Evaluation of Q3s ATD Biofidelity as Compared to Volunteers and Hybrid III 3 Year-Old ATD

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INTRODUCTION

- Around 40% of child fatalities to rear-seated children ages 0-8 years old occur in side impact collisions [1].
- Child restraint systems (CRS) must be evaluated in the side impact condition with a side impact specific dummy to ensure child safety.
- The biofidelity of pediatric ATDs continues to be evaluated with scaled adult cadaveric data, an approach with questionable validity.
- The purpose of this study is to:
  1. Evaluate and quantify the biofidelity of a new side impact 3 year-old ATD, the Q3s, using adult data and pediatric volunteer data, and to compare these quantifications.
  2. Compare Q3s performance to that of the current 3 year-old standard ATD, the Hybrid III 3 year-old.

METHODS

- Part 1: Replicate pediatric volunteer tests
  - Shoulder biofidelity tests [2]
  - Low speed side impact sled tests [3]
  - Qualitatively evaluate Q3s biofidelity based on volunteer data
  - Quantify Q3s biofidelity using Biofidelity Ranking System (BRS) [4]

RESULTS & DISCUSSION

- Can we validate deflection measurements obtained with motion capture using the linear potentiometer in the Q3s shoulder?

- Although limitations exist with the Q3s shoulder potentiometer (limited to one axis measurements), Vicon marker motion capture has shown to be repeatable and accurate and allows for 2D deflection calculations.
- Preliminary Q3s shoulder stiffness values do not agree.
- Preliminary Q3s shoulder stiffness values vary significantly from pediatric shoulder stiffness values.
- Further analyses will provide insight into fully quantifying the Q3s shoulder biofidelity.

CONCLUSIONS

- Although limitations exist with the Q3s shoulder potentiometer (limited to one axis measurements), Vicon marker motion capture has shown to be repeatable and accurate and allows for 2D deflection calculations.
- Preliminary Q3s lateral vs. oblique deflection stiffness data indicate significant differences.
- Preliminary Q3s shoulder stiffness values vary significantly from pediatric shoulder stiffness data.
- Future work includes moving deeper into the data analysis stage of this project to complete 1. validation and quantification of Q3s biofidelity with various volunteer datasets, and 2. Q3s comparison to Hybrid III.