

The frontal-impact response of a booster-seated child-size PMHS

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Abstract-

Objectives:

This article presents the response of a child-size postmortem human subject using a booster seat in a series of three frontal impact sled tests.

Methods:

A 54-year-old female cadaver was seated in a booster seat in the rear seat of a buck representing a mid-sized American sedan. Two different restraint systems (conventional belt and pretensioning, force-limiting belt) were used to run three simulated frontal impacts (one at 29 km/h, two at 48 km/h). Instrumentation included accelerometers rigidly mounted on relevant body landmarks as well as chest bands. Trajectories were assessed through high-speed video cameras.

Results:

Specific focus was on the whole-body kinematics and resulting head trajectories under two different restraint conditions (booster seat and standard belt, booster seat and force-limiting pretensioning belt) in a rear seat environment. At 48 km/h, the pretensioning, force-limiting seat belt reduced the forward excursion of both the head (353 mm vs. 424 mm) and the h-point (120 mm vs. 152 mm) compared to the standard system. Maximum torso pitch was similar for both seat belts.

Conclusions:

A complete description of the outcome of the tests is presented in the article. These results suggest that the introduction of a pretensioning force limiting belt in the rear seat can be beneficial for small size occupants like children using booster seats.

Index Terms- Frontal impact, Child restraint systems, Kinematics, Restraint systems

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