Improving the Performance of Instant-fit Earpieces By Making Use of FE-Analyses

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Abstract

According to a report conducted by the World Health Organization (WHO), more than 466 million people suffer from hearing loss. Conventional hearing aids are sufficient for most patients, being constantly further developed and optimized - connecting the service of the hearing aid to the patient needs. Special interests are laid on digitalization and especially wearing comfort.

Hearing devices worn behind the ear (BTE) are equipped with earpieces, guiding the sound from the receiver behind the ear toward the tympanic membrane. The focus of the present work is on the receiver in the ear canal (RIC) supported with non-customized standard earpieces. Usually, non-customized earpieces for BTE and RIC devices are provided to the customer as soft silicone parts, so-called silicone domes. Although, silicone domes are well accepted in the hearing aid market, they are suffering from two main limitations: The domes are often perceived to be uncomfortable to wear over a prolonged time and having a non-consistent acoustic performance, due to uncontrolled acoustic leakage. Both limitations are seen as a result of a non-ideal fit of the silicone domes, as they are currently designed to the user's ear canal geometry.

The overall object of this work is the development of a better understanding of the interaction of a silicone dome in anatomically shaped ear canals. COMSOL Multiphysics® has proved to be an useful tool analyzing the interaction of mechanics between instant-fit earpieces and simplified ear canal geometries. The combination of COMSOL Multiphysics® Base Module, CAD Import Module, Material Library and Structural Mechanics Module works very well. At the beginning of the evaluation, the contact pressure, contact area and circumferential stresses are of particular importance. Based on a simplified simulation model, the first evaluation has been started with a 2D axisymmetric model.

Further development of the simulation towards anatomical shaped ear canals is a possible target to gain a better understanding of the interaction between a silicone dome and anatomically shaped ear canals. Another goal could be an optimized design with different sizes for an increasing wearing comfort and an increasing application range. Therefore, the definition of comfort and application range is indispensable. In addition, the model should be complemented by a 3D model towards an anatomical shaped ear canal.

Figures used in the abstract

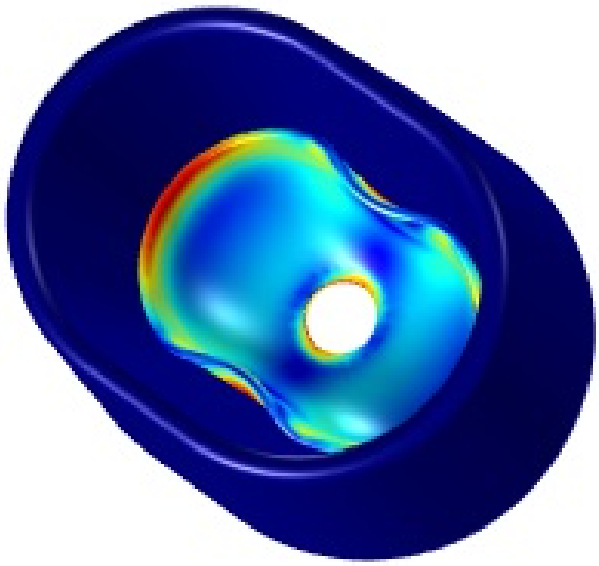

Figure 1: Top view of the interaction between a silicone dome and a simplified ear canal - plotted with COMSOL Multiphysics®. The lateral seal is in contact with the inner surface of the simplified ear canal. The plotted model shows the results of the von Mises stress.