Clinical Ophthalmology

Dovepress
open access to scientific and medical research

Open Access Full Text Article

LETTER

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

Talitha Asmaria, Christina Safira Whinie Lestari, Monica Dwi Hartanti

Center for Biomedical Research, Research Organization for Health, National Research and Innovation Agency (BRIN), Cibinong Science Center, Cibinong, West Java, Indonesia

Correspondence: Talitha Asmaria, Center for Biomedical Research, Research Organization for Health, National Research and Innovation Agency (BRIN), Jl. Raya Bogor No. 490, Bogor Km. 46, Cibinong, West Java, Indonesia, Email tali001@brin.go.id

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 al[2] that was run on the surface of the eye-ball model, whereas Ueno at 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 at al[3] 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.

Acknowledgments

The authors would like to acknowledge all the researchers and Prof. Dr. Sunarno at the Center for Biomedical Research BRIN for his continued support. The authors would also like to convey gratitude to the research team of Ueno et al for their valuable research report.

Disclosure

The authors report no conflicts of interest in this communication.

Received: 19 March 2024
Accepted: 3 April 2024
Published: 15 April 2024

References

1. Ueno T, Fujita H, Ikeda A, et al. Finite element analysis of changes in deformation of intraocular segments by airbag impact in eyes of various axial lengths. *Clin Ophthalmol*. 2024;18:699–712. doi:10.2147/OPTH.S445253
2. Kobayashi A, Izaki R, Fujita H, et al. Finite element analysis of changes in tensile strain and deformation by airbag impact in eyes of various axial lengths. *Int Ophthalmol*. 2022;43(7):2143–2151. doi:10.1007/s10792-022-02609-7
3. Kearney S, Strang NC, Cagnolati B, Gray LS. Change in body height, axial length and refractive status over a four-year period in caucasian children and young adults. *J Optom*. 2020;13(2):128–136. doi:10.1016/j.optom.2019.12.008
4. Parvez MS, Rahman MM, Samykano M, Ali MY. Current advances in fabric-based airbag material selection, design and challenges for adoption in futuristic automobile applications. *Mater Today Proc*. 2023. doi:10.1016/j.matpr.2023.09.081

https://doi.org/10.2147/OPTH.S469660