Analysis of Probabilistic Response of Human Mandibular Trabecular Bone and Its Application to Oral Implant Surgery Simulator

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The authors have so far proposed a stochastic image-based homogenization method that considers the uncertainties in the material properties and image processing for microstructure modeling as well as miscellaneous errors in the experimental measurement. It was applied to the prediction of effective properties of human vertebral trabecular bone and the uncertainty parameter was calibrated through comparison with many published experimental data. In this paper, the calibrated parameter, which expresses the inter-individual difference, was extrapolated to the analysis of human mandibular trabecular bone and the mechanical response in the drilling procedure for oral implant surgery, because experimental results are lacking for human mandible differently from vertebra. The numerical results were utilized in the reaction force sensible implant surgery simulator, which is under development for dentists' educational use. To this end, the surgery simulator allows the users to experience variety of drilling operation cases virtually.

Keywords: Stochastic homogenization method, Trabecular bone, Mandible, Inter-individual difference, Oral implant