

Chest Injuries of Vulnerable Road Users – Application of the THOMO Model to a Frontal Crash Setup

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ABSTRACT

The objective of the study is to check the influence of the seatbelt settings on the possible injury outcome, using an anthropometric model of the human thorax. Automotive industry faces a problem of changing profile of the customers. The population is aging. Biomechanical tolerance of the elderly people is different than of the younger car users, therefore the passive restraints settings (pre-tensioning force, belt force limiter) which would not harm the healthy person may lead to thoracic injuries in case of the elderly occupants. Additionally, currently used crash test dummies do not give a possibility to verify the effect of aging on the injury outcome. The research consists of series of numerical simulations, basing on the simplified human body model containing soft tissue organs, developed within the THOMO project (FP7, www.thomo.eu). The THOMO project interacts with the Global Human Body Models project (www.ghbmc.com), which aim is to obtain and maintain the world's most biofidelic human body models. Different settings of the passive restraints are being applied to the model, used in a standard EuroNCAP test simulation. The effect of the settings on the endurance of the rib structure is estimated using standard injury criteria for the thorax and measuring strain in the ribs. The results prove that settings of the belt pre-tensioner and belt force limiter, which can be sustained by younger occupants, may pose risk of injuries to the elderly and vulnerable car users. Basing on the demographical changes and the results of this research and many researches taking into account diminished biomechanical endurance of the aging occupants, it is recommended to consider variation of the passive restraints settings. It is yet another suggestion for introduction of the adaptive restraints.