

Head Cases

By William A. Staar

As awareness and the list of injuries tied to concussions grows, so too will the number of related lawsuits.

The Coming Wave of Concussion Litigation

In 2005, 19-year-old Preston Prevetes suffered a concussion during football practice at LaSalle University. One month later, he returned to the field, experienced a second concussion, lapsed into a coma, and ultimately suffered

severe brain damage. Today, he communicates primarily through a keyboard and cannot walk. In November 2009, a lawsuit brought by the Prevetes family against LaSalle was settled on the courthouse steps for \$7.5 million. This is but one of many such cases to come. A fast-growing body of studies and data concludes that concussions, once thought of as minor nuisances, are significant brain injuries that can lead to serious and permanent disability. Even more troubling, the numbers of concussions reported in all contact sports is on the rise. Wherever significant injuries appear, plaintiffs' lawyers will follow. Any entity appearing to cause or failing to prevent a brain injury suffered by an athlete is a potential defendant. The primary groups likely to become targets are manufacturers of athletic helmets, school systems and universities, physicians, coaches, and trainers.

This article examines the emerging information concerning sports-related brain injuries, including current efforts to try to prevent them and the various legal implications that will develop from them.

Varieties of Brain Injuries

The four types of sports-related brain injury that defense attorneys are likely to encounter are concussion, post-concussion syndrome, second-impact syndrome, and long-term brain damage.

Concussion

Some disagreement exists about what constitutes a concussion, also sometimes referred to as a mild brain injury, mild traumatic brain injury (MTBI), mild head injury (MHI), or minor head trauma. For ease of discussion, this article refers to all of these collectively as a "concussion."

Description and Causation

A concussion requires two elements: (1) trauma to the head, and (2) a resulting transient loss of normal brain function. "Loss of normal brain function" can include any of approximately 25 symptoms, including dizziness, headache, blurred vision, and nausea. A concussion occurs when g-forces, the apparent increase in body weight due to rapid acceleration, linear or rotational,



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cause the brain to compress into the skull so forcefully that axons, the nerve fibers that transmit electrical impulses, are stretched, distorted, or ripped completely. Kenneth Frazier, *Acceleration*, in 4 Gale Encyclopedia of Science 8 (K. Lee Lerner and Brenda Wilmoth Lerner, eds., 4th ed. 2008). If damage is slight, normal function returns in seconds or minutes. If damage is severe, recovery takes much longer. The concussion threshold is around 100g. Most contact sport impacts are under 25g, but hits of 50g to 120g are common, and extreme hits can approach 200g.

Grades

Various standards exist for grading concussions. The “Cantu” system, named for widely respected authority on brain injury, Dr. Robert Cantu, is frequently used and defines the three grades of concussions as follows:

Grade 1: Brain injury with no loss of consciousness and post-traumatic amnesia from 0–30 minutes.

Grade 2: Loss of consciousness for less than five minutes or posttraumatic amnesia for 30 minutes to 24 hours.

Grade 3: Loss of consciousness of greater than 5 minutes or amnesia for greater than 24 hours.

Grading concussions helps coaches, trainers, and medical professionals determine the minimum steps necessary to treat concussions.

Treatment

Currently, rest is the only known concussion treatment. If an athlete returns to play before fully healing, he or she is more susceptible to additional concussions and more severe forms of trauma.

Numbers

The number of athletes annually experiencing concussions is uncertain. Some sources estimate the total at several hundred thousand. The Centers for Disease Control and Prevention claims 1.6 to 3.8 million cases in the United States annually. The National Athletic Trainers Association asserts that high school football players collectively experience between 43,000 and 67,000. The Associated Press claims 100,000 in football alone, with 40 percent occurring at the high school level. In 2007, the National

Institutes of Health commenced a \$3.6 million, five-year study to learn more about concussions, including the actual number of people affected. The reason for uncertainty about the number of cases is twofold. First, as discussed below, many concussions are unreported. Second, many athletes do not understand what constitutes a concussion and, thus, when they experience a concussion, do not report it.

Post-Concussion Syndrome

Post-concussion syndrome, which may last days to years after someone suffers a concussion, generally involves depression, irritation, poor concentration, memory loss, mood swings, headaches, decreased appetite, fatigue, slowed reflexes, impaired speech, impaired balance, sensitivity to bright lights, dizziness, seizures, blurred vision, nausea, or general malaise or “feeling off.” As with concussions, only rest can help resolve these symptoms.

Second-Impact Syndrome

Second-impact syndrome occurs when an athlete still healing from a prior concussion experiences a second force-related event to the brain. Occasionally, second-impact syndrome can lead to brain swelling, coma, permanent brain-function loss, or death. That is the condition suffered by Preston Prevetes, and it afflicts teenagers almost exclusively. Cerebral blood flow and pressure increases dramatically, which causes arteries to swell beyond capacity. According to the University of Pittsburgh, second-impact syndrome kills seven high school football players annually.

Long-Term Brain Damage

Most recently, the media, medical community, and federal government have focused intensely on the long-term effects of concussions. Over the last five years, several studies have concluded that concussions are linked to increased rates of Alzheimer’s disease, dementia, and, most seriously, Chronic Traumatic Encephalopathy.

Chronic Traumatic Encephalopathy

A catastrophic disease once associated only with boxers, Chronic Traumatic Encephalopathy (CTE) results when a toxic protein builds up in the brain, kills cells, and causes severe depression or demen-

tia. In 2006, 44-year-old former Philadelphia Eagle Andre Waters committed suicide by gunshot. An autopsy found CTE, and Waters’ brain was likened to that of an 85-year-old Alzheimer’s sufferer. That death raised many red flags and sparked the current focus on sports-related brain injuries. According to *Medical News Today*, as of October 2009, CTE had been discovered in several football players, including 17 NFL alumni, a college player, and an 18-year-old high school player. In December 2009, 26-year-old Cincinnati Bengals wide receiver Chris Henry was killed after reportedly leaping from a moving pickup truck driven by his fiancée. An autopsy revealed the presence of CTE, making Henry the youngest player in NFL history to be diagnosed with the disease. The Associated Press has reported that the NFL will (1) encourage current and former players to agree to donate their brains to the Boston University School of Medicine Center for the Study of Traumatic Encephalopathy, and (2) donate at least \$1M to the center. In January 2010, the center announced that, for the first time, a former hockey player, New York Ranger Reggie Fleming, had been diagnosed with CTE.

Frontal-Lobe Damage

Poorly self-regulated off-field behavior by professional athletes is by no means limited to those who play contact sports. A few basketball players and one or two golfers immediately come to mind. Some medical professionals, however, suspect that concussion-related damage to the frontal lobe, the portion of the brain that controls judgment, inhibition, and social behavior, may play a role in causing some of these incidents. Presently, it is unclear whether such damage may constitute an early form of CTE. In April 2010, Pittsburgh Steelers quarterback Ben Roethlisberger, who has a history of concussions and off-field problems due to bad decision making, reportedly attempted to force himself on a woman in the restroom of a Georgia bar. In May 2010, Hall of Fame linebacker Lawrence Taylor, who also has a history of head injuries and off-field problems, was arrested for hiring a 16-year-old prostitute. Pittsburgh forensic pathologist Cyril Wecht and Dr. Jordan Grafman, a neuropsychologist who specializes in frontal lobes, agree

that individuals with frontal-lobe damage may have a much more difficult time controlling base urges and making socially acceptable decisions.

Single-Concussion Deficits

At least one recent study suggests that even one or two concussions can result in mild, long-term brain damage. Whereas CTE

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apparently affects only a small number of athletes who suffer many concussions over time, a study addressed in the February 2009 edition of the *Journal of Neurotrauma* and conducted by professors at the University of Illinois suggests that many more people could suffer long-term brain damage from far less exposure to concussions. Participant students having just one or two concussions showed, in some cases more than three years later, signs of a decreased ability quickly to detect physical changes in their immediate environment. The thought that even a single concussion may cause some type of permanent brain injury is startling, and this issue certainly will receive far more attention in the future.

Exacerbating Factors

A number of factors have made concussion rates among athletes worse than necessary. Ignorance, a “warrior culture” among athletes, concerns about job security, and insufficient funds have all contributed to rising concussion rates.

Ignorance

Most athletes, coaches, trainers, and parents simply do not know what causes a concussion, when a concussion has occurred, the symptoms of a concussion, and how dangerous a concussion can be. Additionally, terms commonly utilized in sports

to describe concussion symptoms sound childlike and benign, including “having your bell rung” or “getting dinged.” Also, concussions are not accompanied by limping, blood, or other obvious symptoms. Children are the group most ignorant about concussions, which is particularly troublesome because their less-developed brains put them at greatest risk for brain injury.

Warrior Culture

In certain sports, players are expected to be gladiators and do anything necessary to keep competing. “Playing with pain” and “sucking it up” are as expected in football as blocking and scoring touchdowns. Failing to play while injured, especially with an injury that is not obvious to the eye, can lead to stigma and ostracism. For this reason, among others, University of Illinois Professor of Kinesiology Steven Broglio claims that “53 percent of concussed high school athletes are suspected of not reporting their injuries to medical personnel.”

Job Security

Many athletes, especially professionals, are concerned that the longer they remain sidelined, the more expendable they become. Every year, a new crop of potential replacements emerges from the NCAA ready to fill a roster spot. As a result, athletes often conceal from coaches and trainers their concussion-related symptoms and instead choose to put themselves at risk.

Insufficient Funds

Money makes a difference in preventing sports-related concussions. Many schools lack funds to purchase the newest football helmets or to have old helmets properly reconditioned. Many old football helmet models have liners consisting primarily of individual foam pads covered by a vinyl skin. Over time, foam condenses and absorbs less force, and those liners must be replaced every two to three years. Additionally, most schools cannot pay for an athletic trainer educated in concussion detection and prevention to attend every game, much less every practice.

Fixing the Problem

In addition to eliminating the factors noted above, the following could reduce the number and severity of concussions.

Rule Changes

Some believe that a variety of rule changes could reduce the number and severity of concussions. In late November 2009, shortly after a painful hearing before Congress, the NFL announced that it was in the process of formalizing a rule change that would prohibit the return of a player to the field in the same game in which he had suffered a concussion. Also under consideration were (1) a rule that would keep a player off the field for one game after a concussion and (2) reducing contact during practice. Additionally, the league may assign a neurologist to each team. Finally, penalties for illegal contact, which is the source of many head injuries, will receive serious consideration by the NFL.

Mental-Performance Testing

Relatively new computer software can compare brain function before and after a concussion to determine whether a concussed player has healed. The tests include memory, reaction time, and mental acuity. One program, developed by ImpACT Applications, Inc., collects cognitive preseason baseline readings as a point of reference. After a known or suspected concussion, the test is performed again to determine whether any of the scores have markedly decreased. Unfortunately, younger athletes reportedly try to defeat the systems by intentionally performing poorly on the earlier tests.

Studies

Researchers recently began paying a great amount of attention to concussion-related issues, including how concussions occur, who is at greatest risk of concussion, and the long-term effects of concussions. For example, in 2005, the University of North Carolina and Dr. Cantu published a study concluding that NFL players who had suffered three or more concussions had a heightened risk of mild cognitive impairment after age 50. In the fall of 2009, an NFL-sponsored study at the University of Michigan concluded that NFL players may experience Alzheimer’s and other brain deficits at a much higher rate than normal. As already noted, researchers from the Boston University School of Medicine Center for the Study of Traumatic Encephalopathy are studying the brains of deceased NFL

players known to have suffered repeated concussions. Until the frequency and severity of concussions begins to decrease dramatically, many more concussion-related studies are a certainty.

Advances in Helmet Technology

Hard-shell polycarbonate helmets, first developed over 50 years ago for use in football, never were designed to deal with concussions. They arose from a goal to eliminate deadly head injuries, such as skull fractures and subdural hematomas, and they have succeeded completely in that task. Additionally, manufacturers, most of which also manufacture face masks, have all but eliminated facial injuries. Concussions are the new target, and manufacturers now are at the beginning of a race to develop technologies that reduce both the frequency and severity of concussions. Hundreds of millions, if not billions, of dollars are at stake, both in potential sales and lawsuit exposure, and both upstarts and established companies are participants in the race.

Impact in Particular Sports

Athletes participating in football, hockey, and baseball, as well as sports not usually associated with violent contact, such as lacrosse and soccer, experience concussions. Causes vary, as does protective helmet technology.

Football

Second only to boxing, football is the most traditional source of brain injury among contact sports. Currently, over two million Americans play football at all levels. Some experts claim that for every three games played, approximately one NFL player per team suffers a concussion. For reasons addressed above, that estimate may be conservative.

Causes

High-speed physical contact is a natural part of the sport, but other factors particular to football that are “fixable” currently result in more concussions than are necessary. Poor tackling techniques are at the top of the list. Rather than keeping one’s head up and using one’s shoulders and arms to target an opponent’s waist, many current players have supplanted that tackling technique with the following.

- “Spearing” or “Torpedoing”: That technique involves facing downward and leading with the crown of the helmet, which focuses all of a tackler’s mass on a single point and can result in devastating contact. It also requires a tackler to “fly blind,” leaving him no means of gauging what his helmet may hit or when.
- Helmet-to-Helmet Hits: Many defensive players purposely use their helmets and face masks as weapons with which to hit other players in the head.
- “Launching”: In executing this tactic, a player leaves his feet to make a tackle. Launching sometimes is used in conjunction with spearing. It reduces a player’s ability to control his direction, and instinctively causes his eyes to close.

These dangerous techniques have become more prevalent over time for two main reasons. First, they can result in big hits that are rewarded with praise and additional exposure. Second, to reduce frequency of injury, many teams at all levels have severely reduced full contact during practice. Less contact means less opportunity to teach proper tackling.

Helmet Technology

Historically, football has led the way in the development of athletic helmets. Today, helmet manufacturers offer a variety of different technologies designed to disperse the forces that cause brain injury, including shock absorbers, high-tech plastics, and air-channeling systems.

Riddell, Inc.

With reported gross sales of approximately \$100M per year, Riddell (<http://www.riddell.com/>), has its largest market share at the professional level, where it is the licensed “Official Football Helmet of the NFL.” In 2007, Riddell reportedly supplied the helmets of 84 percent of all players. For several decades, its VSR-4 model, which relies on a vinyl-coated, foam-liner system, was typical of the industry standard. Its current flagship line, which was introduced in 2002 and now comes in four versions, is the “Revolution.” All Revolution models contain the same basic impact-attenuation system, which Riddell calls “CRT” for “Concussion Reduction Technology.” The primary advertised characteristics of the Revolution are:

- Side Facial Protection: As a result of a late-nineties study by the NFL finding that seven of ten concussions were caused by blows to the side of the head, the padded jawline of the Revolution extends forward two inches further than traditional models.
- Large Shell Size: The helmet shell is noticeably larger than is standard. The

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- greater distance from the shell to the head of the wearer due to its large size offers more room for padding and, thus, more opportunity to disperse g-forces.
- “Tru-Curve” Shape: The shell has been designed around the head’s center of gravity. Additionally, both the helmets and Riddell face masks have been made as round as possible to maximize force deflection.
- Light Weight: The shell is lighter than that of a traditional helmet, resulting in less neck fatigue and a greater opportunity for the wearer to keep his head up when making tackles.

Schutt Sports, Inc.

In 2003, Illinois-based Schutt, (<http://www.schuttsports.com/>), introduced the “DNA” helmet and, more recently, offered the “AirXP” and “ION 4D” lines. In terms of sales, it is in second place in the NFL, but appears to be closing the gap. The more important reported aspects of Schutt’s newest models are as follows:

- TPU Cushioning: Thermoplastic urethane, or “TPU” cushioning forms the liner of most of Schutt’s helmets and is an alternative to traditional vinyl-coated, foam padding. It is a lightweight collection of bubble-wrap-like cells that absorb more shock and degrade far more slowly than foam. TPU is not of Schutt’s

own design, but was developed by Skydex Technologies, Inc., a Colorado corporation that manufactures, among others, padding for military vehicle seats and helmets.

- “Brain Pad” Mouth Guard: Schutt has partnered with Brain-Pad, Inc., to produce a mouth guard that Schutt claims may reduce the chances of concussion.

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- Energy-Wedge Faceguard: This system involves a face mask attached to a helmet by shock absorbers that absorb up to 15 percent more of the impact of a frontal impact than traditional masks.

Adams USA, Inc.

Tennessee-based Adams, (<http://www.adamsusa.com>), has been comparatively quiet with respect to its helmets’ anti-concussion features, and its website offers only a few relevant points. First, Adams mentions that its helmets have an anatomically correct shape. Second, Adams specifies that its helmets have a “Skeletal Sub Structure (SSS) System.” That system is a liner composed primarily of expanded polypropylene (EPP), a lightweight and stiff Styrofoam-like material used in most hockey helmets, and ethylene vinyl acetate (EVA) foam, a soft material generally known as foam rubber.

Xenith, LLC

Xenith, (<http://www.xenith.com/>), of Lowell, Massachusetts, is a new company currently receiving much media attention. Testing of its “X1” model began in 2007, and general sales commenced in the fall of 2009. Like Schutt, Xenith abandoned foam as a primary liner material, but the similarity ends there. The X1’s primary anti-concussion feature is its “Shock-Bonnet” system, which is described as having two parts:

- Aware-Flow Shock-Absorbers: Eighteen plastic, hockey-puck-shaped shock absorbers with small holes in their ends act as crumple zones in a car and last longer than traditional foam or gel systems.
- Bonnet: The shock absorbers are attached to a cable-lined cap inside the helmet, not to the helmet itself. The wearer tightens the chinstrap, and the cap molds to his head, keeping all discs as close as possible to the skull to help dissipate energy more evenly.

Protective Sports Equipment Company

The four-person, Pennsylvania-based Protective Sports Equipment Company began work on its “Gladiator” helmet in 2007, and development continues today. Publicly available details are few, but the media has reported the following:

- Soft-Hard-Soft Design: The Gladiator abandons traditional two-layer design—a hard shell and softer liner—for three layers, a soft exterior made of foam, a hard carbon fiber center, and a soft inner liner of undisclosed material.
- Light Weight: The helmet is considerably lighter than traditional helmets, primarily because it substitutes plastic with carbon fiber.
- Resin-Composite Face Mask: The Gladiator’s face mask eliminates the use of metal altogether, making it as light as possible.

Which Helmet Is Best?

To date, no independent reviewer has determined which football helmet is most effective against concussions. The NFL is in the process of studying the issue, but whatever it concludes will meet stiff resistance and not end the discussion. For now, consumers are left to rely on manufacturer claims.

NFL Helmet Testing

In 2009, the NFL began closed-door testing of approximately one dozen helmets from all five manufacturers mentioned above. The initial phase concluded in December 2009. The stated goals of the tests have been to determine what progress, if any, manufacturers have made in impact-attenuation technology over the past 10 years. On July 24, 2010, the *Washington Post* reported that, the day before, the NFL and its play-

ers’ union released the results for review by all teams and players. According to the report, the league stated that (1) “[N]o contemporary helmet [tested] performed worse than the helmets” from the 1990s; (2) Three current helmet models—the Riddell Revolution, the Revolution Speed, and the Schutt DNA Pro—qualified as “top performing” helmets; and (3) The NFL was not endorsing any particular helmet because (a) the tests were only an initial step in learning more about the effectiveness of safety equipment, not a definitive statement on helmet performance, and (b) a number of follow-up studies are planned.

For helmet manufacturers, the importance and risks associated with these results cannot be understated. It is presumable that many consumers almost certainly will rush to purchase the helmets reported as “top performing.” Additionally, plaintiffs’ attorneys in future head-injury product-liability suits almost certainly will seek to use the results to validate design-defect claims and argue that manufacturers of non-“top performing” models failed to utilize the best available technology. Many in the field, however, are deeply concerned and already have dismissed the venture, citing multiple problems with the testing, including faulty testing methods and the too-close relationship between Riddell and the NFL.

Manufacturers’ Claims

Riddell advertising has targeted only old helmet technology but has not yet compared its technology with the company’s competitors’ new technologies. Its website claims that, on average, Riddell wearers are 31 percent less likely to suffer a concussion compared with concussions suffered by wearers of old football helmets, and 41 percent less likely for those never having experienced a concussion before. The research supporting those claims was Riddell-financed and published in 2005 by the University of Pittsburgh Medical Center. That study tracked 2,140 high school football players from 17 schools over a three-year period (2002–2004). Approximately half of the players wore the new, Riddell Revolution helmets, and the others wore traditional helmets of unknown age and condition produced by various manufacturers. At the end of the period, the

study participants experienced 62 and 74 concussions respectively, a difference of 12. Comparative MTBI rates were 5.3 percent and 7.6 percent, with a 2.3 percent difference. The study concluded that Revolution wearers were 31 percent less likely to sustain a concussion compared with athletes who wore standard football helmets ($5.3 \div 7.6 = 69$ percent).

Reported criticism of the study methodology has been widespread and includes the following:

- The authors of the study had conflicts of interest because they were linked to Riddell on some level;
- The size of the injury group, 136, and the difference in the total number of injuries between helmet systems, 12, was statistically insignificant;
- The new Revolution helmets were measured against helmets of unknown age, manufacture, and condition. As noted above, foam-padded liners degrade over time.
- The mean age for players who wore the Revolution helmets was statistically higher than those who wore traditional helmets, an average of six months. Again, as already noted, the younger the athlete, the more susceptible he is to concussion.
- Revolution wearers scored higher on preseason baseline tests, which may have indicated that they made smarter on-field decisions than players that wore other helmets, which, in turn, reduced exposure.

Schutt, which has targeted both traditional helmets and those of its competitors, primarily claims the following on its website, in addition to points already mentioned:

- Each Schutt model exceeds the National Operating Committee on Standards for Athletic Equipment (NOCSAE) standard for football and is designed with the intent to reduce the risk of concussions.
- In hot, game-like conditions of 105 degrees, (1) the TPU's performance remains consistent, whereas traditional foam padding performs worse, and (2) the ION 4D and Air XP models dramatically out-performed all Riddell models and the Xenith X1 by significant margins in impact-absorption. Xenith's website does not directly com-

pare the performance of the X1 with its competitors' products. It does, however, provide links to a number of news articles that offer some statistics. One is an October 2007 article in the *New York Times* stating, "During its certification test [in October 2007], the Xenith helmet scored in the 200's in several key locations [in the impact-severity test] and averaged about 340, scores generally lower than those attained by today's helmet designs." In fairness, however, the article went on to say that the real-world value of these results is limited.

Hockey

According to a number of prominent sources, the hockey world is experiencing exponential growth in the reported number of concussions.

Causes

Experts and the media point to several factors behind the increase in the number and severity of concussions in hockey, including the following:

- The stigma that accompanies reporting concussions has decreased.
- The size and speed of modern hockey players has increased over time. In 1980 the average NHL player was 5'11" and 188 lbs. The 2009 All-Star-Game players averaged 6'2" and 214 lbs.
- Modern shoulder and elbow pads that minimize pain to the wearer now are used as weapons.
- The NHL has been reluctant to reduce violent play and fighting. In September 2000, the NHL formed a panel to study concussions and other injuries. For unknown reasons, the panel was disbanded during the 2004–2005 season.
- Helmet designs are far smaller and may be less protective against concussion than helmets used in football.
- Partial plastic face masks, also known as "half-shields," may contribute to player concussions. At least one study has concluded that such masks are responsible for more severe concussions because they can distort players' peripheral vision, causing some players to unbuckle their chinstraps and tilt the helmet up to improve vision. At that point, the helmet no longer is fitted to the player's head, reducing its impact-absorbing qualities substantially.

Helmet Technology

With one exception, today's primary hockey-helmet manufacturers essentially employ the same basic, protective technology: a hard, outer plastic shell, an inner liner approximately one-half-inch-thick, made of some type of impact-absorbing material, and a thin "comfort layer" of foam between one-quarter-inch and one-eighth-inch thick.

Sport Maska, Inc., and Easton Hockey

For their high-end helmets, both Sport Maska, a parent to both Reebok Hockey, (<http://www.reebokhockey.com/>) and CCM, (<http://ccmhockey.com/en/>), and Easton Hockey, (<http://eastonhockey.com/>), employ EPP as an inner-layer padding. EPP is a relatively dense material often described as a pliable Styrofoam. Generally, it is considered a superior material to its predecessor, vinyl nitrate, which remains the liner material of choice for most companies' less-expensive helmets.

Bauer

Most Bauer, (<http://www.bauer.com>), helmets also employ EPP and vinyl nitrate, but Bauer's top-end 9500 helmet uses "Fused Expanded Polypropylene" (FXPP), which Bauer claims transmits 20 percent less energy than the same volume of EPP.

Sports Helmets, Inc., d/b/a/ Cascade Sports

The lone helmet from Cascade Sports, (<http://www.cascadeicehockey.com>), the M11, abandons EPP and instead uses "Seven Technology," described as "a combination of design and material that replaces foam with pucks of cylinders that compress upon impact." Based on website images, it appears to be a collection of seven, open-ended, rubber-like cylinders, each measuring approximately one-half-inch wide by one-half-inch long, set on end and interconnected to form a pad.

Cascade's website claims the following for Seven Technology: "Seven Tech performs up to 140 percent better in multiple impacts than conventional EPP foam," and "Seven Technology is tuned to absorb impact using lateral displacement, providing the protection of two helmets in the space of one—one for catastrophic hits and one for concussions." It further claims that Seven Technol-

ogy laterally displaces energy and “performs better than EPP.” On June 28, 2010, in response to a challenge from Bauer, the National Advertising Division of the Council of Better Business Bureaus directed Cascade to cease making claims that M11 reduces incidences of concussion because Cascade had provided no competent and reliable evidence in support of such a claim.

Helmet manufacturers offer a variety of different technologies designed to disperse the forces that cause brain injury.

Which Is Best?

No independent study yet has declared that one hockey helmet offers the best concussion protection. Further, a 2009 article in the *Journal of Sports Engineering and Technology* suggested that modern liners may not be at all superior to traditional, vinyl nitrate liners in many circumstances. Regardless, it appears that significant advances cannot be made to prevent concussions in the short term as long as hockey helmets do not approach the size of football helmets, which are 100 percent to 200 percent thicker than hockey helmets. Unfortunately, many believe that today’s adult male hockey player remains more concerned with aesthetics than helmet safety. Until that changes all hockey helmets’ ability to prevent concussion may remain limited.

Baseball

Baseball also has seen a recent rise in concussion numbers.

Causes

Concussions occur during baseball games when players wear inadequate or no head gear and (1) balls make contact with players, (2) players make contact with a hard surface, such as a wall, or (3) players make contact with one another. The great size, speed, and strength of the average mod-

ern baseball player magnifies the relevant forces.

Helmet Technology

Baseball has been relatively slow to advance its head-protection technology. The first true batting helmets only became mandatory in 1971. Those with ear flaps were not required until 1983. In 2003, Rawlings, the official supplier of all Major League Baseball helmets, introduced the “Coolflo” batting helmet, now used by approximately one-third of Major League Baseball teams. It has 15 vents for cooling and a slightly thicker plastic shell than models worn before 2003, but these “advances” are primarily aesthetic. Like its predecessors, it only needed to withstand a flush hit from a baseball traveling 70 mph fired from two feet away.

In August 2009, Rawlings introduced the S100 model. A week after experiencing a concussion, New York Met David Wright returned to the field wearing the very large S100 that one reporter called “big enough to fit Mr. Met,” the New York mascot, whose head is almost three feet in diameter. The helmet, which utilizes EPP and allegedly is able to withstand pitches of up to 100 mph, is significantly larger than prior helmets to allow space for more padding. Rawlings recently tweaked the aesthetics of the helmet, and several MLB players, including Albert Pujols, wore the helmet in the July 2010 All Star game. Use of the S100 is mandatory in Minor League Baseball.

Other Sports

Players involved in sports not traditionally associated with violent contact also experience concussions.

Lacrosse

According to a 2007 article in the *Journal of Athletic Training*, concussions were the third-most-common injury in men’s and women’s lacrosse, currently the second-fastest-growing sport in America. Lacrosse helmets largely offer the same impact-absorbing technologies found in hockey and some football helmets. Manufacturers Brine and sister-company Warrior utilize liners made of EPP and EVA. Riddell, distributed by Onyx, offers models with an “air-fit” foam liner, although the padding is thinner than that in the Riddell football

helmets. Cascade’s “Pro 7” model, like its M11 hockey helmet, uses the Seven Technology system. As with the other major sports, no independent studies determining which helmet is best have yet been conducted.

Soccer

The vast majority of soccer player concussions today occur as the result of impact with another player, a goalpost, or the ground. A minority result from heading a ball, but because modern balls no longer are made of leather, they cannot absorb the moisture that once made them far heavier and more likely source of concussion. Surprisingly, head protection already is available for soccer players. A San Diego-based company called Full90 Sports, Inc., has for several years offered what is best described as a wide headband made of high-density foam. The company claims that the product reduces impact force by up to 50 percent and has minimal impact on the speed of headed balls.

Implications for the Defense Practitioner

The implications for litigators of the rising concussion numbers and paucity of independent evaluation about which headgear best protects players are not difficult to understand. As concussion awareness and the list of brain injuries that are tied to concussions grows, so too will the number of concussion-related lawsuits. Doctors will face claims that they failed to diagnose and properly treat concussions. Coaches, trainers, and school systems will be accused of teaching improper techniques, ignoring evidence of potential concussions or, worse, of ignoring concussions when they knew that players suffered them for the purpose of short-term gains on the field. Those entities with the financial means to acquire new technologies to protect players from concussions but that choose not to do so, will expose themselves to negligence claims, at the very least.

If and when a truly superior helmet technology is identified and becomes available, manufacturers that do not employ it or, at least, match it, will become targets. In *Rodriguez v. Riddell Sports, Inc., et al.*, 242 F.3d 567 (5th Cir. 2001), the plaintiff, a

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high school football player wearing a VSR-4 helmet, collapsed during practice and lost consciousness. He was diagnosed as having suffered a subdural hematoma—perhaps from second-impact syndrome—and suffered severe permanent brain damage. The plaintiff claimed that Riddell failed to use a new type of foam or thicker pieces of old foam in the helmet that the player wore that would have prevented the injury. At the trial, the jury awarded the plaintiff in excess of \$10 million. In *Arnold v. Riddell, Inc.*, 882 F. Supp. 979 (D. Kan. 1995), the plaintiff, who had suffered a fractured spine while playing football, claimed that Riddell failed to use in the helmet that he wore, a PAC-3 model, a superior, energy-

attenuation system that was available in the company's own Microfit model and in a helmet manufactured by competitor Bike. At the trial, the jury assessed total damages at over \$12 million. Many more concussion-related lawsuits of this type are coming. It is just a matter of time.

Conclusion

A fast-growing body of knowledge increasingly shows that concussions, once considered minor temporary annoyances, are significant injuries having potentially catastrophic consequences. With increased awareness comes increased opportunity. Leagues, trainers, coaches, and medical professionals at all levels can reduce the frequency and seriousness of concussions

by recognizing symptoms and taking necessary steps to protect youth and adult athletes. Changing rules and cultures will not be easy, but it is not impossible. Opportunity heavily laden with necessity also exists for athletic helmet manufacturers. As the spotlight on concussions brightens, parents and athletes seeking to purchase helmets for contact sports will gravitate toward helmets that they believe will provide the best protection against concussions. Additionally, in the years to come, manufacturers may develop helmets for use in sports in which such helmets have never been used before. This area of science, product development, and law is very dynamic, and we can expect to see many new related developments in the months and years to come. 