

A Mechanical Platform Design to Study Sports-Related Head Injury

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A concussion occurs when the brain impacts the inside of the skull and becomes bruised as the result of a drastic change in acceleration that causes the brain to move. Concussions can occur from any head impact, but they are most often associated with sports. Chronic Traumatic Encephalopathy (CTE) is a neurodegenerative disease that is thought to be the result of a long history of concussions. Symptoms associated with CTE include memory loss, confusion, impaired judgement, depression, and aggression; not completely unlike concussions themselves.¹² Football helmets, which offer protection, are mainly a polycarbonate shell technology that has not changed much since the 1970s. Some companies such as the Seattle start up VICIS have tried to engineer a solution with their Zero1, which is a helmet made to deform with impacts in order to absorb incoming energy,³ but face issues with cost being four to five times more than the standard polycarbonate ones.⁴ In this project, we built a mechanical platform to model head impacts in sports and eventually be able to take relevant data such as force and acceleration.

The main idea of this platform was to have a system to drop a dummy head from a height and take data about the impact. The platform was designed using SolidWorks, with files downloaded from 8020.net, where materials were also ordered from. The platform was designed with a few specifications, such as having mobility, being lockable in place, as well as be able to vary the angle of impact a dummy head has with the ground. Apart from building the platform, a two-part study was conducted to both give quantitative data, as well as act as a guide for the project.

When all of the materials were present, the platform was assembled in a day at the UNH Biomedical Lab in Branford, CT. We were not able to acquire a dummy head to be able to test due to financial constraints, so we will likely be looking into other methods of modeling the head. As of September 14, the concussion survey garnered 90 student responses from various sports, and for the most part, results came back as expected. Only 7.95% of athletes say they never experience impacts from playing their sport. Even though they occur more frequently in certain sports, it is possible to get one doing just about anything. Andrea Harmon, the UNH head of Sports Medicine said in an interview that: "How an athlete responds to a concussion varies greatly, and the more concussions an athlete suffers, the harder it is for them to recover from the current one."⁵ Despite this, 95.45% of athletes said that they not reconsider playing after suffering concussions, most often citing their passion for the sport as the reason for wanting to continue. One of the only surprises to come out of this survey was that 66.67% of athletes believe enough is being done to prevent them in sports, which further plays into the idea that athletes for the most part, are undeterred by the risks.

We plan on continuing to work on this project in the coming months, adding components that we were unable to get to in the SURF program, with hopes to use in the future for testing various head protection.

¹ Gavett BE, Stern RA, McKee AC. Chronic Traumatic Encephalopathy: A Potential Late Effect of Sport-Related Concussive and Subconcussive Head Trauma. *Clinics in sports medicine*. 2011;30(1):179. doi:10.1016/j.csm.2010.09.007.

² "What Is CTE?" BU CTE Center. Web. 01 Aug. 2016. <https://www.bu.edu/cte/about/what-is-cte/>.

³ Shanes, Josh. "Vicis Continues To Raise Millions Of Dollars For Its Effective Football Helmet Technology." *SportTechie*. N.p., 21 Apr. 2016. Web. 04 Sept. 2016.

⁴ Stella, Rick. "Flexible Football Helmet Absorbs Hits like a Car Bumper, Could Put an End to Concussions." *Digital Trends*. Digital Trends, 19 Jan. 2016. Web. 01 Aug. 2016

⁵Harman, Andrea. "Interview with Andrea Harmon, UNH Head of Sports Medicine." Personal interview. 26 July 2016.