Irregular Bone Defect Detection and Device on Dental Implants

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Dental implants are generally used in edentulous patients. The key issue of this dental surgery is the effective osseointegration of implants with spongy bone and cortical bone and then they become a part of loading structure. Current osseointegration detection devices only offer overall evaluation without the information of location and orientation of bone defects. This study is to develop detection techniques to measure the quantity as well as to locate the orientation of imperfection around bone-implant interface based on resonance frequency analysis (RFA). A noncontact measurement technique is performed with acoustic excitation through a loud-speaker and displacement response via a capacity-type pick-up. In the first and second series experiments, RFA is applied to estimate the orientation and quantity of irregular bone defects on various in-vitro faulty models. The variation in RF not only locates the orientation and depth of defects but also reflects the change of boundary conditions surrounding the defective models. According to these results, the detection technique to locate irregular osseointegration is established. Furthermore, the detection device to this end is proposed as well. The proposed examining approach and device are promising and able to assist dentists in dental implant surgery.

Automatic Oxygen Delivery System for Premature Babies

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When an infant is born prematurely, there are a number of health risks. Among these are underdeveloped lungs, which can lead to abnormal gas exchange of oxygen or hypoxemia. Hypoxemia is treated through oxygen therapy, which involves the delivery of supplemental oxygen to the patient but there are risks associated with this method. Risks include retinopathy, which can cause eye damage when oxygen concentration is too high, and brain damage, when the concentration is too low [1]. Supplemental oxygen concentration must be controlled rigorously. Currently healthcare staff monitors infants' blood oxygen saturation level using a pulse oximeter. They manually adjust the oxygen concentration using an air-oxygen blender. Inconsistent manual adjustments can produce excessive fluctuations and cause the actual oxygen saturation level to deviate from the target value. Precision and accuracy are compromised. This project develops an automatic oxygen delivery system that regulates the supplemental oxygen concentration to obtain a target blood oxygen saturation level. A microprocessor uses a LABVIEW® program to analyze pulse oximeter and analyzer readings and control electronic valves in a redesigned air-oxygen blender. A user panel receives a target saturation level, displays patient data, and signals alarms when necessary. The prototype construction and testing began February 2010.

