Head Acceleration During Girls Youth Soccer Using Real Time Data: A Descriptive Study

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Introduction

With continued discoveries on the long-term effect of sports-related concussion on motor and neurocognitive function, there has been a great amount of concern in the safety of youth and adult athletes related to head injury. Soccer athletes are of particular interest because of techniques in the sport, including heading, that have potential to cause repeated brain injury. Head acceleration in youth athletes is especially important to study because the developing brain responds differently and is more vulnerable to injury from head trauma than the adult brain.[1]

While head acceleration due to heading was found to be below the concussion threshold, there is some evidence that the cumulative effect of repeated heading may be detrimental to the brain.[2] Many studies have already found a potential link between heading in soccer and neurocognitive impairments,[3,4,5] however few studies have actually measured the head acceleration that youth soccer athletes experience in real-time games.

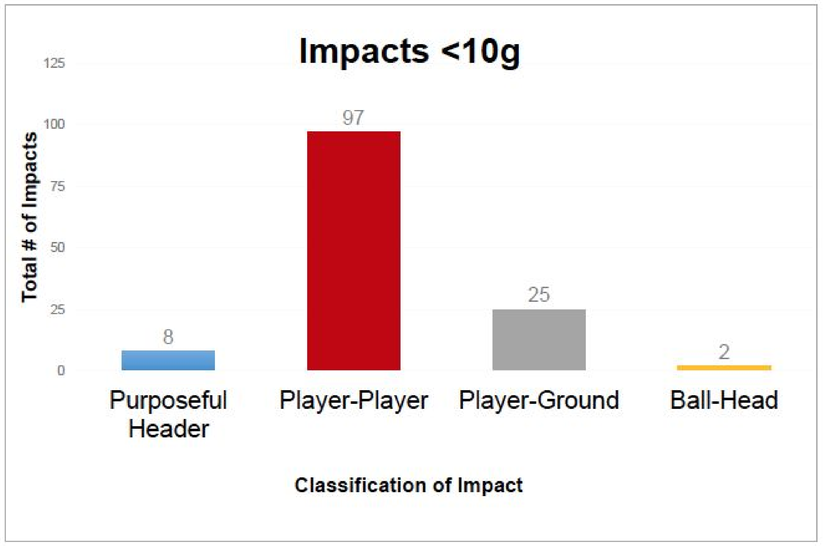
Purpose

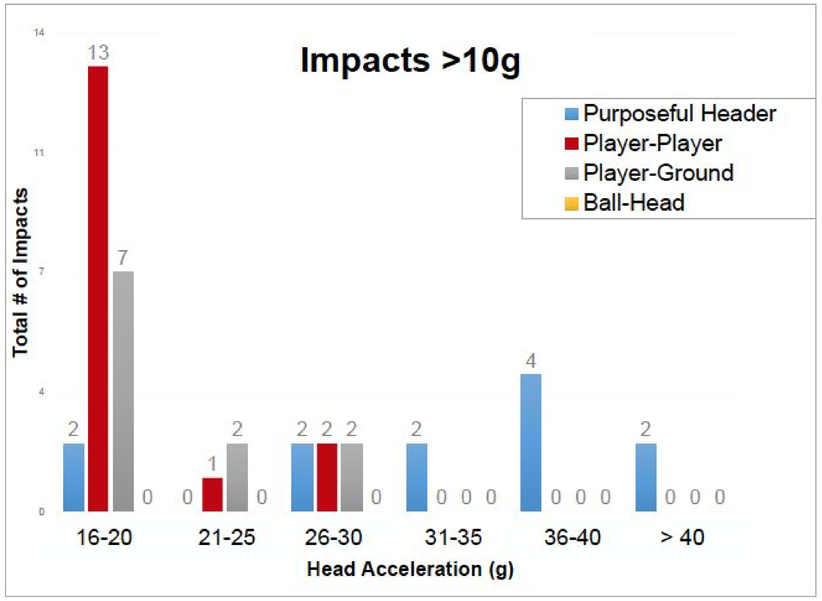
To measure the head acceleration that youth soccer athletes experience during real-time soccer games.

Methods

Participants were selected from U15 girls youth club soccer teams. Smart Impact Monitor (Triax Technologies, Norwalk, CT) headband accelerometers were used to collect head accelerations that the players experienced throughout 3 soccer games. Each player was assigned an accelerometer and checked for proper headband placement prior to their game. During games, the TRIAX accelerometers collected and transmitted real-time g-force of any head impacts sustained by each participant, with 10g as the minimum acceleration.[5] These impacts were observed live, as well as video recorded and saved for later analysis. Data was collected during 3 games throughout the season, and was categorized by type of impact: purposeful header, player to player, player to ground, and ball to head. All impacts were recorded including any that did not reach the 10g threshold. Data was analyzed using descriptive statistics of frequency, mean, and standard deviation.

The accelerometers are housed in headbands and are worn with the accelerometer placed at the base of the skull.





Descriptive Data of Recorded Impacts by Classification

Acceleration (g)	Purposeful Header	Player-Player	Player-Ground	Ball-Head
Average ± SD[a]	36.75±14.89	19.5±4.62	20.45±4.18	0
Peak	73	30	26	<10

[a]Averages for impacts greater than threshold of 10g

Results

The majority (77%) of head accelerations observed were under 10g. Of the accelerations that occurred over 10g, the majority (66%) were from player to player contact. All of the accelerations recorded with the exception of one were below the concussion threshold of 70g.[6] We observed that heading with techniques such as the ball impacting the top of the players' heads rather than the forehead resulted in greater accelerations. This includes the highest acceleration recorded, 73g, however the player reported no concussion related-symptoms.

Discussion

There are many challenges associated with collecting data during real-time games, including observing simultaneous accelerations and filtering out false positives. Having video recording and multiple observers is essential for accurate data collection. There is a need for continued research on the frequency and magnitude of head acceleration during youth soccer games, and whether these accelerations have a detrimental cumulative effect.

Conclusion

While purposeful headers yielded the highest average acceleration, it was one of the least frequently occurring impact. Player to player impacts were most common however the majority produced little to no head acceleration. While there was variability of head acceleration that occurred within each type of impact, no type of impact produced consistently dangerous (70g or above) accelerations.

References

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