Foundation restorations for pulpless teeth
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Purpose
The purpose of this clinical update is to assist the clinician in selecting the materials and techniques appropriate for the restoration of endodontically treated teeth that require a full coverage restoration.

Introduction
The endodontically treated tooth requires special restorative consideration because it has shown a proclivity for fracture, and usually has lost a considerable amount of tooth structure due to caries, endodontic therapy, and/or previous restoration (1). When restoring endodontically treated teeth the following factors should be assessed (2):

- Good apical seal
- No sensitivity to pressure
- No exudate
- No fistula
- No apical sensitivity
- No active inflammation

Using a post system to retain a core, over which a crown can be placed, is often necessary when inadequate coronal tooth structure remains. A unique balance exists between maximizing retention of the post and maintaining resistance to root fracture. Resistance to root fracture is directly related to the thickness of remaining dentin, especially in the buccolingual direction (3). The amount of alteration, the location of the tooth, its current morphology and the manner in which it is restored, all will affect the degree to which dentin is susceptible to fracture (4). Six features of successful design when creating a post space are (2):

1. Adequate apical seal. At least 45 mm of gutta percha should remain.
2. Adequate post length: a) optimum length is 2/3 to 3/4 of the root length. b) post length at least 1/2 the length of the root contained in bone.
3. Minimal canal enlargement.
4. Positive horizontal stop in order to minimize wedging.
5. Vertical wall to prevent rotation.
6. Extension of the final restoration margin onto sound tooth structure.

Indications for cast post and core
Tooth reduction for an esthetic crown combined with the dentin lost during access preparation usually leaves minimal coronal foundation for retention of an artificial crown; thus the cast post and core is usually the coronoradicular stabilizer of choice for single-rooted teeth and premolars (5). During preparation for a custom-cast post and core, gross undercuts in the pulpal chamber are removed or blocked-out with cement to ensure a path of insertion. Increasing the diameter of the post does not provide a significant increase in the retention of the post, however, it can increase the stiffness of the post at the expense of the remaining dentin and the fracture resistance of the root (3,4). The cast post and core should be passively fitted to the prepared root canal space and designed to resist rotational forces (5).

Techniques of fabricating cast post and cores
A reliable method for fabricating a custom cast post and core is direct fabrication of the pattern utilizing autopolymerizing resin. The tooth is prepared for the crown after the existing restorations, dental caries, and weakened tooth structure are removed; the post space is then prepared. In vivo studies have suggested that clinical success of posts is directly proportional to their lengths; so it is rational to prepare a post channel as long as is consistent with anatomic limitations while maintaining 4 to 5 mm of apical gutta percha seal (1,6). The post space should provide resistance to rotation of the dowel core. If the configuration of the prepared canal is circular in cross section, a keyway should be placed within the canal (1,7). A positive seat for the core at the opening of the post-space is desirable to prevent overseating of the dowel, which may wedge the root and cause vertical fracture (7).

Alternatively, the post space and remaining tooth structure can be impressed with an elastomer and the resultant cast used to fabricate the custom cast post and core. This indirect method conserves chair time by delegating pattern fabrication to a dental laboratory technician. An accurate impression of the prepared post space is a challenge. Impression material must be injected in the post space and distributed by a spiral paste filler to capture the internal morphology of the canal (1,2). A rigid object such as wire, paper clips or plastic sprues is inserted in the canal before the initial setup of impression material to strengthen this impression and minimize potential for distortion.

Prefabricated posts
The use of prefabricated posts with a direct core reconstruction is often regarded as the representative method of choice for restoration of the pulpless molars with substantial loss of tooth structure (1,5). There are numerous types of prefabricated post systems available; however, there are six categories of commercial systems available. These are as follows (2,3):

- Tapered, smooth posts, such as Endo-Post (Kerr), Filpost (Vivadent)
- Parallel-sided, serrated, and vented posts, such as Para post (Whaledent), Triax (Whaledent).
- Tapered, threaded posts, such as Dentatus classic post (Weissman), Ventra-post (Ellman).
- Parallel-sided, threaded, split-shank post such as Flexipost (Essential Dental Systems).
- Parallel-sided threaded post such us Radix Anchor (L. D. Caulk)
There are several luting agents available to the clinician. They include zinc phosphate, polycarboxylate, glass ionomer, resin modified glass ionomer, and resin cements. Filling the canal with cement will avoid air entrapment and ensure a uniform cement lute. A lentulo spiral is helpful to ensure cement is introduced to the apical extent of the post space; however, few cements provide adequate working time for its use. Zinc phosphate cement is often the cement of choice as it has an extended working time and high strength (1). The use of resin based cements for post and cores should be restricted to situations where minimal retention is available. Resin cements have demonstrated a tendency for increased dimensional change with water absorption that may predispose the root to fracture (1).

References:

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