

YOUR
BODY
 IS NOTHING
 WITHOUT A
BRAIN
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ICE
 HOCKEY
 rugby

How many times have parents or coaches of children playing a contact sport seen a child get “bonged” or “dinged?” More importantly, how often does that experience go unacknowledged and unreported? For decades, as spectators, we have enjoyed watching athletic teams of all ages face off and score those points. The participants take pride in displaying their athletic performances. Whether they block the offense, make a winning pass, or simply run up and down the field, sports will always be a source of pleasure, challenge, and fitness to a large segment of our population. Many parents experience vicarious excitement and pleasure watching their children participate in sports.

Unfortunately, contact sports and some recreational sports carry risks for serious head injury. While many people may think that this is obvious, most are not aware that small repetitive brain injuries can cause long-term damage. There is documentation that continuous or additional sub-concussion level impacts can result in long-term neurological deficits that manifest themselves during the playing time or after the individual is retired from the sport. In fact, sub-concussive impacts can easily result in reducing the threshold of temporary and/or permanent brain injuries.

LACROSSE football
 SOCCER

FEATURE

BILLIONS OF NEURONS

A BRAIN CONTAINS

Contact sports such as football, soccer, ice hockey, lacrosse, mixed martial arts, and rugby did not exist in the 5th century B.C. nor did motorcycling or bicycling. However, the importance of the brain and its contribution to one's quality of life was appreciated. Hippocrates more than documented the fact that the brain is the most important organ of our body. If that is true, why are so many young children, teenagers, and adults constantly placing themselves at risk of compromising their quality of life with a brain injury whose effects could be temporary, permanent, or delayed into the future?

This author was able to solve the problem of paraplegic and quadriplegic injuries in young children and adults resulting in blows to the steel face mask used in football. The weight of the new face mask, commercialized and licensed to Riddell, was less than half the weight of the pre-existing steel face mask and was able to flex, absorb and dissipate some of the impact forces transmitted to the head, neck, and spinal column. Eventually, the rest of the steel face mask followed suit, reducing the fatigue factor of young children wearing the helmet and face mask. Manufacturers also coated and colored the steel, making it attractive enough to be used by competitors of all ages. The overall result was that the risk of paraplegic and quadriplegic injuries was essentially eliminated with the change in weight alone. This was accomplished without any changes in any standard.

Unfortunately, there isn't one helmet in the world that can prevent a concussion. Further, it is common knowledge that one does not have to receive a blow to the brain to experience a concussion, nor does an individual have to receive concussive blows above the predicted threshold level. The main objective of protective helmets in sports is to reduce and/or eliminate subdural hematomas caused by contact with the helmet itself. The industry has been successful with respect to that type of injury. It is impossible, based upon the technology available and other variables, to entirely eliminate sub-concussive and concussive injuries.

In many instances, concussion diagnosis is flawed because the injured players must report their symptoms to the coach, trainer, or parent. The worse scenario is when a child receives a head injury

In the 5th century B.C., Hippocrates stated in *On the Sacred Disease*:

"Men ought to know that from nothing else but the brain come joys, delights, laughter, and sports, and sorrows, grief, despondency and lamentations. And by this, in an especial manner, we acquire wisdom and knowledge, and see and hear and know what are foul and what are fair, what are good, what are sweet, and what are unsavory, . . . And by the same organ we become mad and delirious, and fears and terrors assail us. . . . All these things we endure from the brain."



ity: all the motor information through which we are able to move; all of the sensory information through which we are able to see, taste, and touch; and, of course, all of the cognitive information through which we are able to reason, think, dream, plan, remember, and do everything else that we do with our minds. Each of these neurons is connected to between 5,000 and 200,000 other neurons.

Most recently, research by neuroradiologists, biotech firms, medical researchers, and other specialists has focused on the axon, a long, slender projection of a neuron, that carries electrical impulses away from the nerve cell's body. The research finds that the stretching of the axon can make the cell susceptible to additional damage by additional stretches well after the initial stretch, causing swelling and possibly disintegration of the cell due to a pileup of proteins. Symptoms can worsen up to a day later. There are no medical and/or scientifically accepted criteria at this time to know when it is safe for the player to return. A mistake in diagnosis could result in a permanent disability.

When neurons are damaged or destroyed, they may be able to regenerate or repair themselves. Since they generate electrical signals called action potentials that provide all the motor information described above, it is important for every person to reduce the risk of damaging or destroying any portion of the neurons in their brain. Neuronal reorganization after head trauma has a significant impact on long-term development. Cumulative sub-concussive head injuries can cause debilitating memory loss, chronic headaches, and clinical depression.

Even if regeneration and repair occur, there is no guarantee that the individual's brain will normalize to its original state. Even without receiving a full-blown concussion, one can still be permanently affected as a result of continuous damaging or destroying of neurons. The effects would include behavior, memory, maturity, and learning capacity. To date, no one has been able to measure the magnitude

during a contact sport when a medical specialist is not on hand to hear reports of symptoms.

Although still not widely known, it is now accepted by pediatric neurologists that children, especially infants and preschoolers up to the age of 7, have a substantially higher vulnerability to neurological trauma than adults. Some of the long-term effects do not manifest themselves until the child has reached adulthood (Jeanette, 2001). Dr. Cynthia L. Beaulieu recently published findings showing that children who sustained injuries in their first five to six years exhibited less recovery of and greater impairment to intellectual skills as compared with children who were aged between 6 and 16. The age at which the injury was received and its severity dictate the rate and extent of recovering from deficits in language, memory, attention, and academic and decision-making skills (Beaulieu, 2002).

Every time an athlete absorbs a direct impact to the brain area, neurons can be destroyed or damaged. A brain contains billions of neurons (nerve cells). The neurons process all of the information that flows from within, to, or out of the central nervous system (CNS). Therefore, an impact can have comprehensive effects on brain activ-

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of the initial deficit. However, there have been numerous reported cases where the brain starts to deteriorate after a lapse of time. This phenomenon has manifested itself in boxing, football, and soccer well after the participant retired from the sport.

For example, Italian researchers have suggested that their soccer players are six times more likely to develop motor neuronal disease (MND) than the general population. The illness is incurable. British neurologists have connected illness such as MND, Parkinson's and Alzheimer's to repeated brain trauma without receiving a concussion. Heading the ball, impacting of heads, or an elbow into the temple of the soccer player can be the precursor to the ultimate neurological

THERE ARE **3.8 MILLION**
SPORTS-RELATED CONCUSSIONS PER YEAR



Ballistic engineers at the University of Glasgow demonstrated that a soccer ball can approach a speed of 80 mph prior to impacting with one's head. It should also be noted that Billy McPhail, a player with the Glasgow Celtics in the 1950s, wound up disabled with pre-senile dementia and died in 2003. Other soccer players of note were Celtic Jimmy Johnstone who, in 2002, was diagnosed with ALS; former England manager Don Ravie, with ALS; Derby's Rob Hindmarch, with ALS; and Middlebrough's Willie Maddren, with ALS.

A 1992 Norwegian study found that 35% of active soccer players in that country had abnormal brain scans, and another study in that country of retired professional players found one-third (33%) of them had brain atrophy or a shrinking of brain tissue that resulted in behavioral and cognitive problems. The study concluded that the damage was directly related to sub-concussive repeated heading.

Although young children and teenagers do not experience the extreme force of the ball as professionals, their skulls have not matured and are constantly at risk. Rob Hughes, a columnist for the *Sunday Times*, stated in 2005 that, "The line between a hardy and a fool-hardy sportsman is sometimes too blurred to sense, let alone to see."

There is no method of reducing the risk of head injuries when a player is hit in other parts of the body and not the head. The percentage of head injuries that relate directly to head impacts, relative to impacts to other parts of the body that also result in head trauma, cannot be reduced with any type of protective equipment.

Year round, sports are the leading cause of injuries in the 11-to-18 population. The United States Centers for Disease Control and Prevention estimates that one-half of the 1 million-plus sports injuries seen among young children each year could be avoided with proper education and the use of protective equipment. The assumption here is that the injuries reported do not involve organized contact sports.

problem and deficit. In fact, in 1974, the *Sunday Times* in Britain reported coroners' findings relating to eight deaths that were directly caused by heading in soccer. It is only through well-directed epidemiological studies that the accumulated data from the past can now be accurately analyzed. In spite of these older reports, the players still refuse to protect themselves.

According to Michael Collins, PhD, a neuropsychologist from the University of Pittsburgh, there are 3.8 million sports-related concussions per year, most of which go undiagnosed. In a William "Pinky" Newell Lecture, he said that the injured victims who continue in their chosen sport and are re-injured are risking the possibility of permanent disabilities.

A London neurologist, Professor Andrew Lees, studied the case of Ray Kennedy, who developed Parkinson's disease soon after helping Liverpool win three European Cups. He concluded that Kennedy's illness could have been detected 14 years before he was diagnosed at the age of 35. It is also known that Jeff Astle died at the age of 59 from brain injuries caused by repeatedly heading a soccer ball in his 20-year career.

Kevin Guskiewicz, director of the Sports Medicine Research Laboratory at the University of North Carolina at Chapel Hill, has stated, "While many parents and athletes think that concussions rarely occur in sports such as lacrosse, soccer, softball, and baseball, recent data suggests that concussions occur more frequently in these sports than previously thought."

When a player has a fractured leg or fractured arm or other injuries that are visible to the rest of the team members, it is understandable why he/she is not participating in the game. However, when a player receives a concussion or head trauma and is not playing, it can be embarrassing, and the peer pressure can force the player back into the game when the player does not admit to the severity of the condition and how he or she truly feels. This is a hidden danger to the player, his parents, his coach, and the athletic trainer for the team. The "win at any cost syndrome" can be a detrimental one to all concerned, especially the injured player.

Where does all this lead parents and participants in amateur sports? When it comes to a child's brain, parents have a non-delegable responsibility to their children, who deserve a life without a debilitating brain injury that could have been prevented. If less than one-tenth of 1% of all participants in sports are good enough for the professional ranks, then one has to weigh the risks versus the benefits. If the child is good enough to get a scholarship to participate in collegiate sports or if he is a LeBron James who was drafted right out of high school, then it may be worth the risk. However, in many cases, the parent and child are wishful thinkers or dreamers and not realistic. As parents we cheer, spend a lot of time taking our children to practice, watch games, and hope that our child is having a good time.

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Children, in most instances, play for volunteer youth coaches who lack medical training and have never taken a first aid course. They also play a variety of contact sports at all levels through pain, even after a collision has rattled the brain. Then there are parents and coaches often too willing to rush their children and players back onto the playing field.

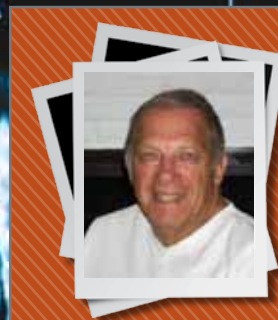
The decision that parents make with or without their children's input must be rational and realistic. If their child is permanently injured based on their choices, the parent and the child have to live with that decision for the rest of their lives. Based upon all of the research and findings to date, the issue is whether participation in contact sports for young children is worth the investment of time and money and the risk of brain injury. The question for parents is this: Should we choose an alternative, safer sport that our children could play for the rest of their lives?

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