

QUESTION 2

When restoring endodontically treated fractured anterior teeth with a full-coverage restoration, what criteria are used to determine the ideal treatment?

Background to the Issue

When restoring endodontically treated fractured teeth with a full-coverage restoration, 2 main requirements must be met.

Preparation Height

First, a sufficient amount of preparation height (ideally 3 mm, as measured from the interproximal finish line¹) must be available to provide adequate retention and resistance form for the final restoration. When a tooth has fractured, leaving less than 3 mm of height, the preparation can be lengthened by the addition of core material. The core material is usually secured to the tooth by a cast post with an indirect technique or by a titanium or fibre post with a direct technique.²

Alternatively, the preparation height can be increased by lowering the finish line in an apical direction. When the margins are “dropped” in this way, care must be taken to not impinge on the soft-tissue attachment of the biologic width. Consequently, this technique is favoured when placement of a supragingival finish line is possible (i.e., on teeth with clinical recession). When there is no evidence of clinical recession, then crown-lengthening surgery is required to apically displace the soft-tissue attachment and thus increase the preparation length.

Another means to lengthen a preparation with inadequate initial height is through a combination of “subtractive” crown-lengthening surgery and “additive” core build-up technique. This method simultaneously increases the preparation height in

the apical and coronal directions. Similarly, combining orthodontic forced eruption with crown-lengthening surgery simultaneously increases preparation height in both apical and coronal directions.

Ferrule Effect

The second requirement in restoring endodontically treated fractured teeth with a full-coverage restoration is ensuring that the final restoration has adequate ferrule effect. Sorensen and Engelman³ defined the “ferrule effect” as the 360° metal collar of the crown that encircles the prepared, parallel walls of dentin down to the shoulder of the preparation. This collar increases the resistance provided by the extension of the dentinal tooth structure.⁴

Libman and Nicholls⁵ used fatigue loading to compare the effects of different ferrule lengths of a maxillary central incisor. They found that the initial failure, which was clinically “invisible,” was breakage of the cement seal. This failure eventually led to the “visible” failures of cement leakage, secondary caries, crown dislodgement, and post and tooth fracture. They concluded that a minimum of 1.5 mm of ferrule height is needed to improve crown resistance.

When no ferrule is present, the occlusal forces are resisted exclusively by the post, which may eventually fracture or loosen. Therefore, 2.0 mm of ferrule length is recommended as a clinical minimum under crown restorations for long-term post-and-core survival.



Figure 1: Patient requiring anterior reconstruction after tooth 13 fractured off at the gum line.



Figure 2: Composite cores are made to the future incisal edge position.



Figure 3: Tooth 13 has insufficient ferrule and will be restored with a bonded fiber post and composite core.



Figure 4: Short clinical crown with coronally positioned gingival margin. Crown lengthening surgery is required to obtain ferrule and improve tooth proportions.



Figure 5: Final restoration with adequate ferrule and apically repositioned gingival margin.



Figure 6: Final restorations have harmonious gingival levels and good proportion.

Management of the Issue

When there is insufficient ferrule (less than 2 mm of sound tooth structure), clinical crown-lengthening and/or orthodontic forced eruption may be required. When deciding which of these treatment options to use, several factors must be considered, specifically, esthetics, root shape, crown-to-root ratio, probing depths and treatment time.

There are 2 common methods of obtaining sufficient ferrule: dropping the crown margins or forced eruption with surgery.

Dropping the crown finish line in an apical direction increases the preparation height at the gingival third and creates an adequate ferrule. This may require crown-lengthening surgery to apically reposition the supracrestal attachment apparatus and to thereby maintain biologic width.

However, obtaining ferrule in this way necessitates a compromise in the esthetic result, because of altered gingival levels, tooth length and proportion, as well as a compromise in the biologic outcome, resulting in decreased clinical attachment.

Consequently, a key factor in treatment planning will be the desired gingival esthetics (Figs. 1 to 6). The ideal clinical situation for crown lengthening is represented by a tooth with the following characteristics:

- inadequate ferrule height
- short clinical crown with long roots
- coronally displaced gingival margins
- width/length ratio that is less than ideal.

The second method to obtain adequate ferrule, which is used when the tooth proportions and gingival levels are ideal, combines crown-length-

ening surgery with forced eruption. The forced eruption moves the gingival levels and the attachment apparatus coronally. The incisal edge can then be reduced by an amount equal to the extrusion, which results in a shorter crown. Afterward, crown-lengthening surgery can simultaneously provide ferrule and restore gingival height, tooth length and tooth width/length ratio to their original levels. ✦

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*Dr. Ceyhan will be a co-presenter at the Jasper Dental Congress with Drs. Lorne Kamelchuk and Bruce Yaholnitsky. Their session, titled *Restorative Treatment Planning of Esthetic Dilemmas Using an Interdisciplinary Approach*, will be presented on Saturday, May 26.*

References

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