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Acta Medica Iranica

2009;47(4) : 109-115

Effect of Taper on Stress Distribution of All Ceramic Fixed Partial Dentures: a 3D-FEA Study

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Abstract:

Statement of Problem: Mechanical failure of ceramic materials is controlled by brittle fracture, mostly occurred in tension. In 3-unit all-ceramic FPDs the connector area is considered to be at fracture risk because of tensile stress concentrations. **Purpose:** The aim of this FE analysis was to evaluate the effect of taper on stress distribution in all-ceramic FPDs. **Materials and Methods:** In this experimental study two 3-D finite element models of three-unit IPS-Empress 2 FPDs replacing mandible second premolar were created by means of finite element software. The digital images were obtained from CT scan of human skull. Abutment was reduced with 12 and 22 degrees of taper. The cement layer, PDL, cancellous bone and cortical bone were also modeled. Frameworks of core material were fabricated. A static load of 100 N was applied at mid pontic area. Resolved stresses were calculated according to the Von Mises criterion and principal stresses. **Results:** In both models stresses were concentrated at the connectors. The maximum stresses were lower in the model with larger taper. The maximum Von Mises stress was recorded at the connector region of the premolar and the pontic. In model with larger taper the patterns of stresses were also more distributed and less concentrated. **Conclusion:** The highest Von Mises and principal stress were recorded at the connectors. Tensile stresses developed at the gingival connector of premolar and pontic was higher than molar. The stress level in model with 22-degree taper was lower compare to 12-degree and the stress pattern was more distributed, lowered the risk of concentrations.

Keywords:

All ceramic crown

TUMS ID: 2338

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