Medical Xpress

Off-season doesn't allow brain to recover from football hits, study says

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Six months off may not be long enough for the brains of football players to completely heal after a single season, putting them at even greater risk of head injury the next season.

"I don't want to be an alarmist, but this is something to be concerned about," said Jeffrey J. Bazarian, M.D., associate professor of Emergency Medicine at the University of Rochester School of Medicine and Dentistry and lead author of the study, published in *PLOS ONE*.

"At this point we don't know the implications, but there is a valid concern that six months of no-contact rest may not be enough for some players," he said. "And the reality of high school, college and professional athletics is that most players don't actually rest during the off-season. They continue to train and push themselves and prepare for the next season."

Bazarian investigated the brains of 10 Division III University of Rochester football players before the start of the 2011 season, at the conclusion of the season, and after six months of no-contact rest. All took part in daily practices and weekly games, but none of them suffered a concussion.

Imaging scans showed changes consistent with mild brain injury in about half of the players six-months after the season ended, despite the fact that no one had a concussion. Brain changes in the football players were compared to a control group of five college students who didn't play

contact sports.

The new data also suggest that inflammation may be a key factor in whether players recovered within six months. Levels of inflammatory markers present in a player's blood sample correlated with a lack of complete brain recovery.

"What is an adequate rest period? We don't know. Six months may be enough for some players but not for others," Bazarian said. "The autoimmune response and inflammation we observed in the blood of players who didn't recover could be a result of genetics, diet, or other factors, but it was not the result of a concussion, since none of the athletes suffered one."

Bazarian noted that his goal is not to derail football, but to make the sport safer. One idea that has been proposed by organizations such as the Sports Legacy Institute is to implement a system similar to the pitch count used in baseball. In football, this would mean identifying a threshold number of head hits of a certain force – above which the brain is likely to develop white matter changes consistent with injury, and removing players from the game once they reach that threshold.

Some in the field have also proposed that no child under the age of 14 should have head contact in football, Bazarian said, and the National Collegiate Athletic Association or NCAA is considering a limit of two contact-practices a week.

The UR college players who participated in the study wore accelerometers mounted inside their helmets, which were provided by Riddell, a leading manufacturer of football equipment. Researchers were able to track every hit, from seemingly light blows in practice to the most dangerous type of hit – a bobble head phenomenon known as rotational acceleration. They found that the players sustained between

431 and 1,850 head blows in the single football season, none of which resulted in a concussion.

Investigators observed brain changes with advanced technology called diffusion tensor imaging (DTI), which is similar to an MRI scan. They also measured changes with standard balance and cognitive tests and blood tests.

Bazarian's analysis revealed that white matter changes in the players' brains started to look different from the control group when players experienced as few as 10 to 15 head impacts with a rotational acceleration that exceeded 6000 rads/sec2. For reference, when a person nods his head up and down as fast as possible, this produces a rotational acceleration of approximately 180 rads/sec2.

Future studies are needed, and already a follow-up project is underway to focus on inflammation. Ten additional football players were added to the 2011 data, for a total of 20 players plus the five controls. In collaboration with researchers from Harvard Medical School and the Cleveland Clinic, Bazarian's group is analyzing inflammatory markers in the blood of the players and comparing them to the DTI images.

Provided by University of Rochester Medical Center

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