Simulation of mechanical trauma by finite element analysis in human mandible orthotropic

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Abstract
This study presented a finite element analysis in human mandible where the cortical bone was assigned as orthotropic material and was simulated a traumatic force. The mandibular neck was evaluated, in which presented high von Mises stress.

Key words: finite element analysis, morphology, trauma.

Introduction
The mandible is one of the bones more susceptible to fracture in Brazil\(^1\). The finite element analysis (FEA) is useful for simulation of mechanical trauma to the bone tissue\(^2\). The results allow us to understand how the stresses are distributed from mechanical traumas and which mandibular regions are more likely to receive treatment to stabilize fractures.

In literature, we found differences in the biomechanical responses in AEF, considering the mechanical property of the mandibular cortical bone as isotropic or as orthotropic. The orthotropy proved to be a property more precise to be applied in mandibular cortical bone in the simulation of masticatory loads\(^3\). Thus, the aim of this study was assess the stress generated by mechanical trauma in symphysis of the human mandible with orthotropic cortical bone in different positions of dental occlusion by finite element analysis.

Results and Discussion
The orthotropicity in mandibular compact bone structure associated to traumatic force at the mental region caused high deformation of mandibular body, resulting in two areas with high stress values in the mandibular neck. The lateral and posterior faces presented equivalent von Mises stress with major intensity in comparison to the other mandibular areas. Stress areas were well defined, with gradual decrease along the mandibular ramus, being the low values located at mandibular angle. This characteristic occurs due to the orthotropic material that presents more defined areas of stress in the regions with more stress sensibility according the kind of force\(^3\).

Conclusions
The mandibular cortical bone with orthotropic material assignment presented more defined stress areas. In this situation, the traumatic force in the mental region resulted in major stress values at the lateral and posterior faces of mandibular neck.

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References