

Finite Element Analysis of Changes in Deformation of Intraocular Segments by Airbag Impact in Eyes of Various Axial Lengths [Letter]

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Dear editor

Finite element analysis (FEA) has been widely used to understand the phenomenon of any biomechanical responses. It is really interesting to read and further discuss the paper by Tomohiro Ueno et al regarding Finite Element Analysis of Changes in Deformation of Intraocular Segment by Airbag Impact in Eyes of Various Axial Length.¹ The dynamic finite element simulation was run on different axial lengths of three types of eyes, myopic eyes, emmetropic eyes, and hyperopic eyes, with five different velocities, ranging from 20 to 60 m/s and time interval after the impact is 0.2 from 0 to 2 second. The subject (a three-dimensional model of eyes) in this study is more complete than for a previous similar study by Kobayasi et al² that was run on the surface of the eye-ball model, whereas Ueno et al employed more complete anatomical details of each component, consisting of the cornea, anterior chamber, lens, and vitreous, iris, and sclera, which could represent the clinical situation more accurately and ultimately affects the visualization of deformation results from FEA. We believe that the eye's morphology might have different significant results on the airbag impact. The anatomical details among age-groups in a study by Kearny et al³ showed that adults and children have significant differences, correlated with the body height. If we discuss the effect of the airbag, where children might be a passenger that still potentially receives airbag injuries, it could also continue to impact on deformities after the airbag strikes the occupant (child) and continues to expand. The FEA simulation could further explore the various possible passenger's profiles.

Furthermore, based on Parvez et al,⁴ the location of the airbag in a city car is varied, some of them might have a direct impact to the passenger's eyes, for example the driver's frontal airbag, passenger's frontal airbag, curtain airbags, and front side airbag. Therefore, we recommend the FEA simulation could adjust the direction of airbag impact based on the location, distance, and possible expansion rate to the passenger's eyes in further research. Overall, we congratulate all authors who have provided important information regarding the possibility of the greatest damage due to the airbag impact, which will be valuable information for the airbag industry to estimate the design as well as the expansion scheme.

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Disclosure

The authors report no conflicts of interest in this communication.

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