Factors Influencing the Resonance Frequency of Dental Implants.

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Abstract

PURPOSE: Resonance frequency (RF) analysis has been used by several investigators to assess the boundary conditions of dental implants. However, a scientific investigation of the association between the structural condition of the alveolar bone and the dynamic behavior of dental implants has not yet been reported. The aim of this study was to assess the factors influencing the RF of dental implants using an in vitro modal analysis. MATERIALS AND METHODS: Resonant vibration within implants was induced by an impulse-force hammer. The induced vibration signal was subsequently detected using an acoustic microphone and analyzed by fast Fourier transform. The resultant data were further analyzed to test the statistical effects of the embedding-material boundary height, thickness, and density on the RF values of the sample implants. RESULTS: Significant changes ($P < .05$) in RF values were revealed for implants embedded within a high-density block when decreasing boundary height reached 6, 5, and 4 mm, at respective thickness increments of 10, 15, and 20 mm. For analogous low-density samples, significant changes ($P < .05$) in RF values were found when respective decreasing boundary height reached 6, 4, and 3 mm. CONCLUSIONS: Our findings indicate that boundary height, width, and density factors can influence the RF of dental implants and that a lower boundary density and greater boundary thickness can lead to more obvious RF changes.