INTRODUCTION

- Pediatric injury prevention in MVCs poses challenges due to the sparsity of pediatric biomechanical data for ATD design. Consequently, current pediatric ATDs are scaled according to adult biomechanical responses [1].
- This is especially important in head injuries, the most common injury sustained by children in MVCs [2].
- The HIII 6YO ATD, designed as a surrogate for a 6-year-old child, contains a molded neck and center cable, calibrated by applying a torque of 2.0 ± 0.2 in-lb. Head and neck responses of the HIII 6YO may vary by prolonged testing and differences in initial neck cable tension.
- The objective of this study is to investigate the repeatability of the HIII 6YO head and neck responses to a frontal impact with neck cable tension at 1.6, 1.8, 2.0, 2.2, and 2.4 in-lb.

MATERIALS & METHODS

- The HIII 6YO head and neck assembly was fixed to the mini sled and subjected to frontal impacts with a pneumatic ram (Figure 1).
- The nominal sled velocity was 14 km/h, in accordance with child ATD T1 acceleration in FMVSS 213 sled tests [3], and the peak y-moment occurred at roughly 100 ms (Figure 2).
- The results were quantified by a six-axis load on the upper neck and three accelerometers and three angular rate sensors in the ATD head.
- The data from each impact was filtered according to SAE J211 standards and processed in MATLAB, and the coefficient of variation (CV) values were calculated.
- The data was normalized by sled velocity. The results showed significant deviation (significance level .05) from 2.0 in-lb condition (Figure 6).

RESULTS & DISCUSSION

- CV values for all upper neck parameters were repeatable within 5% for all neck tensions (Figure 3).
- The head CG X-acceleration and upper neck Y-moment time history plots for all neck tension conditions (Figure 4) exemplify the differences in response across neck tensions. An asterisk in the mean value plots denotes a significant deviation from the 2.0 in-lb condition (Figure 6).
- The head CG X-acceleration and upper neck Y-moment mean curve exemplar plots for 1.6, 1.8, 2.0, 2.2, and 2.4 in-lb are illustrated (Figure 5).
- The head CG X-acceleration and upper neck Y-moment mean curve for 1.6, 1.8, 2.0, 2.2, and 2.4 in-lb are illustrated (Figure 6).

CONCLUSIONS

- The Hill 6YO head and neck responses to a frontal impact were repeatable for each condition with neck cable tension at 1.6, 1.8, 2.0, 2.2, and 2.4 in-lb [4].
- After observing significant differences in sled velocity across neck tensions, the upper neck responses were normalized by sled velocity. The data showed significant deviation (significance level .05) from 2.0 in-lb response for 1.6 and 2.4 in-lb for all criteria, while the 1.8 in-lb did not deviate for upper neck Fx and 2.2 in-lb did not deviate for any.
- Future work will include TEMA localized displacement analysis to further characterize localize displacement to understand the trends in Figure 5.

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REFERENCES CITED