Engineering a Soccer Headgear that Utilizes Non-Newtonian Fluid in Order to Better Reduce G-forces

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Roughly 3.8 million concussions occur every year because of sports in the United States. Soccer has the third highest rate of traumatic brain injuries (TBIs) of any sport in the USA. No headgear is required in the sport. While there are a few marketed headgears that attempt to prevent TBIs, none have been proven to help. The purpose of this project was to engineer a headgear prototype that would sufficiently reduce g-forces more effectively than the three most widely used soccer headgears. Experimentation was completed at physics research laboratory in Buffalo, NY. To mirror reality of impact, a soccer ball was secured to a pendulum and released from a height of 13 cm. The pendulum then struck the forehead of a 50th percentile dummy, equivalent in height and weight of the average North American male. Three accelerometers were placed throughout the head of the dummy to measure impact g's in the x, y, and z direction. The headgear prototype was compared to the top three highest selling soccer headgears, as well as a control of no headgear. The experimental prototype's performance was superior to that of the other headgear. All two sample t-tests demonstrated that this difference was statistically significant: P-values of less than .05 and t-values of less than -2. Utilizing a non-Newtonian fluid to distribute an impact force is a new and potentially superior mode of shock absorption.