The dynamic nature of abutment screw retightening: Finite element study of the effect of retightening on the settling effect.

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Abstract

STATEMENT OF PROBLEM: A fundamental problem in fully understanding the dynamic nature of screw loosening is lack of recognition of the entire process of screw tightening and retightening.

PURPOSE: The purpose of this study was to explain the dynamic nature of abutment screw retightening by using finite element methods to investigate the effect of the coefficient of friction and retightening on the settling effect.

MATERIAL AND METHODS: Precise computer models were designed of a Straumann dental implant, a directly attached crown, an abutment screw, and the bone surrounding the implant. All threaded interfaces were designed with a spiral thread helix with a specific coefficient of static and kinetic friction, and the surfaces were characterized as fine, regular, and rough. Abaqus software was used for dynamic simulation, which involved applying rotational displacement to the abutment screw and torque controlling during the steps of tightening, relaxation, retightening, and second relaxation and at different coefficients of friction. The obtained torque and preload values were compared to the predicted values.

RESULTS: When surfaces changed from fine to rough, the remaining torque and preload decreased, and the settling effect increased. Upon retightening, the remaining torque and preload increased, and the settling effect also decreased.

CONCLUSIONS: The reduction of the coefficient of friction contributes to increases in the preload and decreases in the settling effect. Retightening reduced the settling effect and had an insignificant effect on the preload. At high coefficients of friction, the retightening effect was intensified.

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PMID: 25749092 [PubMed - as supplied by publisher]
The dynamic nature of abutment screw retightening: Finite element study ... http://www.ncbi.nlm.nih.gov/pubmed/25749092