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Clarification of the mechanical behaviour of spinal motion segments through a three-dimensional poroelastic mixed finite element model.

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Abstract
The purpose of this study is to clarify the mechanical behaviour of spinal motion segments through a proper numerical model. The model constructed can give correct information and provide medical fields with valuable guidance in solving clinical problems occurring in the spine. A three-dimensional poroelastic finite element model of spinal motion segments is constructed and a mixed formulation is introduced. The geometry of the model is automatically formed from a series of CT-scanning images. Vertebral column, intervertebral joint, facet joints and ligaments are all included in the model. The contact surface of facet joints is considered as the inclined boundary. Such inclination is imposed when the contact surface is under compression. Ligaments surrounding the vertebral body and the intervertebral disc are put into the model when they are under tension. Iteration is implemented in the computing process to meet such boundary characteristics of facet joints and ligaments. Prediction of the mechanical behaviour in the segment under long term creep loading, is demonstrated using the current algorithm. Results show that the model and corresponding numerical procedures developed here can simulate the mechanical behaviour of the spinal motion segments properly.

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