In vivo versus in vitro microtensile bond strength of axial versus gingival cavity preparation walls in Class II resin-based composite restorations.


**ABSTRACT**

BACKGROUND: Gingival margins in Class II composite restorations are a site of frequent failure. The purpose of the authors’ study was to compare the microtensile dentin bond strength of gingival and axial restored cavity preparation walls of Class II composite restorations under in vivo and in vitro conditions. METHODS: After obtaining informed consent, the authors placed Class II resin-based composite restorations in 14 premolar teeth from five patients, under in vivo or in vitro conditions. The teeth were sectioned to obtain rectangular specimens from axial and gingival walls with a surface area of approximately 0.5 square millimeters. The authors tested 85 microtensile adhesive samples from the 14 teeth on a testing instrument (Universal Instron, Model 125, Instron, Canton, MA) until failure. RESULTS: The mean (+/- standard deviation) microtensile dentin bond strengths in mega-pascals were as follows: in vivo axial, 36.5 (14.9); in vivo gingival, 17.6 (11.6); in vitro axial, 49.5 (13.9); in vitro gingival, 34.0 (13.1). A two-way analysis of variance found a statistically significant difference between in vitro and in vivo conditions and between the axial and gingival walls (P < or = .001). Eighty-eight percent of the fractured samples involved the adhesive layer as observed under scanning electron microscopy up to x2,500. Seventeen of the gingival samples and two of the axial samples debonded during the preparation phase and could not be tested. CONCLUSION: The dentinal microtensile strength of adhesive/resin-based composite bonded to the gingival wall was significantly weaker than the bond to the axial wall, and in vivo conditions produced significantly weaker bond strengths than did in vitro conditions. CLINICAL IMPLICATIONS: The dentinal adhesive bond of resin-based composite to gingival walls is significantly weaker and thus more subject to failure than the bond to axial walls. In vitro bond strength studies may overestimate the bond strength of adhesives in vivo, between a self-etch adhesive and total-etch adhesive at 2 weeks. The use of a flowable composite did not decrease postoperative sensitivity.

**COMMENTARY**

There is no doubt that the trend in restoring posterior teeth is moving from the use of amalgam to composite resin. Amalgam has proved to be a very forgiving restorative material. Resin-based restoratives require multiple steps in their placement, including adhesion and light-curing. The protocol of this study was well done, and the products used are those that have provided success in past clinical studies and have a proven track record. In fact, the light-curing times used in the study, 40 seconds from the buccal, lingual, and occlusal directions are probably greater than most clinicians use. I suspect that shorter curing times would have provided worse data for the gingival wall. This study should provoke some thoughts on how to maximize the longevity of Class II resin-based restorations. The data presented is unsettling and should be viewed with some important considerations, such as the fact that adhesive resin-based restorations will most likely have better survivability when the margins end on enamel. When the gingival margins end on dentin, these restorations must be evaluated thoroughly at every recall for any evidence of degradation of the gingival margin.

Effect of a crown ferrule on the fracture resistance of endodontically treated teeth restored with prefabricated posts.


**ABSTRACT**

STATEMENT OF PROBLEM: Root fracture is one of the most serious complications following restoration of endodontically treated teeth. PURPOSE: The purpose of this study was to compare the fracture strengths of endodontically treated teeth using posts and cores and variable quantities of coronal dentin located apically to core foundations with corresponding ferrule designs incorporated into cast restorations. MATERIALS AND METHODS: Fifty freshly extracted canines were endodontically treated. The teeth were randomly divided into groups of 10 and prepared according to 5 experimental protocols. Control group: teeth with custom cast post and core; 0-mm group: teeth without coronal structure (no ferrule); 1-mm, 2-mm, and 3-mm groups: teeth with 1 mm, 2 mm, and 3 mm of remaining coronal tooth structure (1-, 2-, and 3-mm ferrule), respectively. All specimens in 0-mm through 3-mm (noncontrol) groups were restored with a prefabricated post (Screw-Post) and composite resin (Z100™; 3M™ ESPE™, St. Paul, MN) core located superior to the different tooth structure heights. All teeth were restored with complete metal crowns. The fracture resistance (N) was measured in a universal testing machine at 45 degrees to the long axis of the tooth until failure. Data were analyzed by 1-way analysis of variance and Tukey test (alpha = 0.05). RESULTS: Significant differences (P<.001) were found among the mean fracture forces of the test groups (control group: 818.2 N; 0-mm, 1-mm, 2-mm, and 3-mm groups: 561.0 N, 627.6 N, 745.3 N, and 907.1 N, respectively). When the mode of failure was evaluated, all failures in the control group occurred due to root fracture, and all failures in the 0-mm group occurred due to core fracture. The majority of failures in the other groups occurred due to crown cementation failure. CONCLUSION: The results of this study showed that an increased amount of coronal dentin significantly increases the fracture resistance of endodontically treated teeth.

**COMMENTARY**

When restoring endodontically treated teeth, the concept of a ferrule (especially in the anterior region where most teeth have occlusion at 45 degrees from the long axis of the tooth) has been a benchmark. This study clearly demonstrates the importance of a ferrule when the preparation of an endodontically treated tooth extends beyond the margins of the tooth fracture. Increasing the length of the ferrule design in crowns had a significant effect on the fracture resistance of the endodontically treated teeth restored with a passively cemented, prefabricated post with a composite resin core.

In the past 5 years, there has been an increase in the use of fiber posts. I have seen many articles with an anterior tooth fractured at the gingival line that is then restored with a fiber post and a composite core with total disregard for ferrule design. These restorations will fail. Of more importance is that when these restorations fail, the blame will be on the post, not poor treatment planning. Planning a ferrule of at ≥ 1.5 mm to 2 mm will contribute to clinical success when restoring endodontically treated teeth.