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Anthropometrics and Friction of the Human Head (IRB#20-596)

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Abstract

Risk of impact to the head is not specific to any one person; concussive injuries can affect a large demographic of people in a variety of activities. Approximately 2 million sport- and recreation-related concussion injuries occur each year. Biking is the leading cause of recreation-related head injury in the US. Bike helmet manufacturers have sought to decrease the risk of concussion by reducing linear and angular acceleration. For example, a multi-directional impact protection system, or MIPS, is a new technology that provides a slip-plane for the head to slide independently of the helmet shell, so that upon impact, the head can experience less rotation as the helmet due to friction. However, there is no data on the frictional properties between the human head and bike helmet padding material. Additionally, headform surfaces used in helmet impact testing are not biofidelic of human skin and hair. The goal of this study is to investigate and quantify the interfacial properties, like friction, between the helmet and head. The primary objective is to determine the coefficient of static and dynamic friction between the head and bike helmet padding. A novel friction device will be developed for this research. The secondary objective is to collect anthropometric data to understand typical head geometry. These head measurements will guide examination of a representative human head to determine where interfacial properties, like friction, are most prominent. This research will inform helmet testing procedures so they are more representative of the population and the interacting surfaces during impact. And ultimately, this research will aid to improve helmet design to reduce concussion risk.

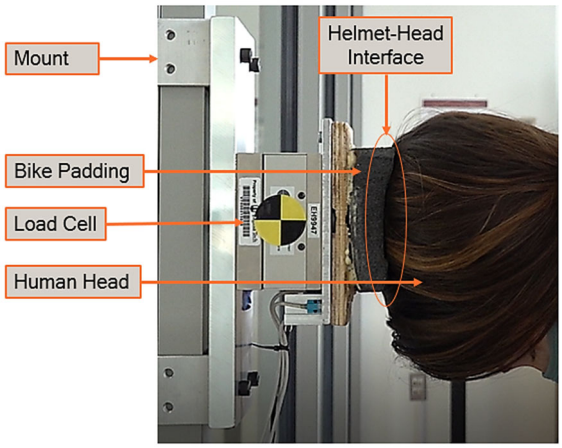

Figure 1. Head friction device with participant sliding their head

Biography

Charlotte Clark earned her BS degree in Materials Science and Engineering from Virginia Tech in the spring of 2020. She began pursuing a MEng degree in Materials Science and Engineering in the fall of 2019 and is expected to graduate in the spring of 2021. She has worked in the Virginia Tech Helmet Laboratory since her sophomore year of undergrad and is now working in the group as a graduate research assistant. With her background in MSE, her interest in cross-disciplinary application, and her long-term experience working in the helmet lab, Charlotte provides a unique approach to her research project with the Helmet Lab.