

## Investigation of the preparation design on stresses resulted in ceramic inlays restored premolars

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**INTRODUCTION:** Ceramic inlays can be used on premolars requiring a class II restoration instead posterior composite resins, amalgam or gold inlays and offer a durable and aesthetic alternative. MOD inlays may increase the susceptibility to fracture. Therefore it is important to ensure optimal performance in selection of the adequate preparation design to reduce stresses in teeth structures and also in the restorations [1-3]. The aim of the study was to investigate the effect of preparation design on stress distribution in premolars with different class II and MOD cavity preparations restored with ceramic inlays.

**METHODS:** The study was performed on an upper first premolar, using a finite element analysis. The geometry of the intact tooth was obtained by 3D scanning using a manufactured device (Fig. 1).

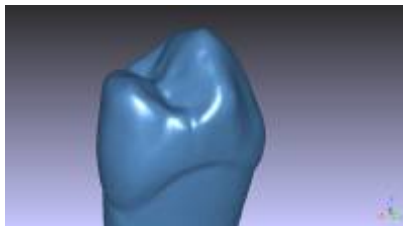


Fig. 1. 3D model of an upper first premolar after laser scanning.

With Rhinoceros modeling program the preparations and the appropriately inlays were designed. These were exported in Ansys finite element analysis software to be used for structural simulations. Twenty-two 3D models of maxillary first premolars, with the following designs of class II and MOD ceramic restorations were generated: eleven class II inlays with butt joint margins, eleven MOD inlays with butt joint margins, both with different tapers (between 0 and 10 degree). The model of the prepared tooth structure for class II was divided into 22568 elements connected at 36935 nodes, and the inlay into 4615 elements connected at 8378 nodes. For the MOD restored tooth, it was divided into 21337 solid elements connected at 35214 nodes, and the inlay into 5990 elements connected at 10809 nodes. Computational simulation of an occlusal load of 200 N was conducted, and stresses occurring in the ceramic

restorations, and teeth structures were calculated using Ansys finite element analysis software.

**RESULTS:** Occlusal load on inlays restored teeth produces stress surrounding the contact areas. In the teeth restored with ceramic class II inlays, the von Mises equivalent stress values were similar to those the intact tooth (Fig. 2). In the teeth restored with ceramic MOD inlays, the von Mises equivalent stress values were higher than in the intact tooth (Fig. 3). For the studied cases, the stress values were not significantly influenced by the taper of the preparation.

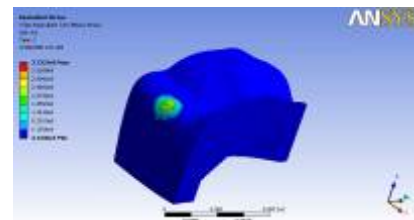


Fig. 2. Stress distribution in a class II inlay for a premolar.

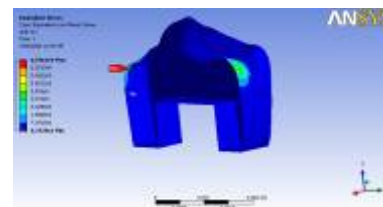


Fig. 3. Stress distribution in a MOD inlay for a premolar.

**DISCUSSION & CONCLUSIONS:** Within the limitations of the study, it was demonstrated that ceramic inlays on premolars prevent failure and produce a low stress values, even if MOD restorations are used. A taper between 0 and 10 degree of the preparation is not decisive for the stress values.

**REFERENCES:** <sup>1</sup> B. Dejak, A. Mlotkowski (2008) *J Prosthet Dent* 99:131-140. <sup>2</sup> R.B. Fonseca, A.J.F. Neto, L. C. Sobrinho, C.J. Soares (2007) *J Prosthet Dent* 98:277-284. <sup>3</sup> B. Dejak, A. Mlotkowski, M. Romanowicz (2007) *J Prosthet Dent* 98: 89-100.

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