

PMHS and ATD Chin Impact Biofidelity Testing

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ABSTRACT

In current child restraint system (CRS) testing, it is common for the Hybrid III child ATD to experience a high HIC value even though the head of the dummy may not have contacted any aspect of the vehicle. These high HIC values in many cases are derived from the chin of the ATD contacting its anterior chest. Due to the critical role that HIC plays in CRS certification testing, it is imperative that the impact response of the ATD chin is biofidelic. The objectives of this study were to: (1) analyze differences in chin thickness and impact responses of Hybrid III 10 year old ATD heads manufactured both by Denton ATD (DATD) and First Technology Safety Systems (FTSS), (2) evaluate chin impact responses of post mortem human subjects (PMHS) at an energy level, 34J, commonly experienced by ATD heads during CRS testing. The chin impact tests for 10 ATD heads (4 DATD & 6 FTSS) were completed at an impact velocity of 1.6 m/sec using a 26.8 kg pneumatic impactor. Three PMHS chins were then impacted three times each using the same 26.8 kg impactor. The initial and final impact to each PMHS chin was conducted at 0.8 m/sec in order to exercise the temporomandibular joint and provide a baseline response of the chin for injury identification. The second impact to each PMHS chin was conducted at an impact velocity of 1.6 m/sec, similar to the ATD impacts. The deformation of the chin was measured using a linear potentiometer on the ram and high speed photography. Force, measured by a load cell on the front of the impactor, and displacement data were then used in evaluating the biofidelity and reproducibility of the ATDs. The stiffness responses of the ATDs from each manufacturer were reproducible and similar to the responses of the PMHS chins. The results of this testing will be useful in resolving the issue of child dummy chin to chest contact in CRS testing.