

Heading footballs causes decline in brain function, study finds

Researchers saw evidence of a change to brain structure and possible increase in the risk of dementia in later life

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Regularly heading a football leads to a measurable decline in brain function over two years in active players, and could increase the risk of dementia in later life, a study has found.

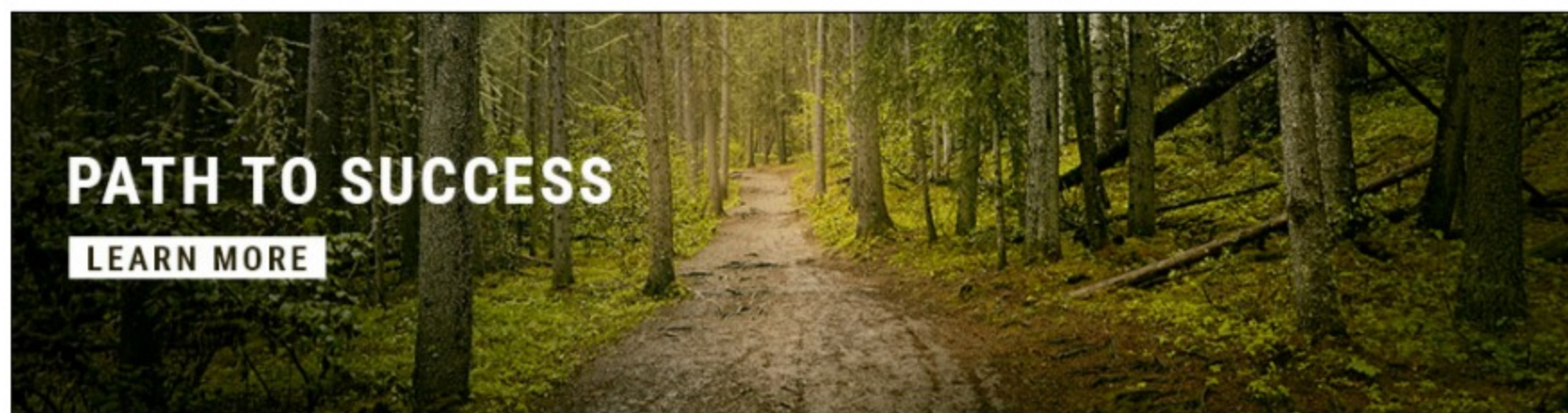
Concerns over the impact of headers in football have led the Football Association to trial a ban on heading for children aged under 12 in youth teams, while in Scotland restrictions were brought in to minimise heading in training on the days before and after matches.

The West Bromwich Albion striker Jeff Astle died at the age of 59 in 2002 after having developed chronic traumatic encephalopathy, a progressive brain disease. A coroner ruled that his repeated [heading of footballs](#) during his career had damaged his brain and ruled that he had died from an “industrial disease”.

Researchers from Columbia University in the United States took 148 amateur footballers with an average age of 27, three quarters of whom were male and a quarter [female](#). They developed a questionnaire to ascertain how often they headed the ball while playing.

The amateur players recruited for the study had to engage in training or competitive matches at least twice per week over at least six months of the year, and have done so for the past five years.

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The researchers said: “The participants are typically in local league teams. They are not just playing once in a while. Typically they play and practice at least three times per week with one competitive match per week on average. Some may be on school teams but we do not specifically enrol collegiate athletes.”

“When we first started, there was no method for assessing the number of head impacts a player experienced,” said Dr Michael Lipton, a radiology and biomedical engineering professor at Columbia. “So we developed a structured, epidemiological questionnaire that has been validated in multiple studies.”

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The players were given memory and verbal learning tests, and underwent a form of MRI scanning called [diffusion tensor imaging](#), which can examine the structure of the brain by tracking the movement of water molecules through the tissue. They then underwent the same tests again two years later.

“Our analysis found that high levels of heading over the two-year period were associated with changes in brain microstructure similar to findings seen in mild traumatic brain injuries,” Lipton said. “High levels of heading were also associated with a decline in verbal learning performance. This is the first study to show a change of brain structure over the long term related to sub-concussive head impacts in soccer.”



Jeff Astle was the first British professional footballer confirmed to have died from chronic traumatic encephalopathy

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A separate study by the same researchers, also to be presented to the annual meeting of the Radiological Society of North America in Chicago this week, followed 353 footballers over a year and found that those who headed the ball more regularly — displaying higher levels of “[repetitive head impacts](#)” or RHI — scored worse on verbal learning tests. The research focused on the area where the brain’s white and grey matter meet, which should be a sharp divide but can become “fuzzier” after injury and degeneration.

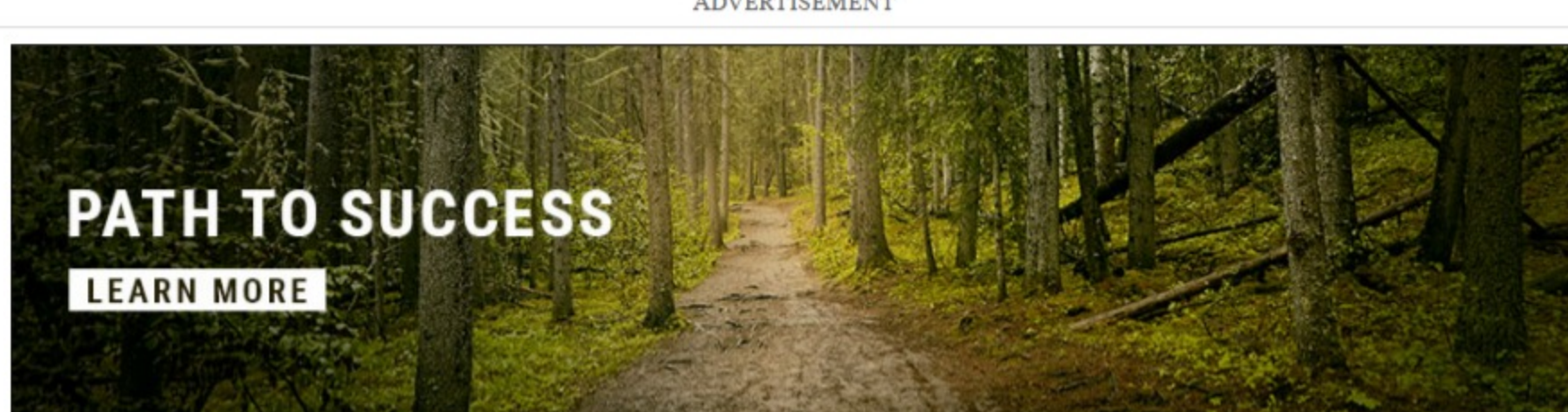
“Our new approach addresses a brain region that is susceptible to injury but has been neglected due to limitations of existing methods,” Lipton added. The researchers concluded that there are “adverse associations of soccer RHI with [worse cognitive performance](#)”.

The impact was described as “sub-clinical”, meaning that the decline in brain function and cognition was not significant enough to require treatment or intervention, but the results still “suggest greater heading exposure over two years is associated with adverse effects”.



“There is enormous worldwide concern for brain injury in general and in the potential for soccer heading to cause long-term adverse brain effects in particular,” Lipton explained. “A large part of this concern relates to the potential for changes in young adulthood to confer risk for neurodegeneration and dementia later in life.”

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The England Football website notes of its [trial to ban heading for children](#): “Reducing heading at this level can support the development of more skilful players who are able to stay on the ball when in possession, contributing to the improved technical ability of our young players.

“We also want to mitigate against any potential risks that may be linked to heading the ball while research is ongoing in this area.”

In children’s football, deliberately heading the football is punishable through the award of an indirect free kick — one from which a goal cannot be scored directly — to the other team.

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