Study finds concussed brains take longer, must work harder to tackle memory tasks

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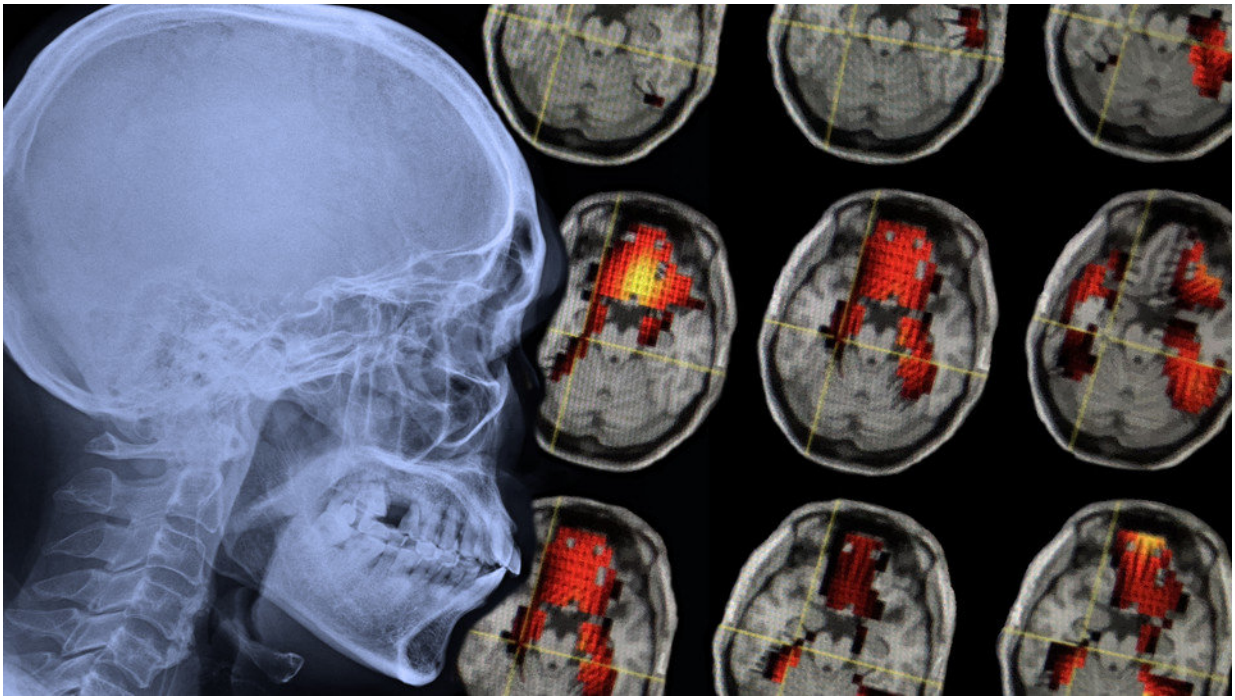

New research from the University of Nebraska-Lincoln's Center for Brain, Biology and Behavior has shown that previously concussed athletes have cognitive delays and changes in brain pathways that last far longer than previously thought. Credit: Troy Fedderson | University Communication

It's clear what happens during a concussion: First, there's a violent collision that twists the brain inside of the skull. That sends the brain's neurons into chaos, often leaving the victim confused, dizzy and with

blurred vision.

More difficult to understand is how quickly the brain begins to return to normal after those initial symptoms fade.

It's been generally assumed that the brain begins to repair itself quickly – within days or weeks of the injury. New research from the University of Nebraska-Lincoln, however, shows that undesirable effects can linger much longer among those with a history of concussions.

Scientists from the Center for Brain, Biology and Behavior at Nebraska used high-density electroencephalography, or EEG, to map and time electrical activity in the brain among two groups of male athletes – those with a history of concussions, and those without. They discovered that athletes who had suffered concussions at least a year earlier displayed cognitive responses one-tenth to two-tenths of a second slower than those who were concussion-free. In cognitive terms, that gap is "a really big deficit," said Dennis Molfese, professor of psychology at Nebraska and an author of the study.

They also found the post-concussive athletes had to engage larger areas of their brains to complete memory tasks.

"For those with a concussion, at least a year post-injury, their brains haven't figured it out yet," Molfese said.

Because the athletes had, on average, suffered concussions years before the study, and because the results are similar to work Molfese and colleagues published in 2013 to test athletes immediately after a suspected concussion, the new study's results suggest that while noticeable symptoms may subside, cognitive delays may never go away post-concussion.

The findings are another reason concussions should be taken seriously by coaches, trainers, parents and doctors, Molfese said.

"A concussion is brain damage," he said. "The brain's design is incredible; up to a certain point it is able to compensate. But if you keep piling on the injuries, it loses that ability."

Molfese said the brain is constantly forming pathways of electrical activity between neurons to learn, grow and understand the world. As regular actions are performed, these circuits are shortened and are usually relegated to a few areas of the brain, which makes the brain an efficient, constantly improving machine.

That all changes with a concussion, which alters the brain's cognitive pathways—which are in turn forced to reorganize away from damaged areas. Molfese said that "reorganization" is likely creating the cognitive delays and processing difficulties among study participants.

"Engaging more areas and forming new pathways take time," he said. "When you pull in other brain areas, the brain has to learn how to make a new network it has already spent years developing."

The Center for Brain, Biology and Behavior, or CB3, is an interdisciplinary center at Nebraska that brings together faculty in the social, biological and behavioral sciences and engineering. The center's state-of-the-art facilities and multidisciplinary environment expands understanding of brain function and its effects on human behavior. The center's unique capabilities and partnership with Nebraska Athletics deepen the university's research capacity, including its leading expertise in concussion research.

More information: Caitlin M. Hudac et al. History of concussion impacts electrophysiological correlates of working memory,

International Journal of Psychophysiology (2017). DOI: 10.1016/j.ijpsycho.2017.09.020