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Editorial Open Access

Protection of Vulnerable Occupant Population in Traffic Incidents

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Editorial

Motor vehicle crash (MVC) related injuries have been effectively reduced over the past decades. However, field data analysis indicates not all occupants were equally protected under the current safety design. Comparing to mid-age and mid-size occupants, children, elderly, and obese occupants are at greater risk of severe injuries and death [1-3]. For example, with similar incidents, a 75-year-old occupant is, on the average, 3.87 to 6.7 times as likely to die as a 21-year-old male occupant. Moreover, older occupants are at greater risk of serious injury to all body regions [1]. As a result, vehicle safety designs should be specifically tailored toward these vulnerable populations for full-scale injury prevention.

The most widely used injury assessment tools in automotive industries include anthropometric test devices (ATDs), or dummies, as well as finite element (FE) human models. They were mostly developed for mid-sized male occupants. There are only a limited number of selections available to fulfill different anthropometric requirements (95 percentile male and 5 percentile small female ATDs). The children ATDs were developed by simply scaling down adult male ATD [4] as a result of lack of pediatric cadaveric data. Moreover, ATDs that can represent aging and obese conditions are currently not available.

Geometric, compositional, and material characteristics are the three key factors to study how these vulnerable populations injured differently than adult males in traffic incidents [2]. To take all these variations into consideration, subject-specific FE human modeling, which can accurately represent the geometric and compositional characteristics of occupants, is the best tool for injury mechanism study. At the current stage, the difficulties of developing a subject-specific human model includes time-consuming developing process and lack of biomechanical data for age/gender related materials properties and injury thresholds.

In summary, the protection for vulnerable occupant populations requires the development of corresponding injury assessment tool, i.e. ATDs and FE human models. The solution lies in the research that will help us better understanding age/gender related anthropometric characteristics, biomechanical behavior of biological tissues, and injury thresholds. In more advanced stages in the future, a set of FE human body baseline models can be developed and easily modified to represent occupants with different genders, a wide range of age and anthropometric size, as well as varying health conditions. These models will be further applied in automotive safety designs to achieve a full-scale protection equally for all occupants involved in MVCs.

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