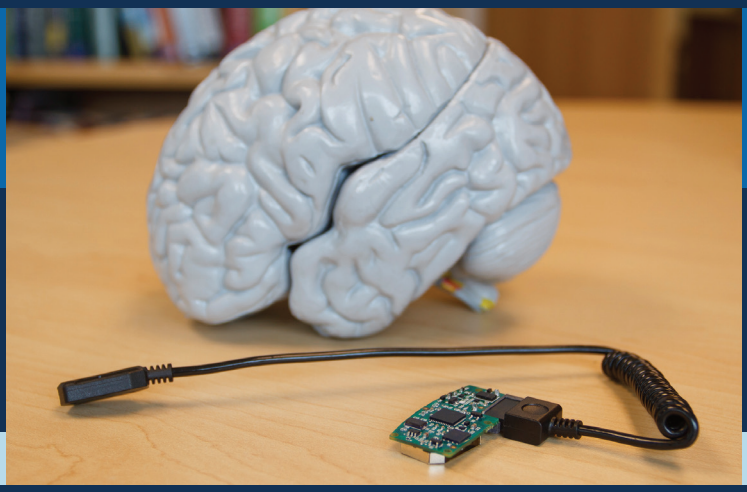
REDUCING CONCUSSIONS



UT Dallas Uses 3D Printing to Help Detect Sports Concussions

"We expect that the study will show that the neural triage device will protect student athletes from injury and make contact sports safer."

— Dr. Robert Rennaker, director of the Biomedical Device Center at the University of Texas at Dallas

The University of Texas at Dallas is 3D printing accelerometers in an effort to reduce concussion injuries in high school athletes.

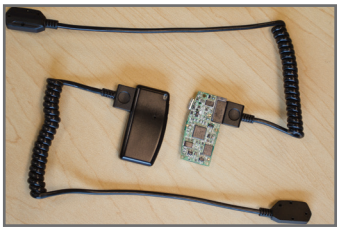
Reducing the estimated 300,000 concussions per year[1] sustained by high school athletes has become a major public health priority. Athletes lose consciousness in just 10 percent of concussion injuries, which makes it difficult to detect concussions and also increases the risk that those athletes will incur a much more serious injury by continuing to play with reduced faculties.

The Biomedical Device Center at the University of Texas at Dallas is working on a system that can be used during sporting events, particularly football and hockey, to quickly and easily detect changes in brain functions. One part of the system attaches to the athlete's head and neck and incorporates sensors to measure the frequency, force and direction of impacts.

If the device detects a severe hit, the player puts on specialized neural triage goggles that supply a visual stimulus and cameras that measure the resulting movement of the athlete's eye. A brain injury is detected when the athlete's response is significantly slower or different than pre-game measurements.

Designing Safety

The goggles presented a difficult design challenge. They needed to fit heads of widely varying sizes, work under different lighting conditions and be easy to put on and take off. It was clear from the beginning that perfecting the design would require building and testing numerous prototypes. Once the design was finalized, the university needed to build many copies to test performance at multiple schools.



These two accelerometers measure impacts to the head. The one on the left is in a case first tested in a 3D printer and then injection molded. The one on the right shows the circuit board contained in the housing

These neural triage goggles supply a visual stimulus, and then tracks the resulting movement of athletes' eyes to determine possible brain injury.

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In the past, the prototypes would have been built either by injection molding or CNC machining. Most of the design process would have been spent waiting to receive prototypes and the entire design process would have taken about 24 months. The cost of building prototypes would have been about $120,000.

Instead, the University of Texas at Dallas used multiple 3D printers – some that ran on FDM® technology and some that ran on PolyJet™ technology – to build most of the parts needed for the prototypes. “The FDM process provides the mechanical strength required by the larger parts and the PolyJet process provides the highly accurate fine features needed in many of the smaller parts,” said Dr. Robert Rennaker, director of the Biomedical Device Center.

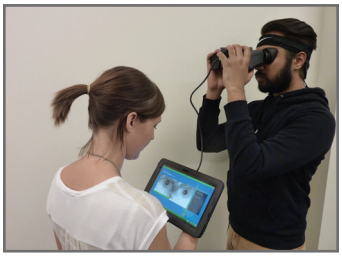
The design team started with a monocular design with two cameras mounted on the side of the athlete’s head. The team found that this design was unable to control for various lighting situations and had difficulty accommodating different size heads. Next the team tried a series of binocular designs. In the early iterations the team ran into problems with the camera view being obscured by the athlete’s eyelids or eyelashes or failing to include both eyes in the image. The team overcame these obstacles and further lighting challenges through six design iterations, the last of which met all the requirements.

The entire design process took only 11 months from start to finish and the cost of the prototypes was only $30,000. Finally, the researcher distributed 35 3D-printed test units to high school football and hockey teams for a research study now underway. “We expect that the study will show that the neural triage device will protect student athletes from injury and make contact sports safer,” Rennaker said.

Method	Time	Cost
INJECTION MOLDING	24 months	$120,000
CNC MACHINING	24 months	$120,000
FDM AND POLYJET	11 months	$30,000
SAVINGS	13 months 54%	$90,000 75%

[1]10. American Journal of Sports Medicine, Epidemiology of Concussions Among United States High School Athletes in 20 Sports, Marar M, McIlvain NM.

The NeuroTriage system hooked up to a Tablet PC. The tablet controls the cameras and provides the trainers with the results of the test.



A student using the NeuroTriage binoculars

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