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Effects of Tooth Preparation Burs and Luting Cement Types on the Marginal Fit of Extracoronal Restorations

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Abstract

Purpose: Although surface roughness of axial walls could contribute to precision of a cast restoration, it is unclear how the roughness of tooth preparation affects marginal fit of the restoration in clinical practice. The purpose of this study was to describe the morphologic features of dentin surfaces prepared by common rotary instruments of similar shapes and to determine their effects on the marginal fit for complete cast crowns.

Materials and Methods: Ninety crowns were cast for standardized complete crown tooth preparations. Diamond, tungsten carbide finishing, and crosscut carbide burs of similar shape were used (N = 30). The crowns in each group were subdivided into three groups (n = 10) for use with different luting cements: zinc phosphate cement (Fleck's), glass ionomer cement (Ketac-Cem), and adhesive resin cement (Panavia 21). Marginal fit was measured with a light microscope in a plane parallel to the tooth surface before and after cementation between four pairs of index indentations placed at equal distances around the circumference of each specimen. Difference among groups was tested for statistical significance with analysis of variance (ANOVA) followed by Ryan-Einot-Gabriel-Welsch Multiple Range Test ($\alpha = 0.05$).

Results: Analysis of measurements disclosed a statistically significant difference for burs used to finish tooth preparations ($p < 0.001$); however, luting cement measurements were not significantly different ($p = 0.152$). Also, the interaction effect was not significantly different ($p = 0.685$). For zinc phosphate cement, the highest marginal discrepancy value (100 ± 106 μm) was for tooth preparations refined with carbide burs, and the lowest discrepancy value (36 ± 30 μm) was for tooth preparations refined with finishing burs. For glass ionomer cement, the highest marginal discrepancy value (61 ± 47 μm) was for tooth preparations refined with carbide burs, and the lowest discrepancy value (33 ± 40 μm) was for tooth preparations refined with finishing burs. For adhesive resin cement, the highest marginal discrepancy value (88 ± 81 μm) was for tooth preparations refined with carbide burs, and the lowest discrepancy value (19 ± 17 μm) was for tooth preparations refined with finishing burs.

Conclusions: Marginal fit of complete cast crowns is influenced by tooth preparation surface characteristics, regardless of the type of luting agent used for cementation. Tooth preparations refined with finishing burs may favor the placement of restorations with the smallest marginal discrepancies, regardless of the type of cement used.

The complete veneer crown is one of the most important restorations in the armamentarium of the restorative dentist;[1] however, a clinically recognized problem is that the surface character of a prepared tooth may prevent complete seating of the crown, resulting in hyperocclusion and inadequately sealed margins[2] and local periodontal tissue inflammation.[3]

The mechanism by which metal burs remove tooth structure differs from the abrading action of a diamond rotary instrument. As burs rotate, the flutes undermine dental tissue, and the amount removed is determined by the flute angle of attack, a basic feature of bur design. In the case of diamond burs, the abrasive particles pass across the tooth surface and plough troughs in the substrate surface. Tooth structure is ejected ahead of abrading particles, and the surface is transformed into a series of ridges running parallel to the direction of the moving particles. This axial wall roughness could lead to undersized