Influence of In-Season Hit History and Post-Season Recovery Time on Brain Health in High School Football Players

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Context: As our group has explored elsewhere, engaging in contact sports has a profound impact on brain health in athletes, even when those athletes do not experience concussions. Further, we have reported that after the end of the season, athlete performance on neurocognitive testing does not necessarily return to baseline levels. We seek to explore the effects of the history of hits and recovery time on brain health in high school contact sport athletes.

Objective: To determine if the count of hits experienced during a football season and time since end of participation predict an athlete’s brain health, as assessed by functional magnetic resonance imaging (fMRI).

Design: A single group experiment study.

Setting: Controlled, laboratory setting.

Patients or Other Participants: Thirty-five members from two local high school football teams (aged 14-18), and 12 non-contact sport athletes (aged 14-18).

Interventions: Football players participated in their regular season while head impacts were monitored. Two to nine months after the end of the season (mean 148, std 47 days), each player participated in an fMRI session.

Main Outcome Measures: During the fMRI session, players completed verbal and visual working memory tasks. Brain activation patterns during these tasks were compared to those obtained from non-contact sport athletes. Using a Pearson’s correlation over the volume of the brain, each football player was assigned a single value for each task representing how well their brain activation matched their healthy peers. Statistical analysis included computing the correlations between a participant’s spatial correlation and post-season recovery time, as well as the number of hits.

Results: Among the 35 participants, the lower bound of the spatial correlation exhibited an increasing trend over time for both verbal and visual tasks, with the last of the football players reaching the 95% confidence interval for the controls approximately 210 days after end-of-season. Correlation between the players’ fMRI results and time of recovery prior to the scan was not significant, nor was the correlation between the players’ post-season fMRI results and in-season experienced number of hits.

Conclusions: Even months after the contact season end, sequelae of repetitive head trauma are still observed by fMRI in some members of a cohort of high school football players, although these effects were not predicted by accumulated head trauma events or post-season recovery time. As a cohort, however, the lower bound of fMRI activation relative to a “healthy” population increased over time, with time-to-recovery for the group being approximately 7 months.

Word Count: 403