

# **In vivo and in vitro natural frequency analysis of periodontal conditions, An Innovative Method**

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## **Abstract**

Abstract Title of Thesis: CLINICAL INVESTIGATION OF RESONANCE FREQUENCY IN HUMAN TEETH Author: Wang, Mao-Sheng Thesis directed by : Lee, Sheng-Yang Ph. D. Lin, Che-Tong Ph. D Currently in the field of clinical medicine, there is no effective equipment or method to evaluate and measure boundary conditions of periodontal tissue. Periodontal probe, radiography, PeriotestO and Periodontometry etc., are commonly used methods in the diagnosis and detection of periodontal disease. Unfortunately, these methods provide only limited quality of data, no precise quantity, which can lead to misinterpretation. The purpose of this study was to evaluate the possibility of using a new method to examine the attachment loss of periodontal tissue in terms of natural frequency. In this study, 1196 natural teeth including central incisor, canine, first premolar and first molar were first examined by conventional probing method. Attachment loss of 5 mm was adopted as an indication for periodontal disease. On the other hand, natural frequencies of these tested teeth were measured using a series of in vivo model testing experiments. The teeth were triggered into vibration by an impulse hammer (PCB Piezotronics,.Inc.), and the vibration response was received by an acoustic sensor. The frequencies were used to evaluate periodontal conditions and compared with the results obtained from the attachment loss measurements. Our results showed that there was no obvious difference in natural frequency among upper-lower-left-right quadrant of teeth, but instead, it showed a statistically significant decrease in natural frequency between teeth with periodontal disease. The natural frequency of anterior teeth (central incisor and canine) with periodontal disease was found to be at  $1.26 \pm 0.10$  kHz which is lower significantly (  $p < 0.01$  ) than that of healthy condition (  $1.34 \pm 0.18$  kHz ). On the other hand, the mean frequency for diseased posterior teeth (first premolar and first molar,  $1.22 \pm 0.13$  kHz) is also decreased significantly (  $p < 0.05$  ) as compared to healthy condition (  $1.27 \pm 0.18$  kHz ). Natural frequency analysis seems to be an effective method in measuring the periodontal condition of teeth. Moreover, it can serve as a non-invasive, non-destructive and minimum contact method for early quantifiable testing and prevention of periodontal disease. This test can give us an insight into a new vision.