# Biomechanical Evaluation of a Wide Diameter Bicon Dental Implant in Various Bone Conditions

by

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## ABSTRACT

An association between higher implant failure rates and regions of poor bone density, commonly found in the posterior maxilla and mandible, has been reported in the literature. Moreover, implant placement in posterior regions is often limited by anatomic changes due to edentulism, where implant design alteration may be an alternative for treatment planning. In this regard, using a short implant with a large diameter in anatomically compromised regions may provide further increase in implant stability and long-term clinical success. The purpose of this study was to evaluate the biomechanical response of the bone for a wide and short implant, (WSI) (6 mm in diameter $\times$ 5.7 mm in length) versus a narrow and long implant (NLI) (3.5 mm $\times$ 11 mm) in various bone densities through finite element analyses (FEA). Both implants are using Bicon Morse-taper and made of Ti-6AL-4V. The implants and their respective bone domains were graphically designed through 3-D CAD software. After mesh refinement, different cortical to trabecular ratios and elastic moduli were assigned to the bone domain's elements to reproduce various bone conditions (Types II-IV). Vertical and horizontal loads were applied to the top of the Morse-taper connected abutments of the two implants. Implant and bone stress and strain states were evaluated numerically for analysis. The results showed that the implants presented comparable strain distributions under vertical loads and that the WSI presented lower strain values when the horizontal load was considered. The stress invariant values were also lower for the WSI implant. Increased stress and strain values were found at lower bone densities, where these values were higher for the NLI in most cases. According to the results obtained by this computer-based analysis, it can be concluded that the WSI implant presented an overall better biomechanical force distribution than the NLI when horizontal forces were applied for the different bone densities analyzed and may be considered for implantation of anatomically compromised regions and regions of poor bone quality.