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Stresses developed during clinical debonding of stainless steel orthodontic brackets

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ABSTRACT

The purpose of this project was to use finite element modeling to calculate and compare the peak stresses generated during clinical debonding of resin bonded brackets. Five debonding techniques were considered: tension, shear-peel, torsion loads on the bracket, wedging of the cement margin, and bracket temperature increase. The data is presented in terms of the relative potentials of the methods for causing enamel fracture. That is, in this idealized model, it was assumed that enamel failures were governed by maximum principal or shear stress. Therefore, all debonding loads and calculated stresses were scaled to correspond to unit peak principal stress or unit peak shear stress in enamel. Furthermore, it was assumed that cement cohesive failure was also governed by maximum principal or maximum shear stress and that adhesive failures were caused by interface normal or shear stress. Thus, for example, it was found that for 1.0 MPa of peak shear stress in enamel, tension and shear-peel debonding generate, respectively, 1.34 and 0.96 MPa of peak normal (tensile) stress in the cement at the enamel-cement interface. The interpretation of this information is that tension debonding is less likely to cause enamel damage than shear-peel loading if it is assumed that (1) the enamel would fail due to the high shear stress, and (2) the joint would fail at the enamel-cement interface because its normal stress limit has been exceeded.

KEY WORDS: Orthodontic brackets, Debonding, Dental stress analysis.

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