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The evaluation of impact characteristics causing persistent concussive syndrome in youth

Lauren Dawson, Gilchrist MD, Cusimano MD, Brien S, Marshall S, and Zemek R
University of Ottawa, Canada

Persistent concussion syndrome (PCS) has become a concerning injury in sport and everyday life. For unknown reasons youths have been reported to be at a higher risk than adults for this injury. The purpose of this study was to reconstruct youth PCS cases in a laboratory to describe the biomechanical characteristics of impacts resulting in youth PCS. Eleven youth (age 6-8) PCS cases were reconstructed using mathematical, physical, and finite element models. A monorail drop system was used to impact a Hybrid III 6yr head form at the height and impact surface obtained by eyewitness accounts of the accident. The impact was described using linear and rotational acceleration curves that were used as input for the University College Brain Trauma Model to determine the maximum principal strain (MPS) in the brain. The results showed that average impact velocity of head impact was 2.8m/s, lower than reported in adults. The resultant peak linear and rotational acceleration was 211.1(73.7) g and 15122(12224) rad/s² respectively with a MPS of 0.465(0.171). The results all indicated a high risk of concussive injury, but were slightly lower than the measures describing adult PCS. In conclusion, although both age categories received similar peak magnitudes of linear and rotational acceleration and MPS the inbound velocity of head impact was lower for youth. This suggests that youth may be at an increased risk for PCS at lower head contact velocities than adults.

Biography

Lauren Dawson has completed her BSc in Human Kinetics and is currently completing her MSc in Biomechanics at the University of Ottawa's Neurotrauma Impact Science Laboratory. Her thesis is under the supervision of Dr. Blaine Hoshizaki studying the biomechanics of head injury in youth. She is the Canadian Standards Association (CSA) National Academic Champion 2013 for research aimed to improve the current CSA ice hockey helmet standard, which was titled "The influence of material compliance on the dynamic response of a Hybrid III headform", and has published one paper and presented at two international conferences.

Ldaw064@uottawa.ca

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