

Concussion researchers study head motion in high school football hits

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Research assistant William Mehring (right) hands a mouthguard to Menlo School freshmen J.P. McKenney. Credit: Paul Sakuma

Three Bay Area high school football teams have been outfitted with mouthguards that measure head motion. Stanford scientists hope to use

the data to better understand what causes concussions.

Scientists at the Stanford University School of Medicine are collaborating with football teams at three Bay Area high schools to understand how hits to the head cause concussions in young [players](#).

In a study launched last month, a research team led by [concussion](#) experts David Camarillo, Ph.D., and Gerald Grant, MD, is outfitting the players with mouthguards that measure the motion of the head during impacts sustained in practices and games. About 100 football players from Menlo School and Sacred Heart Preparatory, which are in Atherton, and Archbishop Mitty High School, in San Jose, are participating in the first year of the study.

Camarillo's team has previously studied concussion in Stanford athletes and NFL players, but never in younger players.

"This will be the first study in kids where we'll be measuring rotation and full motion of the head during impacts," said Camarillo, assistant professor of bioengineering and the co-principal investigator for the study. "It's important to expand our research to the [high school](#) level and younger because that's where there are the most athletes."

While the NFL and college football comprise several thousand players, high [school](#) and children's football programs account for around 4 million players nationwide, he said.

"Our goal is to focus first on high schools in the Bay Area and to deepen our level of understanding about how concussions may occur in one player but not another," said Grant, professor of neurosurgery and the principal investigator for the study. "We're going to gather prospective data on the players in the preseason, as well as during the season and postseason." Grant is also a pediatric neurosurgeon at Lucile Packard

Children's Hospital Stanford, where he treats young athletes with head injuries.



Mehring with the mouthguards, which the high school football players will wear during practices and games. The mouthguards contain sensors that measure motion in three directions. Credit: Paul Sakuma

High-tech mouthguards

The researchers are collecting preseason neurocognitive data that they will use as a baseline for comparison with neurocognitive data collected after any suspected injuries. During practices and games, players will wear special mouthguards equipped with sensors that measure motion in three directions—up/down, left/right and front/back—as well as three types of rotational acceleration: roll, pitch and yaw.

Practices and games will be filmed so that researchers can confirm collisions and assess players' speeds prior to impact. Eye tracking data will be collected as part of an effort to understand whether erratic eye motions after a head impact indicate a concussion.

The researchers hope the data will illuminate exactly what types of collision lead to concussion so that coaches can better evaluate when players who have had collisions are at risk. Simply watching collisions from the sidelines often does not provide an accurate sense of whether a player's brain could be damaged.

"It's entirely possible that something that looks really dangerous may produce accelerations that are not very high, and may not be dangerous," Camarillo said. "Conversely, hits that don't look scary may be high-acceleration. It's difficult to see."

Understanding which hits are dangerous might also help players and coaches learn how to prevent risky collisions, the researchers said.

"It's very exciting to think about using this feedback for coaching," Grant said. "We suspect some players may be at greater risk for concussion than others because of the way they tackle. We hope to use the data to give coaches the tools they need to teach an individual athlete how to play using the safest possible technique."

The study will continue through the 2018 football season and will expand in 2019.

Provided by Stanford University Medical Center

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