

Basic comparison of the injury risk of a male and female dummy model in rear impact collisions

Andreas Gutsche¹, Ernst Tomasch¹, Wolfgang Sinz¹, Xavier Cerrillo², Ines Levallois², Kai-Uwe Schmitt³, Toni Weber³, Hermann Steffan¹

I. INTRODUCTION

According to statistics rear impact collisions are one of the most common accidents in road traffic. Even though the death rate is low, whiplash associated disorders (WAD) are painful injuries and have a huge financial impact on society. Various studies (e.g. Jonsson et.al. 2008) have shown that the risk of sustaining WAD is up to three times higher for females. Nevertheless, development of anti-whiplash systems today is based only on the BioRID II (IIWPG – International Insurance Whiplash Prevention Groupe/IIHS – Insurance Institute for Highway Safety/SRA – Swedish Road Administration). Therefore, in the ADSEAT project (www.adseat.eu) a new numerical female model named EvaRID (Eva - female/RID - Rear Impact Dummy, 50%ile female) was developed. The objective of the present study is to highlight the differences between BioRID II and EvaRID simulations during rear impact collisions. In these simulations a generic seat model and the three Euro NCAP pulses (SRA 16 km/h, IIWPG 16km/h, SRA 24 km/h) were used. One novelty in this study is the possibility to use the EvaRID computational model to compare injury parameters of male and female passengers.

II. METHODS

Finite Element Method (LS-Dyna) was used to virtually investigate the behaviour of male and female vehicle occupants during a whiplash. Based on the results of the BioRID simulation (A), two setups with the EvaRID model and different seat adjustments (B – same as A, C – lowest head restraint position) were compared.

III. RESULTS

In the figures, only the IIWPG 16 km/h pulse is shown. The SRA 16 km/h and SRA 24 km/h behave similarly. Figure 1 shows the different kinematics of the three setups. Depending on the setup, there can be major differences, as illustrated in Figure 2, in injury parameters such as e.g. the Nkm-values vary between 66% and 191% from the BioRID result (normalized by the results of the BioRID).

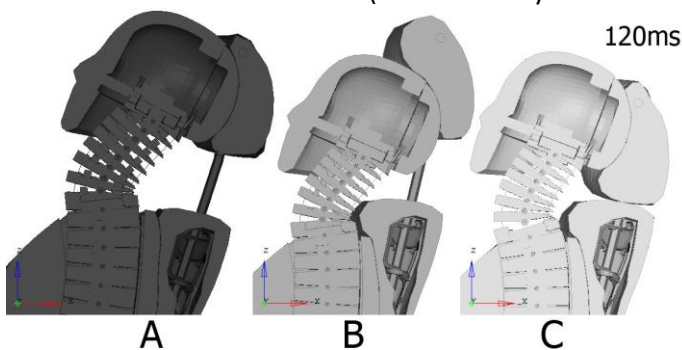


Figure 1 - comparison of the cervical kinematics

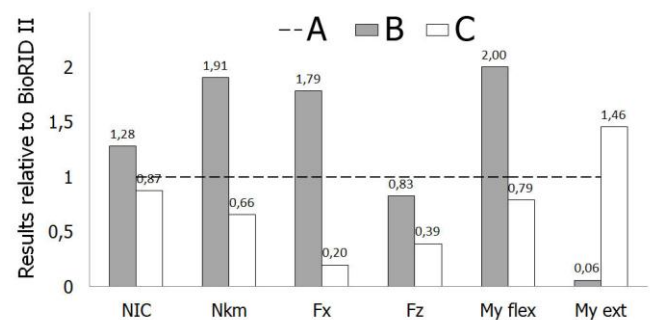


Figure 2 – load-parameters compared with BioRID-results

IV. DISCUSSION AND CONCLUSIONS

To address realistic limits for females in future, modifications of seat performance criteria (e.g. Nkm, NIC) should be applied due to the different anthropometry/characteristics of male and female bodies. Results also indicate that structural parts of seats seem to need modifications to suit male and female requirements. Furthermore, different seat-settings (e.g. backrest angle, headrest position) and posture (e.g. back position, head position) need to be investigated as setting C points out, that one seat can vary in results widely.

V. ACKNOWLEDGEMENTS AND REFERENCES

This study was funded by the European Commission as part of the ADSEAT project.

Contact: A. Gutsche (andreas.gutsche@tugraz.at, phone: +43 316 873 9401, fax: +43 316 873 9402); Affiliations: (1) Graz University of Technology; (2) R&D-Safety & Regulations, Faurecia S.A. Automotive Seating; (3) University and ETH Zurich.