Design of a stability-detecting device for dental implants

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Abstract

Resonance frequency (RF) analysis technology was used to design a dental implant stability detector. The device uses a miniature-sized electromagnetic triggering rod to elicit vibration in a dental implant. Vibrational signals were recorded via an acoustic receiver. To assess the in vivo performance of the test apparatus, animal models were used. Implants were placed in the left tibia of 12 rabbits using a conventional surgical procedure. Standard 3.2 mm x 8 mm implants were placed in each test tibia with pre-tapping cavities of 3.2 mm and 3.7 mm diameters to simulate either a 'well-fitting' or a 'loosely fitting' situation. The RF values of the test implants were detected by the newly developed device which was directly mounted on the healing abutments of the implants. The results showed that the RF values of the implants under well-fitting conditions significantly increased ($p < 0.01$) 3 weeks after surgery and reached a plateau at around 6-7 weeks. Meanwhile implants with higher initial RF values had shorter healing times and higher final RF values at the plateau. Based on these findings, it was concluded that the idea of using the current designed device for detecting the degree of bone healing during the osseointegration process seems feasible.