

Concussive Forces and Brain Trauma in Competitive Sports

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Background

Concussions are the most common type of traumatic brain injury. They are typically caused by severe head impacts, which cause the soft brain tissue to make contact with the inside of the skull, often resulting in temporary neurological impairment.

In 2009, hospitals reported 24,184 cases of soccer head injury, and 28,716 cases of water sport head injury (AANS).



Experimentation



Our testing procedure consisted of launching soccer and water polo balls at an Anthropomorphic Testing Dummy (ATD) head at various speeds and ball pressures, as listed in the table to the right. Six trials were conducted at each speed and each velocity.

	Water Polo	Soccer
Pressures (psi)	10, 12, 13, 14, 15, 17	5, 7, 8, 9, 11
Velocities (mph)	35, 40, 45, 50, 55	35, 40, 45

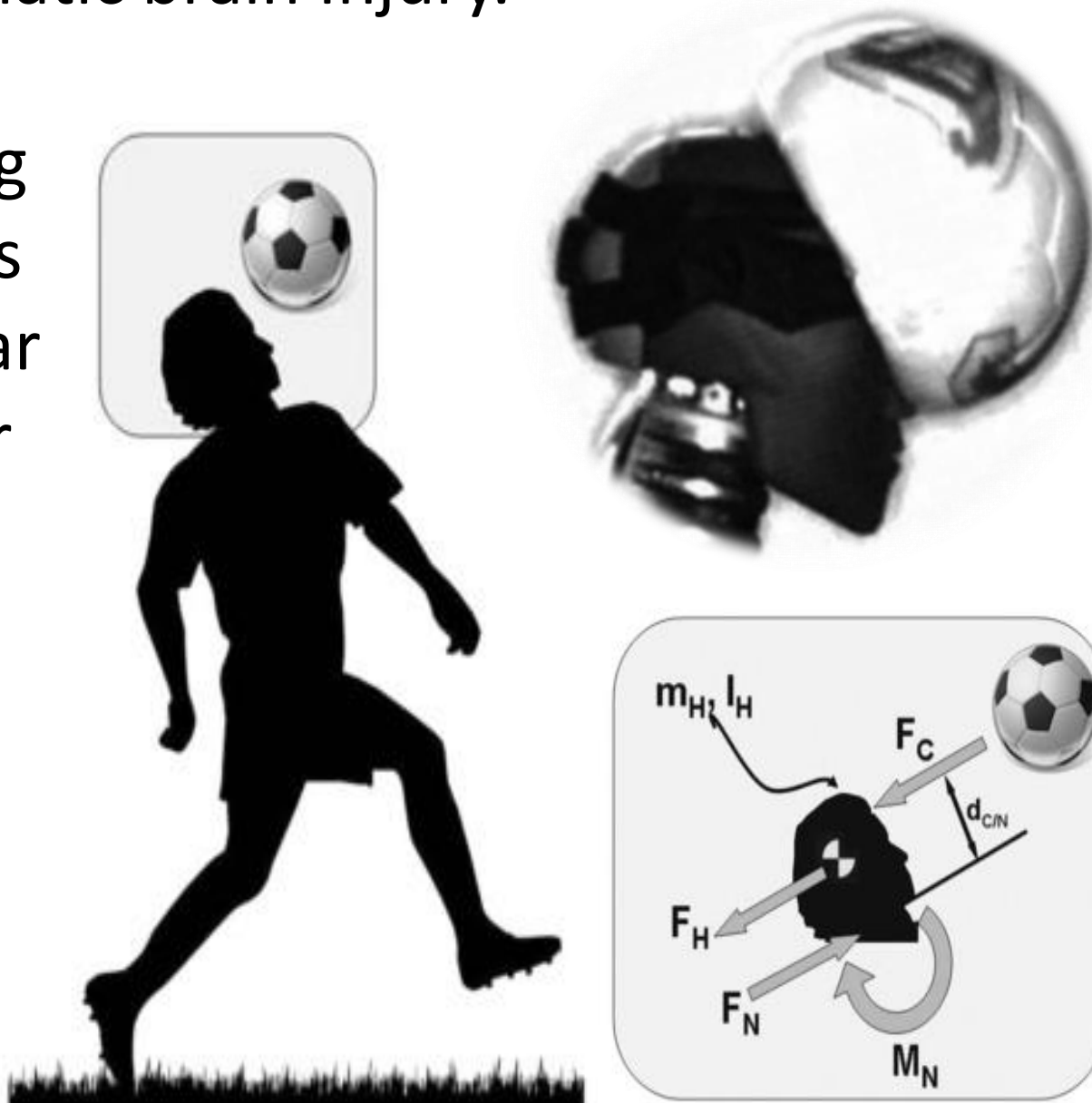
The ATD head from Humanetics was equipped with six accelerometers (piezoresistive and angular rate sensors). They measured G force accelerations in x, y, and z axes.



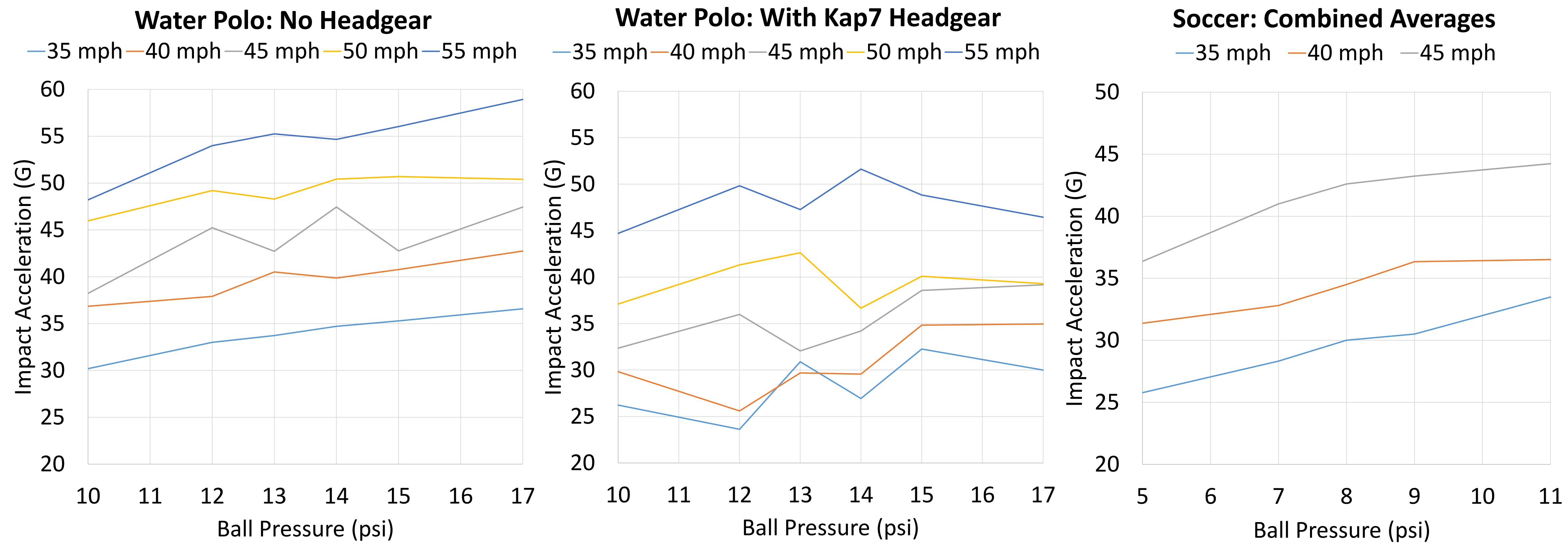
Overall Objective

The primary goal of this research is to determine whether ball inflation pressure has a significant impact on traumatic brain injury.

Auxiliary goals include assessing the effectiveness of Kap7 headgear in water polo for preventing TBI and CTE, and testing the accuracy of the new G-Force head-strap accelerometer.



Results



In all conducted trials, impact acceleration saw a general linear increase with increases in ball pressure. In the water polo trials, the use of Kap7 padded headgear reduced the impact acceleration force by an average of about 18%. After performing p-tests on all of our data sets, it was found that all of our recorded data is statistically significant.

