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BASIC RESEARCH

Investigation of reverse torque effect on bone stress levels in peri-implantitis defects- finite element analysis

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Background: Different treatment options can be applied in the presence of advanced bone loss around implants. It is known that the use of reverse torque is a minimally invasive, time-saving and inexpensive technique for the removal of implant. It is not known whether the stresses that occur when removal torque force is applied, where the tolerance of the bone exceeds, and whether there is any damaged bone tissue due to the formation of micro-fractures in the bone-implant connection.

Aim/Hypothesis: The aim of this study was to investigate the effect of the reverse torque force on the stress distribution around bone surface in peri-implantitis bone defect by using 3D finite-element analysis.

Material and Methods: Four different design implants were placed in the maxillary and mandibular posterior area modeled by varying the elastic modulus for cancellous and cortical bone. A total of 32 models were obtained by creating around of each implant 3 different peri-implantitis defects and control group which is none defect around implant. Axial 10 Ncm removal torque force was applied to the occlusal node at the center of implants. The results were analyzed using maps of maximum principal, minimum principals and Von Mises stresses, and distributions.

Results: As a result of the analysis of different models; implant design, presence and variety of bone defects, and all bone type factors affected the torque force required to remove the implant. In the peri-implantitis models where the implant-bone contact is greater, the removal torque force and stress distribution were increased than other models. The differences in implant geometry affected the reverse torque force and had different stress distributions. According to the results of our study, stress distributions are concentrated in cortical bone compared to cancellous bone.

Conclusion and Clinical Implications: Since the results obtained in our study consist of mathematical examination of models, it gives information about certain conditions about general mechanism and materials. However, it is possible to have knowledge in natural and biological conditions in clinical applications. Therefore, although some results can be obtained as a result of the data obtained from analytical studies, further clinical studies are needed to evaluate these conditions.