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# Influence of Defect Depth on Resonance Frequency Analysis and Insertion Torque Values for Implants Placed in Fresh Extraction Sockets: A Human Cadaver Study

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## ABSTRACT

*Background:* Clinical studies show promising outcomes with implants inserted at the time of extraction. However, this often results in an initial bone defect at the marginal region which preferably should heal for an optimal function. Therefore, monitoring of these implants is vital.

*Purposes:* The aims of this study were to determine the initial stability of implants placed into fresh extraction sockets, and to explore the correlations between the peri-implant bone levels and implant stability parameters.

*Materials and Methods:* Six human cadaver mandibles including all natural teeth were selected for this study. All natural teeth were gently extracted, and 84 implants were immediately placed into fresh extraction sockets with five different implant depths. The maximum insertion torque values were recorded, and primary implant stability measurements were performed by means of resonance frequency analysis (RFA). The vertical distance between implant/abutment junction and the first bone-implant contact was recorded using a periodontal probe.

*Results:* It was found that the insertion torque and RFA were  $28.9 \pm 7$  Ncm and  $65.6 \pm 9$  implant stability quotient (ISQ), respectively, for 420 measurements from all 84 implants. Statistically significant correlation was found between insertion torque and ISQ values ( $r = 0.86$ ;  $p < .001$ ) for all implants. Both insertion torque and ISQ values dramatically decreased when the amount of peri-implant vertical bone defect increased.

*Conclusion:* The results of this study demonstrated a linear relationship between peri-implant vertical bone defect depth and RFA value. It is proposed that the RFA method is sensitive to detect changes of the marginal bone level and may be used to monitor healing of peri-implant bone defects.

**KEY WORDS:** human cadaver, implants, insertion torque, resonance frequency analysis, tooth extraction

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