

Comparison of ATD and Human Body Models for Side Impact Scenarios

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Abstract

Objective

The goal of the study was to compare kinetic and kinematic response of an ATD and a Human Body Model (HBM) for different side impact configurations including pendulum, sled and vehicle scenarios.

Outline of the problem

Severe injury to the thorax is a significant source of occupant injury and fatality, particularly in side impact conditions where occupant protection is challenging due to a limited vehicle crush zone. The integration of HBM and vehicle models provides a unique opportunity to evaluate complex loading scenarios; however, previous studies have identified differences in predicted thorax response when comparing ATD and HBM response.

Methodology

An ES2-re ATD (Dynamore) and a detailed Finite Element HBM (University of Waterloo) were assessed using three impact scenarios: lateral pendulum impact, rigid wall side sled impact, and integrated full vehicle side impact scenario. The vehicle and occupant models were validated in series of tests preceding this study. The HBM and ATD models were assessed using thoracic injury metrics including deflection and the Viscous Criterion, and the results were compared to available PMHS data in the literature.

Data to be included

The reported data will include response assessment and comparison of the HBM and ATD models (time histories, peak values, kinematics), comparison with the cadaver data.

Summary and conclusions

Differences in injury metrics were observed between the ATD and HBM. For the moving deformable barrier impact, the HBM predicted higher rib deflection and a lower VCmax compared to the ATD model. The responses were evaluated using CORA and the HBM response was found to be comparable to the available PMHS test data.