



Bone strain analysis of mandibular neck in mechanical trauma simulation on human edentulous mandible

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Abstract

Once the mandibular neck fractures are common, especially in edentulous mandibles, the present study evaluated the behavior of strain occurs in the mandibular neck in edentulous mandible by finite element analysis.

Key words: jaw, mechanical trauma, finite element analysis.

Introduction

The elderly person has, in most cases, edentulous mandible, then a minimum mechanical trauma can result in a fracture. Often, the mandibular body can be reduced to half its height, in which regions such as the mandibular condyle lead to be extremely fragile¹. According to Schwartz-Dabney & Dechow², the mandibular neck is a region with low values of thickness and density and, therefore, is more likely to be fractured.

The finite element analysis is effective for locating and defining the regions of higher and lower strain. In this study, this analysis was applied to evaluate the bone strain of the mandibular neck in mechanical trauma simulation on human edentulous mandible.

Results and Discussion

The tomographic images of a human edentulous mandible and a human dentate mandible were segmented and the bone structure was selected in the Mimics software v. 17 (Materialise, Belgium). In Rhinoceros 3D 5.0 software we obtained the geometries of the two mandibles, with compact and cancellous bone. The construction of the finite element models were performed in Ansys v17 software. The compact bone and cancellous bone were considered isotropic. Restrictions were applied on the x, y and z axes in the mandibular condyle and mandibular fossa, bilaterally. In this condition, a magnitude of 980N load was applied on mandibular symphysis. Bone strain was analyzed.

The results showed that the maximum strain was not significant for a fracture in both mandibles, but in a dentate mandible, the intensity of strain was higher. We can relate the strain intensity differences with the dentate mandible resistance. We also observed higher strain located in regions of mandibular body in the edentulous mandible, that not occurring in dentate mandible. This also relates to increased strain of the dentate mandible.

Conclusions

The simulation showed that in mechanical traumatic force situation the presence of teeth result in high strain concentrated in the mandibular neck suggesting that have a higher resistance.

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¹ Scolozzi, P.; Richter, M. *J. Oral. Maxillofacial. Surg.* **2003**, *61*, 458-61.

² Schwartz-Dabney, C.L.; Dechow, P.C. *Am. J. Phys. Anthropol.* **2003**, *120*, 252-77.