Frequency, Magnitude, and Distribution of Head Impacts in Pop Warner Football

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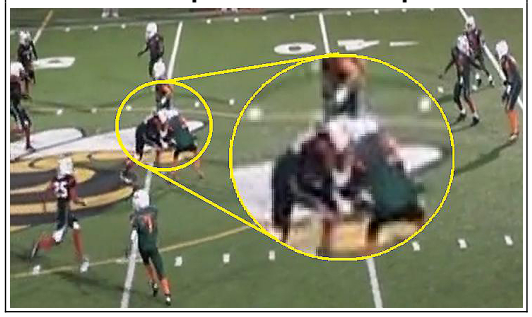
Introduction

A growing body of research suggests that subconcussive head impacts or repetitive mild Traumatic Brain Injury (mTBI) can have cumulative and deleterious effects. Several studies have investigated head impacts in football at the professional, collegiate, and high school levels, in an attempt to elucidate the lifetime effects of head impacts among football players and further delineate the relationship between that burden and later cognitive effects. Youth football players, generally from 7 to 14 years of age, constitute 70% of all football players, yet burden of, and susceptibility to, head injury in this population is not well known. In the only study on head impact exposure in youth football, Daniel et al. followed seven players and found an average of 107 hits per player per season (6.7 hits per player per practice and 5.8 hits per player per game). Based on this data, Pop Warner Football instituted new rules to reduce head impacts during practice. Pop Warner Football eliminated head contact when players are separated by 3 yards or more, as well as reduced any contact drills to only one-third of the week by practice time.

Methods

A novel, non-accelerometer-based, impact sensor was used to follow an entire Pop Warner Football team consisting of twenty-two players for six games and five practices. In addition, video recording of games and practices were used to further characterize the head impacts by type of position (skilled versus unskilled), field location of impact (open field versus line of scrimmage), type of hit (tackling, tackled, or hold/push), and whether the impact was a head-to-head impact or not.

Video Capture of Head Impact



Results

We recorded a total of 480 head impacts. An average of 21.8 head impacts occurred per practice, while 61.8 occurred per game. Players had an average of 2.2 head impacts more during games than practice ($p<0.001$). The number of high magnitude head impacts (>80g) was 11. On video analysis, imapct that occurred in skilled position players (50g), in the open-field (55.3g), while tackling (56.1g), with head-to-head contact, generated the highest cranial impact forces. Two concussions were diagnosed over the course of the season. However, due to technical reasons the biomechanics of those hits resulting in concussions were not captured.

Our results demonstrate 1.5 hits occurring per player per practice and 3.7 hits occurring per player per game. The number of hits per player per practice is substantially less than that reported by Daniel et al. (78% reduction), which may represent the effect of the new Pop Warner rule changes for practice. However, it could also be the result of differing thresholds for hit registration. Our non-accelerometer sensor used 30g as the threshold, while Daniel et al. used 10g. We also found a reduced number of hits per player per game compared to Daniel et al. (36% reduction). The significantly more dramatic reduction in hits occurring per player during practices versus games suggests that the effect seen on practices may be a true reflection of the new Pop Warner rule implementation.

Conclusions

Youth football players sustain a moderate number of head impacts with several high magnitude impacts over the course of a season. Changes to rules of contact during practice or games can reduce the number of hits that occur. Use of impact sensor technology on a routine basis can allow for tracking and management of hit counts. It may also allow for further characterization of cranial impacts, which can direct future rule changes to improve safety.

References

Daniel RW, Rowson S, Duma SM. Head Impact Exposure in Youth Football. Ann Biomed Eng. 2012 Apr;40(4):976-981.