Biomechanical Behavior of Extensively Restored Premolars: Cusp Deformation, Marginal Integrity, and Fracture Resistance.

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Authors: Barreto BC, Van Meerbeek B, Van Ende A, Sousa SJ, Silva GR, Soares PV, Soares CJ

Abstract
PURPOSE: To study the biomechanical behavior of extensively restored premolars by determining the effect of the composite type, presence of cusp weakening, and compressive loading on the cusp deformation (CD), marginal integrity (MI), and fracture resistance (FR) of directly restored premolars.

MATERIALS AND METHODS: Forty premolars received Class II mesio-occlusal-distal (MOD) cavities and were divided into 4 groups (n = 10) in accordance with the two study variables: composite type (conventional: Filtek Z250 XT [Z250], 3M ESPE; low shrinkage: Venus Diamond [VD], Heraeus-Kulzer) and the presence of cusp weakening (with/without). Cusp deformation upon restoration was assessed using strain gauges during the restorative procedure and thereafter when the restorations were subjected to an occlusal load of 100 N. The samples were subjected to thermal and mechanical cycling. Epoxy resin replicas of the proximal tooth/restoration interfaces were made to analyze the marginal integrity (MI) using scanning electron microscopy. To determine the fracture resistance (FR), the teeth were loaded at a crosshead speed of 0.5 mm/min until fracture.

RESULTS: The conventional composite Z250 had higher CD, lower MI, and lower FR than the low-shrinkage composite VD. Cusp weakening had no influence on CD, but MI and FR decreased.

CONCLUSION: The low-shrinkage composite VD performed better in restoring extensively destroyed premolars than did Z250.
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