



# CALIFORNIA SCIENCE & ENGINEERING FAIR 2019 PROJECT SUMMARY

<b>Name(s)</b>  <b>Cameron Do; Christopher Do</b>	<b>Project Number</b>  <b>J2003</b>
<b>Project Title</b>  <b>Tackling Concussions: Testing the Effectiveness of Headgear to Reduce Displacement</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives</b> My brother and I play competitive level sports, including soccer. A key move in soccer for passing and scoring is to head the ball, which causes concern about potential concussions. Wearing headgear is recommended to help protect the brain, especially for younger players. The goal of this project was to test whether protective headgear is effective in minimizing the acceleration of the brain caused by soccer heading. We hypothesized that headgear would significantly reduce the G-force of impacts and that various types of headgear would provide similar levels of protection.</p> <p><b>Methods</b> We performed 88 trials and analyzed over 500 data values measuring the G-force of simulated soccer headings with and without protective headgear. To simulate a human head and shoulders, we attached a plastic skull to a spring, placed the spring through a hole in a paint bucket lid, and zip-tied the apparatus to a 5-pound weight inside the bucket. We encased an accelerometer in a plastic bag filled with ultrasound gel and placed the bag into the skull. To simulate a soccer heading, we set a pitching machine to throw balls at the experimental head at 17 meters/second at a distance of 13 meters. We ran simulations using Rock Solid headgear, Storelli Exoshield headgear, Full 90 headgear, and no headgear (the control). We tested the impact of the ball to the front, back, left and right sides of the head, and analyzed the G-force data collected from the accelerometer.</p> <p><b>Results</b> Based on the results of this project, protective headgear appears to reduce the G-force of an impact by as much as 59% compared to using no headgear. Rock Solid headgear seemed to be slightly more effective than Storelli Exoshield for impacts from the back, left and right sides, reducing the G-force by 59%, 47% and 18% respectively. However, Storelli was the most protective for frontal impacts, with an average 51% reduction to G-force. Full 90 was the least effective of the headgears tested.</p> <p><b>Conclusions</b> Although protective headgear might reduce the force of impact to the skull, it does not eliminate the risk of concussion. As such, improving education about concussion management, encouraging neck strengthening exercises, and minimizing high risk impacts may be the best way to reduce concussions in sports. An option in soccer would be to ban heading altogether. But that might lead to a whole new headache for soccer players and fans.</p>	
<b>Summary Statement</b>  This project investigates the effectiveness of various types of protective headgear in reducing the G-force of impacts from soccer ball headings.	
<b>Help Received</b>  We would like to thank our parents for supervising us while we conducted our project. We would also like to thank our science teacher for guiding us in our project.	