RSNA Radiological Society of North America
RADIOLOGICAL SOCIETY OF NORTH AMERICA
820 JORIE BLVD, OAK BROOK, IL 60523
TEL 1-630-571-2670 FAX 1-630-571-7837
RSNA.ORG
NEWS

Soccer Heading Over 2 Years is Associated with Change in Frontal White Matter Microstructure That Varies by Exposure Magnitude

PURPOSE

Repetitive head impacts (RHI) in soccer have been associated with adverse cognitive and neuroimaging outcomes in cross-sectional studies. However, few have reported on the longitudinal effects of soccer RHI on neuroimaging and cognitive performance. The objective of this study was to assess the association of soccer heading over two years with change in brain microstructure and cognitive performance in adult amateur players (n=148, mean age 26.7 years, 25.6% female).

METHODS AND MATERIALS

Two-year heading exposure was categorized as low (0-556 total headers), moderate (564-1,512 total headers), or high (1,538-23,462 total headers) using the HeadCount-12m questionnaire. Diffusion tensor imaging (3T, 32 encoding directions, b=800 s/mm, 2mm isotropic resolution), neurite orientation dispersion and density imaging (same parameters as above except three shells instead of one: 6 directions at b = 300 s/mm, 32 at b = 800 s/mm, and 60 at b = 2,000 s/mm, and the Cogstate battery were acquired at the initial study visit and two years later. Mixed-effects models accounted for age, concussion history, sex, and education. Significant findings survived false discovery rate of 0.05 (actual p-values 0.001-0.004).

RESULTS

The high heading exposure group, over two years, demonstrated an increase of mean diffusivity (MD), radial diffusivity (RD), and axial diffusivity (AD) in frontal WM regions, and a decrease of orientation-dispersion index (ODI) in the right superior frontal white matter and superior corona radiata. Low and moderate heading was associated with a decrease of MD, RD, and AD, and increase of ODI over the same period. High heading was associated with decline of verbal learning performance over two years, whereas low and moderate heading exposure was associated with improvement in verbal learning, but these findings did not reach statistical significance.

CONCLUSIONS

These results suggest greater heading exposure over two years is associated with adverse effects on white matter microstructure in young adult amateur soccer players. Our results are suggestive of a subclinical effect, given the sub-significant pattern of verbal learning changes. Larger longitudinal studies in diverse cohorts are needed to determine the potential for adverse microstructural and functional change over the longer term to better guide intervention and policy.

CLINICAL RELEVANCE/APPLICATIONS

Decline of brain microstructure over 2 years in soccer players who head at high levels, with trends toward decline of cognitive performance, suggests potential subclinical injury, which could affect long-term brain health.