

**Embargoed: 00.01 hrs (GMT) Wednesday 28 January 2009**

## **Concussion in former athletes can affect mental and physical processes later in life**

Researchers have found the first evidence that athletes who were concussed during their earlier sporting life show a decline in their mental and physical processes more than 30 years later.

The research, published online today (Wednesday 28 January) in one of the world's leading neurology journals, *Brain* [1], compared 19 healthy, former athletes who had sustained concussion more than 30 years ago with 21 healthy, former athletes with no history of concussion. The study found that those who had been concussed only once or twice in their early adulthood showed a decline in their attention and memory and a slowing of some of their movements compared to athletes who had no concussion.

Until now, most research into concussion and its effects has concentrated on the immediate, post-concussion period and on improving decisions about when it is safe for an athlete to return to play. Any potential long-term effects of concussion tended to be over-looked.

Louis De Beaumont, the first author of the study, said: "This study shows that the effects of sports concussions in early adulthood persist beyond 30 years post-concussion and that it can cause cognitive and motor function alterations as the athletes age. In the light of these findings, athletes should be better informed about the cumulative and persistent effects of sports concussion on mental and physical processes so that they know about the risks associated with returning to their sport."

Mr De Beaumont, a graduate student at the Centre de recherche en neuropsychologie et cognition, Université de Montréal, Canada, and his colleagues recruited participants to the trial who were former university-level athletes between the ages of 50 and 60, who were still fit and healthy and who continued to engage in some form of regular physical activity at least three times a week. The former athletes answered questionnaires on their general health and on their history of concussion. Their mental and physical processes were investigated with a variety of tests, including:

- the Mini-Mental Status Examination (MMSE), which tests orientation, attention, immediate and short-term recall, language and the ability to follow simple verbal and written commands;
- neuropsychological tests to detect episodic memory and attention/executive functions alterations, including aspects such as incidental learning and visual memory;
- transcranial magnetic stimulation tests and tests of the brain's response to external stimulus (known as event-related potentials);
- a test of motor control involving repeating at maximum speed a rotation of two hand-held spheres.

Results showed that, relative to former athletes with no history of concussion, those who had sustained their last sports concussion more than 30 years ago had:

- lower performance on neuropsychological tests of episodic memory and response inhibition;
- significantly delayed and attenuated responses to unpredictable stimuli (known as the P3 or P300 response);
- significantly prolonged cortical silent periods (CSP is an interruption of the voluntary contraction of a muscle by a transcranial magnetic stimulation pulse that elicits an inhibitory response; the duration of the CSP accurately measures how well this inhibitory response is working);

- significantly reduced movement velocity.

In their paper, Mr De Beaumont and his co-authors write: “The findings of P300 component abnormalities in former athletes tested at 30 years post-concussion closely resemble those reported previously in athletes tested at three years post-concussion... This suggests that P300 abnormalities may be an early and long-lasting manifestation among former athletes who sustained sports concussions in early adulthood.”

They continue: “Besides P300 subcomponents alterations similar to those found in MCI [*mild cognitive impairment*] patients, former athletes with a prior history of sports concussion displayed significant episodic memory and attention/executive functions decrements on neuropsychological tests selected for their proven sensitivity to MCI and early onset AD [*Alzheimer’s disease*].”

Mr De Beaumont said that follow-up studies would be needed to investigate whether concussion could make former athletes more vulnerable to developing the more severe mental and physical deteriorations in later life associated with mild cognitive impairment, Alzheimer’s disease or Parkinson’s disease.

“Longitudinal studies are needed to determine whether sports concussions induce latent changes in cognitive function that come to surface with increasing age rather than simply acting as an accelerating agent to the aging process,” write the researchers. “Premature aging purports serious clinical implications considering that increasing age is the most potent risk factor of Alzheimer’s disease.”

Mr De Beaumont stressed that all the athletes in the study were healthy and showed no signs of Alzheimer’s or Parkinson’s disease. “It is important to mention that the participants selected were healthy, functional and maintain a very active lifestyle despite these small changes in cognition and motor functions,” he said. “Future studies that follow these former athletes with concussion as they get older are necessary if we are to verify whether sports concussions sustained early in life can lead to more severe deteriorations in their mental and physical functions.”

Mr De Beaumont’s group, working under the supervision of Maryse Lassonde (who holds the Canada Research Chair in Developmental Neuropsychology at the Centre de recherche en neuropsychologie et cognition) are continuing to investigate the underlying brain mechanisms that are causing the long-deficits associated with sports concussion.

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**[1] Brain function decline in healthy retired athletes who sustained their last sports concussion in early adulthood. *Brain*. Published online under advance access. doi:10.1093/brain/awn347.**

**Notes:**

**A pdf of the full research paper is available at:**

**[www.oxfordjournals.org/our\\_journals/brainj/press\\_releases/freepdf/awn347.pdf](http://www.oxfordjournals.org/our_journals/brainj/press_releases/freepdf/awn347.pdf)**

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