

DTI Shows Corpus Callosum Injury after Second Concussion in a Female Adolescent Cleared for Return to Play

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Purpose.

Case of a second concussion in a female adolescent whose diffusion tensor imaging (DTI) indicates white matter injury after having been cleared for return to play.

Methods.

- 18 year old female with 15 years of soccer had second sports concussion without LOC or PTA in early 2015.
- Day 2: Reports mild headache and balance problem on day of injury have cleared; ImPACT scores below baseline on verbal and visual memory composites.
- Day 7: Reports balance problems and dizziness; ImPACT visual memory below baseline.
- Day 10: Asymptomatic and ImPACT scores returned to baseline. Cleared to return to play (RTP).
- Day 17: RTP completed.
- Day 30: MRI, DTI, resting state fMRI on 3T Siemens; neuropsychological tests.
- First concussion: Playing soccer in 2012; no LOC or PTA, but symptomatic for 3 months and resumed play while symptomatic against medical advice.
- No history of neurologic or psychiatric disorder; typical development and good student.

DTI Analysis: Tractography masked to clinical and outcome data and compared to findings from 11 other concussed high school athletes (age range 15-18) who had been cleared to return to play and 8 high school athletes with orthopedic injury (age 15-18).

Results.

- Fig. 1 Boxplot of fractional anisotropy (FA) for the total corpus callosum on day 30 was .451. In comparison, mean FA for the group of 12 concussed athletes imaged on day 30 was .482 (SD=.018, range of the other 11 concussed athletes = .456-.513); and in 8 athletes with orthopedic injury, mean FA was .480 (SD=0.14, range = .466-.507).
- MRI on day 30 was normal.
- Fig. 2 shows symptom resolution by day 10.

- Fig. 3 indicates initial impairment of verbal memory and recovery by day 10.

Conclusions.

- Despite having been cleared for return to play on day 10, this asymptomatic athlete whose cognitive performance recovered to baseline had DTI with FA significantly below controls, suggesting reduced microstructural integrity of her corpus callosum. While only a single case, the DTI data indicate residual white matter injury 30 days after a second concussion in an athlete whose other findings show clinical recovery.
- Dissociation between meeting criteria for RTP and atypical DTI suggesting white matter injury is consistent with recent studies showing reduced functional and/or structural connectivity in student athletes who had been cleared for RTP (Bazarian et al., 2012; Borich et al., 2015).
- This report and related studies raise suggest that imaging be considered in RTP especially in athletes with more than one concussion.

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