Hybrid III Response in a SAE Baja Vehicle under Low Speed Frontal Impacts

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ABSTRACT

Objectives
The goal of this study was to evaluate the risk of injury to the occupant of a SAE Baja vehicle in frontal impacts under different vehicle speeds.

Background
SAE Baja vehicles are subjected to off-road terrain environments which increase the likelihood of accidents such as collisions with rocks or trees. In order to investigate the potential head and neck injury in a crash scenario, a vehicle model was developed to simulate frontal impact and provide a prediction of occupant response in crash scenarios.

Methods
A finite element model of the 2006 University of Waterloo SAE vehicle was developed with added mass representing the non-structural components. This vehicle meets the 2006 regulations for SAE Baja competition. A four point seat belt was modeled using experimental seatbelt data. A deformable Hybrid III FE dummy model and seat model were implemented. The neck response of the Hybrid III model was verified with current NHTSA test procedure requirements. A helmet and foam neck collar were added to represent protective equipment used. The simulations are evaluated against current measurable injury criteria such as N_{ij}, $HIC_{15,}$ and thoracic injury criteria.

Results
Impacts into a rigid wall at velocities of 9, 18 and 36kph were simulated. All injury values including N_{ij}, HIC_{15} were below the acceptable thresholds. Thoracic injury was also calculated and found to be acceptable. Additional simulations were undertaken with and without a foam neck collar implemented. It was found that the foam collar made no significant difference in neck (N_{ij}) or head injury (HIC_{15}) values.

Conclusions
Injury predictions show that the occupant would likely not be injured under representative frontal crash conditions. While all injury values were below threshold values, a potential for neck injury could exist if impact velocity is increased, due to the high rigidity of the vehicle chassis and helmet mass.