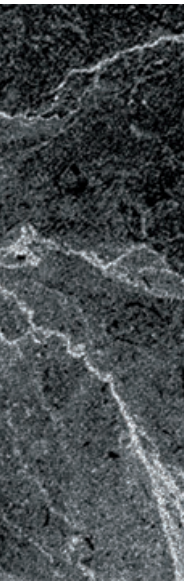

Ask the Experts

FERRULES FOR ENDODONTICALLY TREATED TEETH

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QUESTION: After preparing an endodontically treated tooth for a crown, there frequently is not much tooth structure left. How much remaining tooth structure ("ferrule") is required for a predictable prognosis in these situations? Can you provide some clinical guidelines?

ANSWER: Numerous articles have discussed the appropriate ferrule height for preventing restorative complications; however, we have not yet seen any definitive clinical recommendation.

Eissman and Radka (1987) explained the importance of the ferrule effect for preventing tooth fracture and recommended a ferrule height of at least 2 mm.

Libman and Nicholls compared the effects of different ferrule heights (0.5, 1.0, 1.5, and 2.0 mm) of a maxillary central incisor under fatigue loading. They found that a minimum 1.5 mm ferrule height significantly improved crown resistance. This in vitro study tested the breakage of the cement seal (which could lead to secondary caries, crown dislodgement, or tooth fracture) in a clinically relevant manner using dynamic repetitive loading.

Although tooth fracture is the most common clinical failure mode of the endodontically treated tooth, breakage of the cement seal was investigated as an initial restorative failure that is clinically invisible. This invisible cement seal breakage might cause the subsequent visible clinical failures, such as crown dislodgement or tooth fracture.

Sorensen and Engleman compared different ferrule designs and found that the ferrule is effective only when the walls are nearly parallel. This research proved that the quality of the ferrule is as important as its quantity.

Is a 2-mm ferrule height required at all four surfaces? Unpublished research done at the University of Washington compared the effect of ferrule at the proximal surfaces of maxillary central incisors. There was no difference of crown resistance with or without ferrule at the proximal surfaces. In other words, if adequate ferrule is present at the buccal and lingual surfaces, the proximal ferrule might not be important for retaining the crown.

Junge et al. compared different crown cements with compromised ferrule height (1.0 mm) with cast gold dowels and cores. Their results indicated that both zinc phosphate and resin-modified glass

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DOI 10.1111/j.1708-8240.2009.00278.x

ionomer cement had immediate seal breakage with fatigue loading with the compromised ferrule height. In contrast, resin cement had no breakage under the same conditions.

Other research results (Hsu et al. and Goto et al.) also showed that total amount of bonding area between dowel–core and tooth structure significantly influenced crown resistance. Based upon these in vitro studies, the type of cement using for both dowel–core and crown might significantly affect the longevity of the restoration and tooth.

Although there is insufficient scientific support for making a definitive conclusion of this issue, it seems prudent to accept 2 mm of parallel ferrule height at the facial and lingual surfaces as a clinical minimum to help ensure long-term dowel and core survival beneath a crown restoration.

The ferrule height (i.e., the amount of remaining vertical coronal tooth structure) is one of the most critical factors for restoring the endodontically treated tooth, but several other critical factors contribute to the eventual success or failure of the restorative treatment, including: (1) remaining coronal horizontal tooth structure (ferrule width), (2) orientation (parallelism) of the ferrule, (3) dowel and core materials, (4) cement materials, and (5) definitive crown materials.

Because the majority of ferrule research was done using maxillary central incisors, these guidelines should be limited to anterior teeth. Further research is needed to formulate ferrule guidelines for the posterior teeth.

SUGGESTED READING

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Editor's Note: If you have a question on any aspect of esthetic dentistry, please direct it to the Associate Editor, Dr. Edward J. Swift Jr. We will forward questions to appropriate experts and print the answers in this regular feature.

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