

Mechanical characteristics of mandibular neck by trauma on human mandibular symphysis – a finite element analysis study

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Abstract

This study presented a finite element analyses in which were simulated traumatic forces in dentate and edentate mandibles. The von Mises stress in mandibular neck was evaluated with comparison between the mandibles. The edentate mandible showed more weakness in mandibular neck in comparison to dentate mandible.

Key words: finite element analysis, morphology, mandible.

Introduction

The elderly individuals presents morphologic changes in bone physiology and hence in its mechanical response to trauma. Studies showed that the bone is narrower in the mandibular neck, so this region has less bone strength, mainly, in elderly mandible¹. It is important to understand the biomechanics of edentulous mandibular fractures, mainly, to optimize treatment strategies for traumatic injuries.

Thus, the aim of this study was assess the stress distributed to mandibular neck by mechanical trauma on symphysis of the human elderly mandible by finite element analysis.

Results and Discussion

The traumatic force simulation in mental region caused a bone deformation response in mandibular body toward the posterior and inferior directions, both dentate and edentate mandibles. Thus, the energy dissipation from the impact region, which was calculated through von Mises stress distribution, presented similar behavior in the two cases. The mandibular neck was highly stressed in comparison to other region in mandible and implies that this region is a common area of fractures¹. In both mandibles, the high values of stress located at anterior, lateral and posterior faces of mandibular neck. The dentate mandible presented high stress values with minor area. On the other hand, the edentate mandible presented major stress areas with lesse stress values than dentate mandible. Although the static simulation did not demonstrated the graphical aspect of fracture, the morphological differences in mandibular neck ad condyle in this two situation were important to determine the results. These data suggest the edentate mandible weakness results in trauma in these structures¹, i.e. the major areas are affected and less intense stresses are enough to result in fracture.

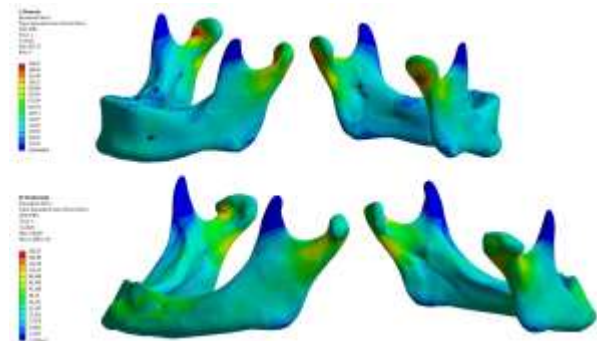


Image 1. Different views of equivalent von Mises stress in dentate and edentate mandible.

Conclusions

This FEA simulation showed major weakness of elderly edentate mandible in comparison to dentate mandible after the action of traumatic force in mental region.

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