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Sensor-Rigged Helmet Gives Football Players a Heads Up on Concussions

An Illinois high school ponies up \$60,000 for helmets designed to protect players against brain and spinal injuries

Oct 3, 2007 | By Larry Greenemeier |

As a high school running back stretches forward to get that extra yard, he is met with a ferocious blow to the head by the opposing team's linebacker. After a quick shake of the head to clear the cobwebs, the player returns to his team's huddle unaware that he's just sustained a concussion that could eventually affect his memory, judgment, reflexes, speech, balance and coordination.

Football parents take heart, some high school teams are now testing a new helmet sensor that promises to alert coaches when players have been hit hard enough to cause a concussion, potentially averting further brain injury.

Unity High School in Tolono, Ill., has equipped its 32 varsity football team members with special helmets that employ Head Impact Telemetry System (HITS) technology. The helmets—made by sports equipment maker Riddell Sports Group—use sensor technology developed by New Hampshire-based Simbex, LLC. The system consists of six battery-powered sensors in the helmet's padding that record the location, magnitude, duration and direction of up to 100 impacts and wirelessly send this information to a PC (within 150 yards) running data collection software. The sensors work by measuring both linear and rotational acceleration of the helmet after a player has been struck, although they add only negligible weight to the helmet itself.

"We can pull up the profile of any player for that game or practice and see every impact he took in any given practice or game," says Steven Broglio, an assistant professor in the University of Illinois at Urbana-Champaign's Department of Kinesiology and Community Health. Broglio is studying the use of HITS as part of his research on concussions, typically caused when a violent blow to the head causes the brain to slide forcefully against the inner wall of the skull.

The greatest sticking point to the technology is its price tag: Unity High spent about



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\$30,000 for the fully equipped, waterproof computer and about \$1,000 per helmet. Only a handful of football players at high schools in Pennsylvania and Oklahoma are also testing the helmets, Broglio says.

HITS was developed in 2002 by researchers at Virginia Polytechnic Institute and Dartmouth College. It was used to monitor head blows sustained by members of the Virginia Tech Hokies NCAA Division I football team during 10 games and 35 practices in the 2003 season, becoming the first technology to record real-time head-impact acceleration levels in actual practice and game situations for each player on a team. Results indicated that players experience as many as 50 significant hits each game, enduring head-acceleration levels similar to those seen in automobile crashes. HITS has also been used by amateur boxers as well as by members of the Dartmouth ice hockey team and University of North Carolina at Chapel Hill athletes.

At the beginning of the season, each Unity High player was given a 25-minute, computer-based test to establish his baseline brain behavior. During this testing, each player performed tasks such as counting backward and placing objects in order. If a player is injured, or an injury is suspected, the high school will administer the test again and compare the results captured by HITS; any major deviation in results could signal to the team that a player has sustained a concussion.

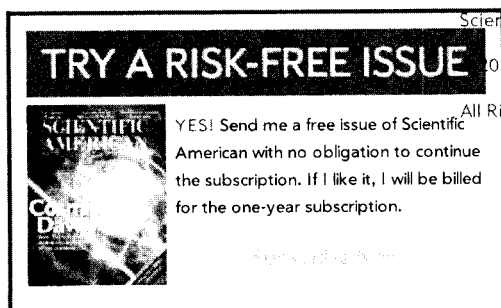
HITS has already indicated that one Unity football player this season was using the top of his helmet to tackle, a dangerous practice that could lead to spinal cord injuries. The heads up, so to speak, gave his coaches the opportunity to correct this bad habit before it caused damage, Broglio says. Unity football head coach Scott Hamilton says he is pleased with system, adding, "Anything to protect our kids is a wonderful concept."

Of the 1.2 million high school football players in the U.S., as many as 5.6 percent experience a concussion during the season, according to research by Kevin Guskiewicz, chairman of U.N.C.'s Department of Exercise and Sport Science. He also found that players who sustained one concussion in a season were three times more likely than uninjured players to sustain another in the same season.

Guskiewicz has also studied the impact of concussions on former National Football League players. Earlier this year, he reported: of the 2,552 retired NFL players he studied, the 595 with a history of three or more concussions were 20 percent more likely to develop clinical depression than those who had not suffered a concussion. The study also linked traumatic brain injury with the onset of neurodegenerative disorders, including mild cognitive impairment as well as Alzheimer's and Parkinson's diseases.

The NFL, which criticized the size of Guskiewicz's research sample, has indicated that 98 g's is the typical minimum force at which an impact will cause a concussion, but "we've found that concussions also happen at higher and lower impacts," Broglio says.

Broglio is in discussions with Hamilton to continue his research at Unity next season and also hopes to sign up other high schools to test the helmets. Only then, he says, will he be able to determine whether HITS or some similar technology should be standard issue for athletes in contact sports.



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