

CUMULATIVE HEAD ACCELERATION IN COLLEGE FOOTBALL PLAYERS DIFFERS BY POSITION

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INTRODUCTION

There are 300,000 incidences of sports-related concussions each year in the United States, with football having the most concussions of any sport [1]. In order to better understand these injuries, the impact event needs to be recorded and analyzed. Head accelerations were recorded during the 2004 Virginia Tech football season. A difference in the average amount of head acceleration per game is seen when comparing different playing positions in football.

METHODS

In-situ linear head accelerations were recorded in real time using the Head Impact Telemetry (HIT) System (Simbex, Lebanon, NH) during practice and games during the 2004 football season. The HIT System measures linear head acceleration of the center of gravity of the head through an array of single-axis linear accelerometers [2,3]. Eighteen players were instrumented as part of a larger study, covering all playing positions. For this study, fifteen players were assessed. Game-only data was compiled from the entire 2004 season, and separated by player. The cumulative accelerations experienced by each player were tabulated and normalized by the number of games recorded for each player. Then, the players were grouped by playing position. Groups were receivers (WR), running backs (RB), offensive linemen (OL), defensive linemen (DL), linebackers (LB), and defensive backs (DB). The average of the cumulative head acceleration experienced by each player position per game played was calculated.

RESULTS AND DISCUSSION

A total of 3,134 impacts were recorded during the 2004 season during games. Average acceleration per impact did not differ by player position. Figure 1 shows the average cumulative head acceleration experienced per game, grouped by position. Distinct difference can be seen throughout the different player positions. Defensive linemen's average cumulative accelerations per game were significantly higher than offensive linemen, wide receivers, and defensive backs ($p < 0.05$). Linebackers exhibited significantly higher accelerations than offensive linemen and wide receivers, and

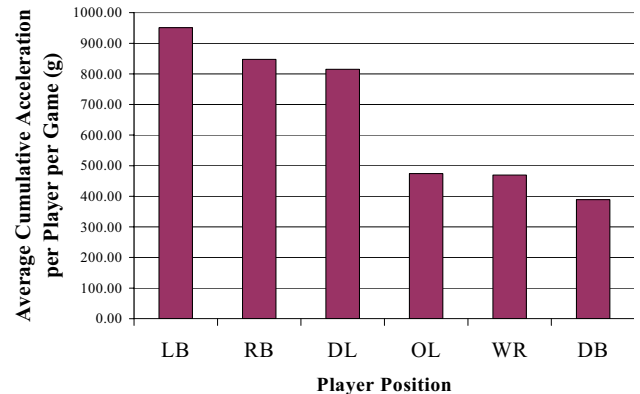


Figure 1 Average cumulative acceleration per player per game, grouped by position.

running backs saw higher per-game averages than offensive linemen and defensive backs (Table 1).

CONCLUSIONS

A better understanding of the head accelerations to which football players are subjected will lead to improved protective equipment and more effective treatment. Head accelerations are inevitable in the game of football. Players at all positions experienced similar average accelerations per impact. However, players at the running back, linebacker, and defensive lineman positions appear to experience higher cumulative accelerations each game than do players at the wide receiver, defensive back, or offensive lineman positions. A limitation of this study is the fact that some variability is introduced due to the fact that some of the players were active in a larger portion of the game than others.

REFERENCES

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Table 1: Head acceleration data, grouped by player position.

Player Position	Number of Players	Hits Recorded	Player Games Recorded	Average Acceleration per Impact (g)	Average HIC per Impact (g)	Average Cumulative Acceleration per Game (g)
LB	2	590	17	31.3 ± 27.2	29.3 ± 83.7	951 ± 46.7
DL	2	747	17	24.4 ± 20.7	16.7 ± 62.0	847 ± 100.2
RB	2	621	20	27.5 ± 23.4	24.1 ± 53.9	815 ± 67.5
OL	3	297	17	25.1 ± 19.3	23.0 ± 43.2	474 ± 59.2
WR	4	540	33	28.2 ± 17.2	22.8 ± 36.1	469 ± 96.9
DB	2	339	20	23.4 ± 21.6	17.1 ± 64.1	388 ± 71.2