Natural frequency assessment of stability of root keeper magnetic devices

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摘要

Abstract

The aim of the study was to evaluate the potential for using natural frequency (NF) as an indicator for assessing the stability of a magnetic keeper device used in prosthodontic treatment. A three-dimensional finite element (FE) model of a root keeper-cement-dentine system was established for NF analysis. The model was first validated against a series of in vitro experiments. Then, NF values of the first vibrational mode of the FE model with various boundary conditions were calculated. The in vitro results showed that the measured NF values of the root keeper-incisor units decreased significantly ($p<0.01$) from 9.07±0.37 to 5.73±0.10 kHz when the units were embedded in simulated bony tissue. Results obtained from FE simulations demonstrated that the root keeper would fully loosen when the constant values of the spring elements were lower than 104 N-m−1. Furthermore, a linear increase in the NF values of the model was observed from 6.16 to 15.52 kHz, when the constant was increased from 104 to 107 N-m−1, and the values then reached a plateau. The results indicate that the NF value of a root keeper has the potential to be used for monitoring the stability of such a device.