

Name: _____ Class: _____

Many Hits, Rather Than A Big One, Pose Greatest Concussion Risk

By Nancy Shute
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A concussion is a serious brain injury that can affect your brain function and cause a range of mental and physical symptoms. In this article, Nancy Shute discusses a study that explores the effects that several hits to the head can have on the brain. As you read, take notes on how researchers conducted the study on concussions.

- [1] High school football players have changes in their brain function long before they have recognizable signs of a concussion, according to a new study.

The more hits a player got, the more brain function changed. The findings support the growing belief that a concussion comes as the result of a succession of assaults, not just one bad hit.



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"I think what you're seeing here is the sum total of what happens throughout the season," says Eric Nauman, an associate professor of mechanical engineering at Purdue University and lead author of the study.

The researchers followed players on the Jefferson High School football team in Lafayette, Ind., over two seasons. The athletes wore special helmets with sensors that measured the number and severity of head impacts. The researchers also put the players in an MRI scanner to measure their brain activity while the students took a test of thinking and memory.

- [5] Then they compared the brain scans with the hits. Those hits weren't rare. Each player logged from 200 to more than 1,800 hits to the head in a single season. Over two seasons, six players had concussions, but 17 others showed brain changes even though they didn't have concussions. There were 21 players in the first season, and 24 in the second, 16 of whom were repeat participants in the study.

Over time, the changes in brain function that showed up in the MRIs correlated¹ to the number and distribution of hits. Mental performance didn't change, but brain activity did.

"The magnitude² of changes in the brain were a function of how many hits you took, and where you took them," Nauman told Shots.

1. **Correlate (verb):** to have a relationship or connection in which one thing depends on the other
 2. **Magnitude (noun):** the great size or extent of something

Those brain changes may be workarounds, with the brain using other areas to replace those affected by the hits, according to Thomas Talavage, an associate professor of electrical and computer engineering at Purdue University and a co-author of the study. The results haven't been published yet, but the work has been accepted by the *Journal of Biomechanics*.

This study raises a lot of questions that it can't answer. It doesn't tell us if these brain changes will improve over time, or if they're the beginnings of permanent brain damage.

- [10] The researchers have expanded their work to include two more football teams, and a girls' soccer team. They're also looking for a boys' soccer team, to see if they can test the widely held belief that girls are more vulnerable³ to concussion.

And they are following the players who took the most hits to see if the brain changes seen are permanent.

Since millions of teenagers play football, soccer, hockey and other sports where hits to the head are common, a clear sense of when those hits start to cause damage would be the start of better ways to prevent and diagnose what has become a major issue in children's health.

Yesterday, Shots reported on a study that found that widely used computerized tests used to establish a baseline of cognitive⁴ function for student athletes aren't accurate enough to diagnose concussions, or to determine if a player is safe to return to the action.

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3. **Vulnerable (adjective):** capable of being wounded or injured
4. relating to mental processes

Text-Dependent Questions

Directions: For the following questions, choose the best answer or respond in complete sentences.

1. PART A: Which statement identifies the central idea of the text?
 - A. While small hits to the head affect brain activity, powerful hits to the head cause irreversible brain damage.
 - B. Players involved in aggressive sports don't receive as many concussions as was previously believed.
 - C. Studies have shown that brain activity is affected by the placement and number of hits one receives to the head.
 - D. Small and frequent hits to the head don't contribute to concussions, but they can result in similar symptoms.

2. PART B: Which detail from the text best supports the answer to Part A?
 - A. "Over two seasons, six players had concussions, but 17 others showed brain changes even though they didn't have concussions." (Paragraph 5)
 - B. "The magnitude of changes in the brain were a function of how many hits you took, and where you took them" (Paragraph 7)
 - C. "Those brain changes may be workarounds, with the brain using other areas to replace those affected by the hits, according to Thomas Talavage" (Paragraph 8)
 - D. "And they are following the players who took the most hits to see if the brain changes seen are permanent." (Paragraph 11)

3. What is the author's main purpose in the article?
 - A. to explore how different hits to the head have different effects on brain function
 - B. to encourage football players not to get hit in the head more than once
 - C. to explore possible solutions that prevent players from experiencing hits to the head
 - D. to warn readers about the potential risks of engaging in certain contact sports

4. How do paragraphs 9-10 contribute to the development of ideas in the text?
 - A. They emphasize all that the study has revealed to scientists.
 - B. They show how little the study truly revealed about concussions.
 - C. They emphasize the conclusions that were taken away from the study.
 - D. They stress questions that still need to be answered about head injuries.

5. What is the connection between how much we know about concussions and our ability to treat or prevent them?
