Concussions linked to suppressed brain functioning years later

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(PhysOrg.com) -- Word is spreading, on the sidelines, in the locker rooms, and in the media, that an athlete whose bell has been rung - that is, suffered a concussion - may have experienced an injury that could take a more serious toll later in life.

Results of a new study by researchers in the department of kinesiology and community health at the University of Illinois support that speculation. The study is outlined in the current online edition of the *Journal of Neutrotrauma*.

“We were able to show that while our group of club and intercollegiate athletes, who were on average 3 ½ years post-injury, performed normally on standard tests a sports-medicine practitioner would use to diagnose and evaluate someone for concussion, they had suppressed brain functioning,” said U. of I. kinesiology professor Steven Broglio. “And that included a decrease in attention allocation to things going on in their environment.”

With respect to existing information linking concussions - medically classified as mild traumatic brain injuries - and the later onset of more serious health problems, Broglio said “there’s a lot of information coming to light, but a lot of it’s been anecdotal.” Much of the buzz, he added, is especially loud around Super Bowl time each year.

“There’s some data coming out of the NFL showing that retired athletes who have had several concussions over their career have increased rates

of depression, mild cognitive impairment and early onset of Alzheimer's disease." However, he said, "there's been no link between young adults with concussions and what we are seeing in the older, retired athletes. So we wanted to get a better idea of what was happening at the brain level to try to figure out what these athletes were reporting."

To move beyond storytelling to seek possible corroborating scientific evidence, Broglio enlisted the assistance of U. of I. kinesiology professor Charles Hillman and graduate students Mathew Pontifex and Philip O'Connor. Hillman's expertise is in electrophysiology - the biomedical specialty that focuses on the study of electric activity in the body and brain.

The concussion study considered performance results of 90 male and female college-aged student athletes who participate in sports, including soccer, ice hockey and rugby. Roughly half of the sample had sustained concussions within the past 3.4 years.

As part of the investigation, participants' functional cognitive performance was evaluated using a battery of tests called the ImPACT inventory.

"No significant differences were found between groups on the ImPACT," the researchers indicated in their report.

Subjects also were fitted with a 64-channel "Quik-cap"; electrodes in the cap measured event-related brain potentials (ERPs), or the brain's electrical response to a stimulus during a "novelty oddball task."

"They were told they would see two types of triangles - regular and upside down - and told, 'Whenever you see an upside-down triangle, press a button,' " Hillman said. "They saw a regular triangle the majority of time. The upside down one was the 'oddball.'

“But what we don’t instruct them on … they saw a number of images they had no idea were coming. Examples of novel stimulation included a cat, a bird, an airplane, a coffee cup. So you don’t know what to do … you have to orient your environment and figure it out.”

Hillman said the researchers saw no long-term effects of concussion among participants when presented with the novel stimuli.

“In retrospect, I’m not sure I would’ve expected so. Orienting to one’s environment has evolutionary implications: The bunny’s in the woods eating grass, hears rustling in the leaves and has to orient to its environment and figure out whether it’s another bunny coming, or a bear, and it’s going to become hot lunch.”

Back in the lab, the oddball task yielded noticeably different results.

Measuring subjects’ P3b amplitude - which Hillman described as “a measure of the amount of attentional resources allocated toward a stimulus in the environment” - the researchers detected a significant decrement among previously concussed participants.

“With concussions, individuals showed a decrease in their ability to allocate attentional resources toward that oddball stimulus,” Hillman said. “So that would suggest they had deficits in their ability to update their working memory of the stimulus environment.

“And this is a long-term deficit.”

That finding is what leads the researchers to conclude that people who’ve incurred concussions may be at greater risk of cognitive impairment.

Still, Broglio cautions that further, cross-sectional study is required before reaching conclusions regarding long-term effects of mild

traumatic brain injuries.

“It’s really unknown at this point,” he said. “All these kids are here (at the U. of I.), so obviously are very high-functioning. They do very well in school. All of our behavioral data from the ImPACT tests shows they’re normal.

“The issue becomes as they age, as natural aging takes over and cognitive processes slow down and decline, whether this has an exacerbating effect. With age, you are less likely to pay attention to things going on around you that make you more susceptible to injury.”

Hillman also stressed additional research is needed not only to better understand how concussions affect cognitive performance as a person ages, but in order to determine whether other influential factors - such as early onset of certain neurodegenerative diseases - play a role in decreased P3b amplitudes.

“So, we’re looking into conducting (more) investigations, and will look at those with and without a history of concussion through the entire lifespan - up to 70 or 80 years old,” Broglio said.

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