

Seat testing to investigate the female neck injury risk – preliminary results using a new female dummy prototype

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I. INTRODUCTION

Dynamic performance tests are conducted to assess the neck injury risk. To date seats are assessed based on sled tests mostly using a BioRID which is based on the 50%ile male anthropometry. Since females sustain whiplash associated disorders (WAD) more often than males, their injury risk needs to be addressed as well.

II. METHODS

A series of sled tests according to the Euro-NCAP whiplash test procedure was performed (16 km/h delta-v). Four standard vehicle seats (A-D) were used; according to Euro-NCAP seats A, B and D were rated good and seat C performed marginally. To represent a female passenger a new loading device was developed and used [1]. The new dummy prototype represents the anthropometry of a 50%ile female (Fig.1), it is based on the current BioRID design and instrumented similarly. The tests were evaluated as defined by Euro-NCAP; injury criteria NIC and Nkm were determined. Also a modified Nkm* was calculated, in which the intercept values were scaled to 29 Nm for extension moment, 53 Nm for flexion moment and 507 N for shear force to consider a female.

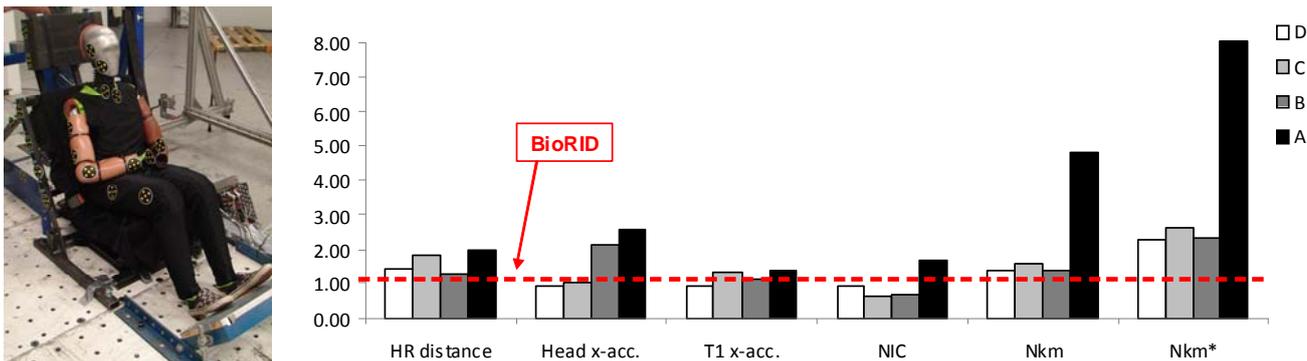


Fig. 1: Loading device (left) and test results normalized with respect to the corresponding Euro-NCAP results (right)

III. RESULTS

Fig. 1 summarizes the results of the sled tests for each seat. The absolute values were normalized by the results of the corresponding Euro-NCAP test, i.e. 1.0 represents the baseline as obtained using a BioRID.

IV. DISCUSSION AND CONCLUSIONS

Despite various limitations (e.g. related to the new loading device, its sitting posture or the seat position for females), the tests clearly illustrate that assessing current seats focusing on female anthropometry will lead to different results. Seats that performed poorly when using a BioRID can show a much better performance under the new setting and vice versa. In seat C, for example, the smaller dummy managed to fit in between the seat frame leading to completely different kinematics associated with lower loading. Likewise the outcome for injury criteria differs. In that respect also the currently used definitions and threshold values need to be re-assessed and possibly adjusted to be appropriate as indicated here when using a modified Nkm definition.

V. ACKNOWLEDGEMENTS AND REFERENCES

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[1] Carlsson A et al., IRCOBI, 2012