邊界骨質狀態對人工牙根自然頻率影響之有限元素分析.

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Abstract

For years, radiographic examination has been the main clinical method for the assessment of the dental implant in vivo condition. However, the use of such method is limited for many applications due to its low sensitivity. As a result, it is thus difficult to diagnose in the early stages of bone losses. Therefore, there is a strong clinical demand for a novel non-invasive technique to evaluate objectively the status of the dental implant under various bone qualities. Thus, the goal of current study is to provide a preliminary numerical analysis of the vibrating behavior of a dental implant at implant-bone interface. A 3D cylinder-type titanium implant FE model was established, with physical dimensions of 3.75 mm x 10 mm. The implant was placed into a 10x10x15 mm3 section of bone. The natural frequencies of the FE model were calculated under different boundary levels and bone densities. Our results indicated that the modeled natural frequency decreased linearly ($r=-0.975$, $p<0.01$) from 17921 to 4966 Hz, with a decreased ratio of 72.3%, while boundary levels decreased 6.8 mm below the first thread of the screw. On the other hand, a linear relationship ($r=-0.996$, $p<0.01$) also found between the bone density and natural frequencies of the implant. Natural frequencies decreased linearly from 17921 Hz (without bone loss) to 641 Hz (90% bone loss) when the bone densities decreased. Our results supported that natural frequency analysis could be a useful clinical tool in the diagnosis during surgical process, and prognosis of implanted dental implant during the healing stages and subsequent routine follow-up care after the treatment.