Effect of bone quality and prosthetic connection on stress distribution

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Abstract: Bone density is a determining factor in treatment planning, implant design, surgical approach, healing time, and primary stability during the prosthetic rehabilitation. The aim of this study was to analyze the influence of prosthetic connections and bone quality on stress distribution in implant-supported single prosthesis by means of 3-D finite element method. Twelve models were simulated using the 3-D computer graphics softwares SolidWorks 2010, Rhinoceros 4.0. Each model consisted of a bone block with different qualities (Type I, II, III and IV), an implant (4.0X10mm) by varying the prosthetic connection (external hex, internal hex and morse-taper) and a single crown. The models were imported into the finite element software, FEMAP 10.2, to have the meshes generated and the boundary and loading conditions established. A 200N-axial and 100N-oblique loading were applied on the occlusal surface of the crowns. The models were solved by the NeiNastran 9.2 software and the results were visualized by means of Maximum Principal Stress maps. Under axial loading, stresses were observed around the implant platform in the cortical bone and at the implant apex in the trabecular bone. Under oblique loading, high stresses were observed at the implant apex threads in the opposite side of the load application in bone type III and IV. It was concluded that the morse-taper implant showed the lower stress concentration; the external hexagon implant showed the highest stress concentration; the bone type III and IV showed the highest stresses.