How can stress be controlled in endodontically treated teeth? A 3D finite element analysis

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Abstract

The aim of this study was to analyze the stresses that develop by oblique and vertical forces in endodontically treated maxillary second premolars that were restored with resin composite. Additionally, in our study the effects of the different restorative approaches and use of different base materials on stress formation were analyzed using three-dimensional finite element stress analysis. For restoration, the models representing both cusp capping, palatal cusp capping, standard MOD restoration, and use of woven fiber in occlusal part were prepared. In all models, oblique forces caused more stress than did vertical forces. Materials with low elastic moduli cause high amounts of stress, whereas materials with elastic moduli similar to that of dental tissues cause low amounts of stress. Additional approaches such as cusp capping, functional cusp capping, and woven fiber use do not affect stress formation on the tooth after endodontic treatment.

Thus, it is logical that clinical studies focusing on endodontically treated teeth (ETT) reveal inferior outcomes compared to vital teeth192021222324, although recent studies could not find less tactile sensitivity of ETT compared to vital teeth which makes the "cherry stone" theory questionable, i.e. that the opening reflex for ETT is be delayed, involving heavier load input during routine mastication of hard. Endodontically treated teeth must be adhesively restored as quickly as possible not only to preserve sealing from coronal access but mainly to reduce fracture risk under functional loading. Operative endodontic procedures cause a decrease of rigidity of the tooth due to the pulp chamber opening and to the loss of one or both proximal ridges in posterior teeth. Endodontically treated teeth, however, can sometime be efficiently restored by adhesive techniques without a post. Fracture resistance depends on the adhesive material combination, type of restored tooth and shape of the residual cavitation.