Child Restraint Systems in 35mph Frontal NCAP Tests

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Background

- TREAD Act mandated NHTSA to:
  - Determine whether to include CRS in every NCAP vehicle (Section 14(b)(9))
    - Vehicle Evaluation
  - Develop CRS rating system (Section 14(g))
    - Ease of Use

Goals for 2003 Pilot Study

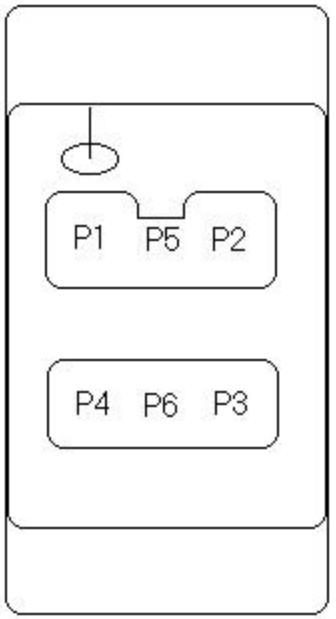
1) Establish whether a 3YO Hybrid III in a 5-point harness performs similar to:
   - 1YO CRABI Rear-facing (RF)
   - 6YO Hybrid III Belt Positioning Booster
   - 3YO Hybrid III Overhead Shield
2) Determine what parameters influence with CRS performance

Experimental Design

- Include cars, pickups, and SUVs
- Paired CRS Tests
- LATCH
- Minimum sample size of 8
- Fully instrumented child dummies
  - Head, chest, and pelvis triaxial accelerometers
  - Chest displacement potentiometer (Hybrid III)
  - Upper and lower neck transducers

Experimental Design/CRS Configurations

- P3 position had forward-facing 5-point harness which was used as baseline for comparing P4.
- P4 position had:
  - 9 tests rear-facing with CRABI
  - 8 tests booster with 6YO
  - 10 tests overhead shield with 3YO



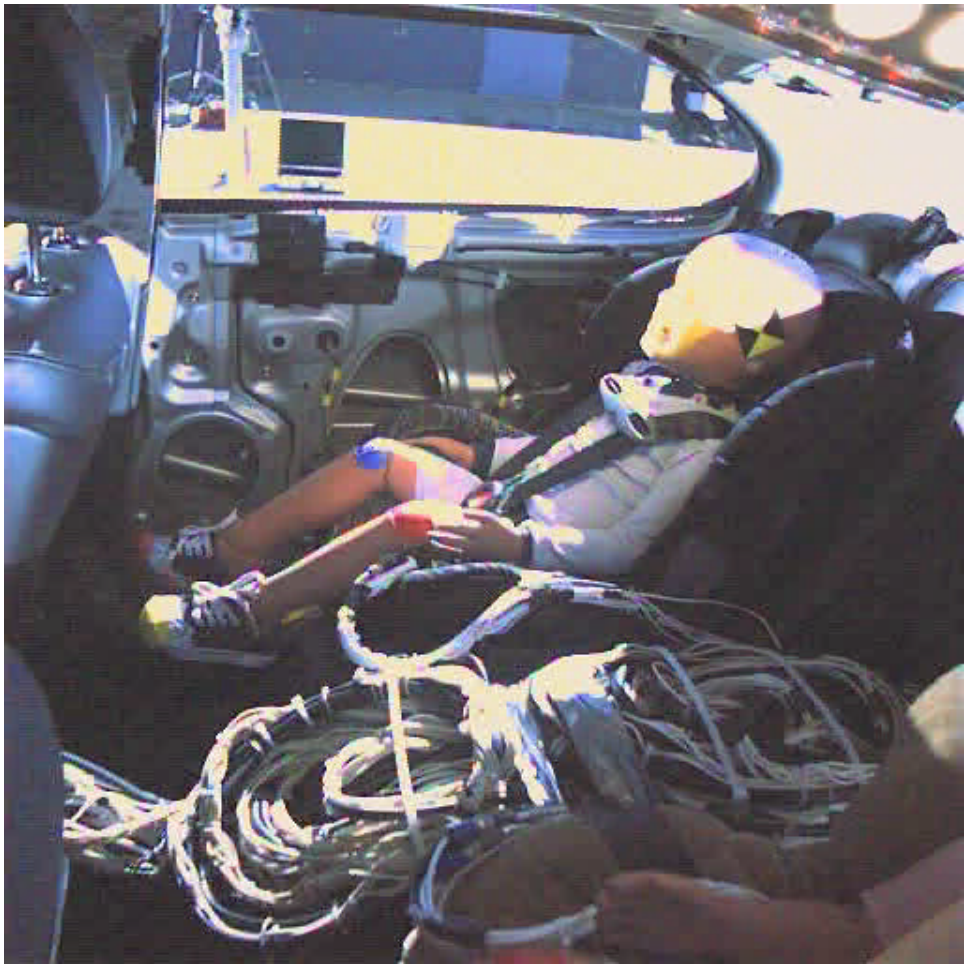
CRS Types Used

Front view

Side view

5-Point		Overhead Shield	Booster
1YO	3YO	3YO	6YO
RF	FF	FF	FF

Example Video



1.) Forward Facing Convertible with 3YO vs. Rear Facing Convertible with 1YO

Photo for test setup

Paired T-test Results

Comparison with 3YO in 5-Point Harness			
HYPOTHESIS: There is NO difference (95% Confidence)			
	1YO	6YO	Overhead Shield
n	9	8	10
HIC	No Difference		
Chest G	Difference Exists		

2.) Forward Facing Convertible with 3YO vs. Highback Booster with 6YO

Photo for Test Setup

Paired T-test Results

Comparison with 3YO in 5-Point Harness			
HYPOTHESIS: There is NO difference (95% Confidence)			
	1YO	6YO	Overhead Shield
n	9	8	10
HIC	No Difference	No Difference	
Chest G	Difference Exists	Difference Exists	

3.) 5pt FF with 3YO vs. Overhead Shield FF with 3YO

Pre-test Photo for 5pt and OH

5-Point Harness

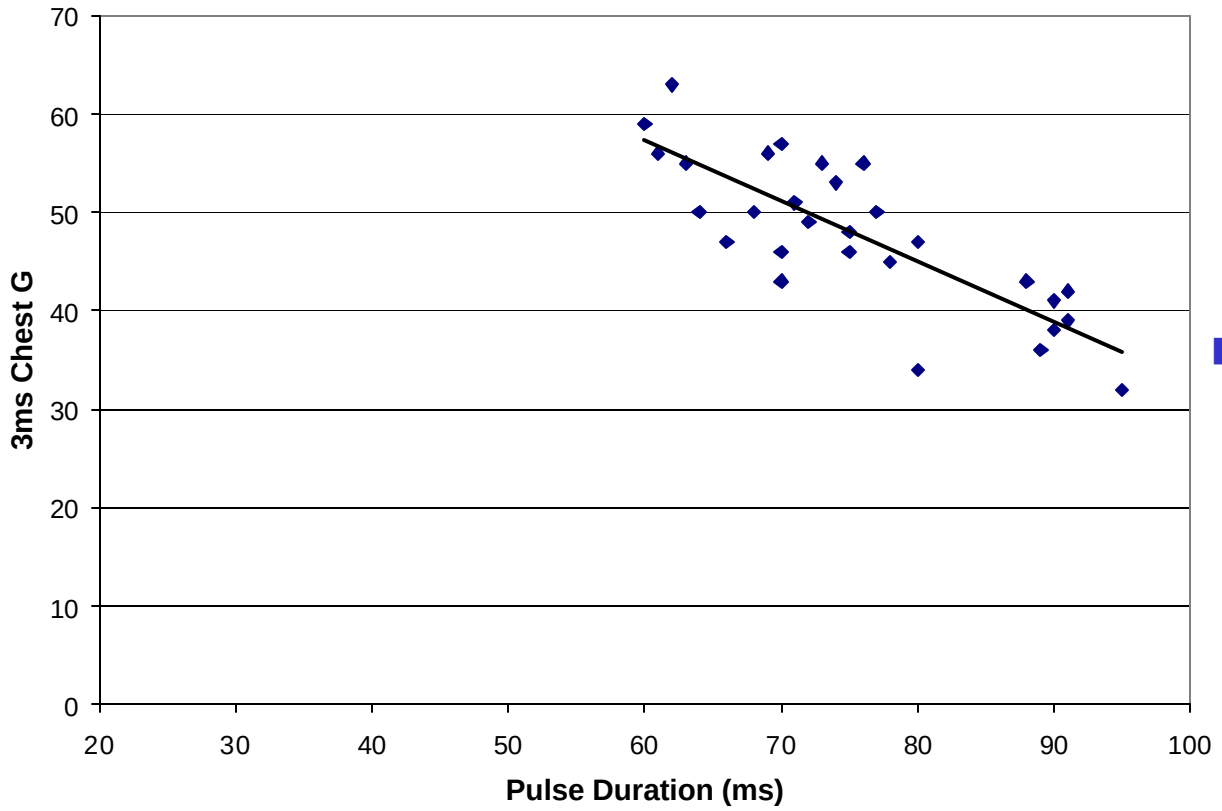
Overhead Shield +
3-Point Harness

Paired T-test Results

Comparison with 3YO in 5-Point Harness			
HYPOTHESIS: There is NO difference (95% Confidence)			
	1YO	6YO	Overhead Shield
n	9	8	10
HIC	No Difference	No Difference	No Difference
Chest G	Difference Exists	Difference Exists	No Difference

4.) Parameters affecting child readings

Vehicle Structure



- Pulse Duration shows mild correlation with chest G
- Similar trends for peak acceleration and static crush

Vehicle Interior Parameters

- Tether location (Vans and SUVs)
- Seat contour
- Seat clearance (RF)
- Seatbelt retractor performance (Booster)

Preliminary Observations

- 3YO in a 5-point CRS HIC readings had no significant difference from 1YO, 6YO, or overhead shield
- 3YO in a 5-point CRS chest G readings had a significant difference from 1YO and 6YO
- No significant difference for chest G between 5-point harness and overhead shield
- Vehicle interior and structure have an effect on child dummy readings

Additional Observations

- Following factors did not correlate with 3YO dummy readings:
  - Driver and front passenger readings
  - Vehicle type

Additional Information

- http://dms.dot.gov/
- Docket #4962

Thank You