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Evaluation of Head Impacts on Football, Lacrosse and Hockey Helmets

Goutham N. Sankaran
Department of Mechanical Engineering, Purdue University
Eric Nauman
Department of Mechanical Engineering, Purdue University

ABSTRACT

Despite improvements in helmet design over the years, traumatic brain injury cases (TBI) from heavy contact sports have increased drastically. Newer understanding of said cranial injuries has granted scientists and engineers the capability to develop acceleration measuring devices to precisely quantify and simulate real life impacts. In this research, various football, lacrosse and hockey helmets were stricken on a head form using an impulse hammer that measures transient accelerations. Once data was collected, specifically defined metric plots were generated that provided a normalized analysis of all helmets' mitigation abilities. These plots revealed that the lowest translational acceleration metric hailed from the lacrosse CPRX-3 which was approximately 0.3 and the highest value came from the hockey Bauer-3 which was around 1.4. The respective rotational acceleration metrics had a low of 0.45 (CPRX-3) and a high of around 1.85 (Bauer-3). The Bauer helmet clearly developed a trend of having a lower impact mitigating ability than the lacrosse across most helmet locations tested. The tests affirmed that helmets in general were better at mitigating translational accelerations than rotational accelerations – the latter being known notoriously for causing more concussions.

KEYWORDS

Traumatic brain injury (TBI), football, lacrosse and hockey helmets, impact-mitigating ability, concussions.