



MECH 493 project: Investigating Bandwidth Requirements of Wearable Mouthpieces to Measure Head Impacts in Soccer

Research Project Overview

Instrumented mouthpieces with inertial measurement units can measure the kinematics of head impacts, common in sports where the head is used to make contact with the ball or other players. The repeated accelerations experienced by the head may result in mild traumatic brain injuries, which has become increasingly focused on in the realm of injury prevention. However, current literature is unable to definitively quantify the minimum ranges of bandwidth and sampling properties of the mouthpieces necessary to accurately capture head impact kinematics, and in turn correlate with changes in brain function from repeated exposure to head impacts in soccer (Wu, 2016).

The goal of this study is to investigate the proper frequency and sampling rate parameters. Currently, the mouthpieces are set at a minimum frequency of 1000Hz. We are presently using these settings in mouthpieces following players on the UBC Women's Soccer team to measure the kinematics of each head impact throughout year. The proposed project will focus on calibrating the mouthpieces to properly measure and better capture significant types of head impacts that is related to mild traumatic brain injuries.

Reference

Wu, L.C., et al., Bandwidth and sample rate requirements for wearable head impact sensors. Journal of Biomechanics (2016)

Research to be performed by the student

- Deploy instrumented mouthpieces to varsity soccer athletes to collect high sample frequency head impact data.
- Frequency analysis of head impact data to determine the effects of sensor bandwidth and sampling rate on the accuracy of measurements.
- Identify appropriate bandwidth and sample rate requirements for soccer head impact measurements.

Facilities and team:

Main lab location: ICICS Building, Room X015

Team: the undergraduate student will work with a PhD student on this project, with direct guidance from Prof. Wu