and make a spectacular play. So this rule was considerably modified. However, due to the increased publicity of head injuries in football, behavior modifications such as discouraging players from leading with the head when tackling are now being instituted. Such practices, if strictly enforced, could do as much as improved helmet design to avert concussions. Along with using safer helmets, NFL's anti-spearing rule is being credited for reducing football fatalities on all levels from 30 to 35 per year in the mid- to late-1960s to an average of eight from 2008 to 2010.

Over a decade ago, the sports equipment manufacturer Riddell developed a new helmet designed to reduce players' risk of concussions. The helmet was ambitiously called the *Revolution*. It would become the most widely used helmet in the NFL and earn millions in sales to players in college, high school and youth leagues. However, just after developing the Revolution, a biomechanics firm, Biokinetics, hired first by the NFL and later by Riddell to test helmets and study head injuries, concluded that no football helmet, no matter how revolutionary, could prevent concussions. In fact, studies showed that even a helmet that passed the industry safety standard for protection against skull fractures and other severe head injuries could leave a player with a 95 percent likelihood of receiving a concussion from a strong enough blow. Nevertheless, Riddell continued to promote the Revolution by saying that players who wore it were 31 percent less likely to suffer a concussion.

Football helmet protection factors are based on tests created by the National Operating Committee for Standards on Athletic Equipment (NOCSAE), an independent standard-setting body. NOCSAE rates helmets numerically on a Severity Index. Severity Index scores reflect how well helmets absorb the energy from an impact by measuring the effects on the head and brain: the higher the score, the greater and potentially more damaging the effects. Helmets that score below 1200 pass the tests. However, Biokinetics concluded that even a player wearing a helmet that scored 291.2 during an impact would well within the safety threshold would have a 50 percent probability of suffering a concussion. A helmet that scored 558.9 during the same impact would carry a 95 percent risk of concussion (the Revolution scored a severity rating between 444 and 513).

It is apparent that helmets (as well as other football PPE; face guards, mouth guards, shoulder pads, etc.) do provide some protection, but as football players become bigger, faster, and stronger, including their understanding that poor performance will, most likely, result in being cut from the team roster, and ending one's career, hard hitting and intense contact cannot be denied.

In the end, it seems that the burden will fall on the referees who must make the calls and throw the penalty flags for infractions that in the past, would have been considered acceptable football. Just how these administrative controls will be implemented will, in all likelihood, depend on the fans' acceptance of these new rules. Will the control of physical contact be mitigated to such a point, that it causes the level of competitiveness to diminish? This may be the deciding factor of whether it is important to control career-ending and life-threatening injuries.

I have tried 99 times and failed, but on the 100th time came success

Albert Einstein