

Numerical Simulation of the Stress–Strain State of the Dental System

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We present mathematical models, computational algorithms and software, which can be used for prediction of results of orthopedic treatment. More interest issue is biomechanics of the periodontal complex because any prosthesis is accompanied by a risk of overloading the supporting elements. Such risk can be avoided by the proper load distribution and prediction of stresses that occur during the use of dentures.

In this regard, we developed the mathematical model of the periodontal complex and its software implementation. This model is based on linear elasticity theory and allows to calculate the stress tensor and displacement fields in periodont and jaw bone.

The input parameters for the developed model can be divided into two groups. The first group of parameters describes the mechanical properties of periodont, teeth and jaw (for example, elasticity of periodontal ligament etc.). The second group characterized the geometric properties of objects: the size of the teeth, their spatial coordinates, the size of periodont etc.

The mechanical properties are the same for almost all, but the input of geometrical data is complicated because of their individual characteristics. In this connection, we develop algorithms and software for processing of images obtained by computed tomography scan and for constructing individual digital model of the tooth-periodont-jaw system of the patient.

Integration of models and algorithms described allows to carry out biomechanical analysis on three-dimensional digital model and to select denture design.