PRINT ISSN : 0040-8891

The Bulletin of Tokyo Dental College
Vol. 47 (2006) , No. 4 :149-156

Stress Distribution in Maxillary Alveolar Ridge According to Finite Element Analysis Using Micro-CT

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(Received October 20, 2006)
(Accepted December 20, 2006)

Abstract: The purpose of the present study was to evaluate stress distribution by finite element analysis in an accurate model simulating trabecular bone using micro-CT. Dentulous and edentulous maxillary jaws of Japanese adult cadavers were used (5 sides each; total, 10 sides). Imaging was performed using a micro-CT, followed by reconstruction with 3-D images. Finite element analysis models were developed using the maxilla with average bone morphometry. A load corresponding to occlusal force was applied in different loading conditions, followed by evaluation of stress distribution. In dentulous maxillas, a load was applied in the dental axis direction to the first molar crown (LD). In edentulous maxillas, a load was applied directly to a circular area 4mm in diameter (LER0) to a cylinder 4mm in diameter and 10mm in height (LER10) corresponding to the first molar area. Stress was concentrated in cortical bone around the first molar, trabecular bone and cortical bone at the maxillary sinus base in LD, cortical bone of the alveolar ridge in LER0, and trabecular bone around the cylinder and cortical bone at the maxillary sinus base in LER10. LER0 showed a stress distribution markedly different from that in LD. Compared with LER0, LER10 showed a stress distribution close to that in LD. A model simulating trabecular bone allows a more accurate evaluation of stress distribution.

Key words: Maxilla, Micro-CT, Finite element analysis, Stress distribution

To cite this article:

Syuntaro Nomoto, Satoru Matsunaga, Yoshinobu Ide, Shinichi Abe, Toshiyuki Takahashi, Fumiaki Saito and Toru Sato: “Stress Distribution in Maxillary Alveolar Ridge According to Finite Element Analysis Using Micro-CT”. The Bulletin of Tokyo Dental College, Vol. **47**: 149-156 (2006) .

doi:10.2209/tdcpublication.47.149

JOI JST.JSTAGE/tdcpublication/47.149