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Vestibular rehabilitation in vertiginous syndrome using smoothed-particle hydrodynamics method for fluid simulation

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Abstract

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].

The aim of this work is to contribute to a better understanding on how the vestibular system works. This knowledge will help in the development of new techniques that will facilitate a more efficient rehabilitation. Vestibular rehabilitation consists in a set of exercises, known as maneuvers, which can reduce and even eliminate the symptoms of dizziness and imbalance associated with a vestibular disorder [2].

In this work, a three-dimensional model of the vestibular system, containing the fluids which promote the body balance, will be used. The smoothed-particle hydrodynamics (SPH) method will be used to simulate the fluid behaviour and the study of its interaction with the soft tissues of the vestibular structure will be an important step during the simulation. SPH is one of the computational methods used for simulating fluid flows and it is based in the lagrangian method, in which the elements are represented by particles and have constant

mass. This model will allow the simulation of the maneuvers of the vestibular rehabilitation in order to improve its results and the quality of life of patients suffering from vertigo.

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