

# Potential Risk Factors for Concussion in Volleyball; High Velocity Attacks and Head Exposures

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## Abstract

**Context:** There are 3.8 million concussions a year in the United States from sports and physical activity. The concussion rate in collegiate volleyball players is 5% with the majority of these occurring as a result of contact with the equipment (the ball).<sup>4</sup> It has been determined that the average speed of a volleyball kill in elite-level college volleyball is 50-70 mph.<sup>5</sup>

**Objective:** This study analyzed the opportunities created during a volleyball match that could result in head impacts with the ball and lead to a concussion.

**Methods:** Using VolleyMetrics, a software that offers videos of volleyball matches, 48 Mid-season ACC volleyball games (20 in 2016 and 28 in 2022) were coded to record high-velocity kills, head impacts in front-row and back-row players, and occurrences when the front-row player's heads were over the net during blocking. Data were collected to answer if there were differences between 2016 and 2022 in the percentage of high-velocity attacks, the percentage of heads over the net, and the number of heads hit as well as in which rows.

**Results:** A Kruskal Wallis H Test through SPSS Version 29 concluded that there was not a significant difference in the percentage of high-velocity attacks and the percentage of heads over the net in 2016 and 2022. The average percentage of high-velocity attacks was 59.21%. There was an average of 250 attacks a game from the 48 games analyzed, therefore, 148 of the 250 attacks would be deemed high-velocity. This is 148 times there is an opportunity for a

concussion to occur. Although the difference between time periods was not significant, the incidence rates for hits to the head might explain the number of concussions that are seen in volleyball. For front-row players, the overall incidence rate of ball hits to the head was 6.8 per every 1000 exposures. There was an increase in the incidence rate of back row players hit in the head from 1.7 per every 1000 exposures in 2016 to 4.6 per every 1000 exposures in 2022.

**Conclusion:** While we are unable to determine if these impacts to the head with the ball result in concussion, the incidence of head hits is concerning as they may lead to injury.

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