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BIOMECHANICAL STUDY OF THE VERTIGINOUS SYNDROME USING THE FINITE ELEMENT METHOD TO IMPROVE VESTIBULAR REHABILITATION

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The vestibular system is located in the posterior portion of the inner ear and is a key to our sense of balance and movement. Any changes in this system can cause symptoms such as dizziness, blurred vision, imbalance and nausea, which are vertiginous syndrome indicators. Vertigo is reported as one of the most common symptoms in the world. It is considered the third most frequent complaint in medicine, transmitting a sense of inadequacy and insecurity [1].

One of the most efficient treatments of vertigo is the vestibular rehabilitation, which allows the improvement of the symptoms and the patient's suffering. Since this rehabilitation process is based on empirical maneuvres, the present work aims to provide further insights of the biomechanics of a vertigo episode, in order to improve these rehabilitation maneuvres.

A 3D geometrical model of the vestibular system obtained will be used to construct a computational mesh, differentiating the distinct biological structures and assuming for each one the material properties suggested in the literature. The numerical model will take into account the fluid content (homogeneous endolymph and discrete otoconia particles) and the fluid domain will be properly discretized. The vestibular components will be discretized using the finite element model and the fluid flow will be analyzed using the Smoothed Particle Hydrodynamics [2,3].

The complete model will be used to optimize the standard maneuvers, which will permit the reduction of the number of maneuvers and the intensity of the movements involved. Additionally, it will be studied if other kind of maneuvers are capable to force the migration of the otoconia particles, and consequently improving the balance symptoms.