

# Comparative Performance of Pediatric ATD Necks in Simulated Frontal Crashes

Steven Latman<sup>1</sup>, Zarron Simonis<sup>1</sup>, Jami Saffioti<sup>1</sup>, Jennifer Kadlowec<sup>1</sup>,  
Kristy B. Arbogast<sup>2</sup>, Matthew Maltese<sup>2</sup>

<sup>1</sup>Rowan University, <sup>2</sup>CIRP, Children's Hospital of Philadelphia

## ABSTRACT

*The Q3 and Hybrid III 3C anthropomorphic test devices (ATD's) both represent a three year old child in out-of-position airbag tests and child restraint system evaluations. These ATD's differ in both structure and in the way they perform in static tests and vehicle airbag evaluations. However, they both adhere to the same biofidelic dynamic test requirements. This study seeks to evaluate the differential performance of the Q3 and Hybrid III cervical spines in a simulated frontal crash of a fully harnessed occupant. The ATD cervical spines will be tested using a modified Part 572 pendulum test apparatus. Modifications to the Part 572 pendulum include the addition of springs to increase impact velocity, and changing the stop bar position to modulate pulse duration. We estimate the additional spring energy will increase the magnitude of the impact velocity from 15 mph to 30 mph, and raising the height of the stop bar will increase the duration of the impact from approximately 20 ms to 100 ms. These modifications will result in a more realistic simulation of the chest acceleration of a torso- harness-restrained three year old ATD. Visual shape data of both cervical spines from a high-speed video camera will be paired with load and moment data from tests with the pendulum. This data will be used in a further study to compare the ATD cervical spine flexion and extension angles with those cervical spine flexion angles produced through voluntary range of motion testing in human volunteers.*