The classification of single-rooted, pulpless teeth

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This paper draws attention to the important role of supragingival tooth structure in providing resistance to displacing forces, particularly transverse forces, on crown posts. Evaluation of the success rate of crown posts has indicated that remaining tooth structure and post space configuration should be taken into consideration during treatment planning. To facilitate the recording of, treatment planning for, and communication about the restoration of pulpless teeth, a simple classification of the remaining tooth structure is proposed. (Quintessence Int 1991;22:939-943.)

Introduction

The reduction of remaining supragingival tooth structure when pulpless teeth are restored has been discussed by a number of authors. From the time of Fauchard to Adelson, crown removal was the accepted starting procedure; this has remained in use in some parts of the world, although several authors have suggested that supragingival structures should be preserved.

Preservation of tooth structure has been suggested for several reasons: (1) the length of the post space is extended, (2) the casting is allowed to surround the root, thus preventing fracture, and (3) the ability to resist loads is improved. Nowhere does the literature suggest that remaining tooth supragingival structure resists transverse forces, but tooth structure always contributes to resistance and retention.

Significance of transverse forces

Transverse forces have only recently been identified as being the most destructive forces at the crown post-root interface.

A review of the literature regarding the retentive capacities of posts of varying length, diameter, and design showed that most of the "retention" evaluation has been carried out in tension. Threaded posts (Kurer Anchor System, Teledyne Getz) were most resistant to axial forces. Two studies evaluated the effects of forces in torsion. Axially resistant threaded posts proved to be at least as resistant to torsional forces, even without a rotation lock, as the other posts tested.

Yet a small failure rate of threaded posts of adequate length, in which both axial and torsional forces were effectively resisted by the threads and by rotation locks, has continued to be observed. In addition, threaded posts acting as overdenture retainers (Kurer Press Stud overdenture retainer, Teledyne Getz) or as fixed partial denture abutments, which receive no torsional forces, continue to exhibit a failure incidence that is not expected, although their superior resistance to axial and torsional forces has been established.

Assuming that an appropriately mixed cement is used, the foregoing observations suggest that it is forces in the transverse plane that are the most destructive of the integrity of the crown post-root unit, because the above-described posts are highly resistant to forces in the other two planes (Fig 1).

Evaluation of successful restorations

Sorensen and Martinoff evaluated 1,273 endodonti-
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Fig. 1 The directions of forces that crowns posts must resist.

Fig. 2 Classification of pulpless teeth.

cally treated teeth retrospectively and observed that cast, parallel-sided, serrated dowels, no matter what the type of core, record the highest success rate. When teeth were restored with a post equal to or longer than the crown, the success rate exceeded 97%.

Most significantly to the current topic, they found that cast dowels and cores displayed a higher failure rate than did teeth without intracoronal reinforcement. One possible explanation for this observation is that the amount of remaining coronal tooth structure may have varied substantially throughout the series. Another explanation may be that experienced operators can better judge when sufficient tooth structure remains and when reinforcement with a post is not required.

One third of the failures of cast posts resulted from root fracture. Because the failure rate was so small (1%), it would be difficult to attribute root fracture to any specific cause.

In a retrospective study such as the one by Sorensen and Martinoff, the amount of remaining supragingival tooth structure usually has not been recorded, nor can it be meaningfully assessed radiographically. In their study, when the operator judged the remaining tooth structure not to require a post, the failure rate was lowered. The evaluation of remaining supragingival tooth structure is therefore a factor of major importance in the treatment planning of the restoration of pulpless teeth. For this reason alone it is most important that a simple means of observing and recording remaining tooth structure be developed, so that when the success rate of any given treatment modality is assessed, comparisons can be made easily.

Classification

A classification of pulpless teeth needing posts and cores is presented. This need is related to the amount and retentive capacity of tooth structure available to offer resistance and retention. This system should aid in diagnosis and treatment planning by defining the problem in terms of remaining tooth structure. Discussion and recording of the existing clinical situation relating to the restoration of pulpless teeth will be simplified by use of a common terminology. Five classes of pulpless teeth needing internal support are described (Figs 2 to 4).

Class 1

A tooth in this class has sufficient supragingival tooth structure to prepare a normal crown preparation (Fig 2).
The function of the post, if one is required, is to support tooth core structure. Post retention is no problem, because there are no forces acting directly on the post. The post is a means of transmitting forces, which it has received through the dentinal core from the crown, to the root.

Two aspects of design must be considered: (1) The post and the remaining tooth core structure must be in contact to enable the post to absorb forces transmitted through the dentin; (2) the root must be capable of absorbing any forces transmitted by the post. Any post placed in a root weakens it, but usually a root, cement, post and core, and crown form a unit strong enough to function effectively.

**Class 2**

A tooth in this class has insufficient tooth structure to prepare a normal core preparation, but there is sufficient tooth structure remaining to make a suitable core by supplementing the remaining tooth substance (Fig 2). Even when the remaining dentin is minimal, small remnants may be incorporated into the preparation.

**Class 3**

This class involves a tooth in which only the root remains (Fig 2). Apparently excellent retention in the root canal will rarely be more than adequate. Hence it should be supplemented by means of a collar, coping, or ferrule, which will strengthen the root. In some cases, the gingiva should be reflected and bone removed to expose sufficient root structure for the crown to encircle.

**Subclassification of classes 1, 2, and 3**

**Length.** The length of the post space, and hence the length of the post, is a significant factor in retention, particularly the resistance of the post to axial displacement (Fig 2). A post space of 8 mm is described as "long," a space of 5 to 8 mm as "medium," and one of less than 5 mm as "short." These descriptions are based in relationship to the use of posts offering mechanical resistance (ie, threaded posts). The appropriate descriptions when plain posts are being used would be 10 mm as long, 7 to 10 mm as medium, and less than 7 mm as short.

**Taper.** Taper is a second factor affecting retention, particularly resistance to axial displacement (Fig 2). A parallel post space is type A, one that is tapered in its coronal one quarter is type B, and one that is tapered in its coronal three quarters is type C.

Thus, when there is no supragingival tooth structure remaining, and a 6-mm post space is tapered in its coronal three quarters, it is described as a "medium-rooted, Class 3, type C."

**Class 4**

A tooth in Class 4 has an intraosseous fracture of the root (Fig 3). This class is subdivided into three types: A, B, and C.

**Class 4, type A.** Fracture in the coronal third of the root, which is treated either as in type B, in which case care must be taken to ensure that no communication with the oral cavity exists, or by removing the coronal fragment and orthodontically extruding the root (Figs 4a to 4d).

**Class 4, type B.** Fracture of the middle third of the root, which may be treated by uniting the apical and
Figs 4a to 4d  Example of treatment of a Class 4, type A, tooth.

Coronal fragments of the fractured root with a post. Sometimes, in young patients, the only treatment required is to monitor the tooth’s vitality.

Class 4, type C. Fracture of the apical third of the root, which is treated by an apicoectomy. This procedure is well documented and commonly performed.

Class 5

In this class, periodontal disease is severe; nevertheless saving of a root is considered essential. An intraradicular, endosseous splint is required to stabilize the root prior to restoration (Fig 5).
Conclusion

A classification of single-rooted, pulpless teeth requiring internal strengthening has been presented. It is hoped that this will be helpful in the diagnosis and treatment planning of such teeth and that communication about the remaining tooth structure requiring restoration will be more precise.

The application of this classification may at first be limited to the designation of Classes 1, 2, and 3, and this alone will be valuable. Any new classification is initially an intrusion and should therefore be kept as simple as possible to facilitate its acceptance. In time, this classification may be modified and extended.

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References