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Ball Pressure Correlations with Peak Impact Force and the Potential for Cumulative mTBI when Heading a Soccer Ball

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ABSTRACT

Soccer is a unique sport in which athletes use their heads as tools for gameplay, which may ultimately cause cumulative traumatic brain injuries. Due to rising popularity of soccer in the United States alongside the increased occurrence of CTE and mTBI in other contact sports, there is a growing concern over how to keep the repetitive forces caused by heading, as low as possible. Different variables that can affect the peak force felt when heading a soccer ball can be simulated and compared with in-game data, however, this has never been properly tested before. In the present study two size five and two size four balls were tested at three different gage pressures (8.5, 12 and 16.2 psi). These were kicked at different velocities towards a force plate, in order to simulate an in game kick, to collect data about the peak force and impulse exerted on a head. Data recollected allowed us to find an exisiting linaer relationship between velocity and the force exerted on the force platform. In addition, increasing the ball pressure, lead to higher forces, as observed through the difference of kicking a soccer ball inflated at 16.2 psi rather than 8.5 psi. The higher mass and diameter seen within distinct ball sizes affects the impact force, due to the related trajectory and drag force changes. The results found allow us to correlate with previous studies and confirm that by repeatedly heading a soccer ball you are prone to cumulative brain injuries. Additionally, stricter policies should be enforced, such as not allowing ball pressure to exceed 8.5 psi, thus keeping the game safer for all athletes involved.

KEYWORDS

Soccer, Biomechanics, Traumatic Brain Injuries, Velocity, Force