



RESEARCH ARTICLE

CONSIDERATIONS IN RESTORING AN ENDODONTICALLY TREATED TEETH- A REVIEW.

Dr. Sreegowri, Dr. Prasanna Keshava B, Dr. Nishi Jayasheelan, Dr. Harish Kumar Shetty, Dr. Vidhyadhara Shetty.

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Abstract

A tooth that has been pulpally involved is often rehabilitated with endodontic treatment. It is usually the consequence of caries followed by pulpal infection or traumatic damage to a tooth. Trauma and decay are mostly associated with an extensive loss of tooth structure, necessitating restoration of the tooth with a complete crown for esthetic and functional rehabilitation. If endodontic therapy is unavoidable, conservation of tooth structure is of paramount importance. Otherwise, the cumulative loss of tooth structure from caries, trauma and endodontic procedures combined with the loss of structural integrity contribute to the fracture of the tooth.

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Introduction:-

Endodontic therapy has provided dentistry with the ability to retain teeth that just a few decades ago would have been extracted without hesitation. Improvements in instruments, techniques and modern pharmacologic agents have led to a high success rate of 95%, as reported by Ingle. When the endodontic treatment has been completed, however, questions arise as how to restore and protect the tooth structure that remains during mastication and functional loading.

The endodontically treated tooth must be fortified in such a way that it will withstand both vertical and lateral forces and not be subject to fracture. In cases where tooth structure is relatively intact, conservative approaches, such as composite restorations for anterior teeth and full coverage restorations for posterior teeth are satisfactory.

The objective of post endodontic restoration is to restore the normal tooth structure, function and esthetics. The need for careful post endodontic restoration is reflected in the fact that most teeth treated endodontically develop problems or are lost because of restorative difficulties, than because of failure of the root canal treatment itself. A successful endodontic treatment has to be complemented with an adequate post endodontic restoration to make the pulpless tooth function as an integral part of the masticatory apparatus.

The endodontically treated teeth need special considerations in their restoration. Restoration of endodontically treated tooth replaces missing tooth structure, maintains function and esthetics and protects tooth against fracture and infections. The final restoration depends on important governing factors like remaining amount of tooth present, functional load on tooth and esthetic requirements. Ideally the final restoration should be planned before root canal treatment is begun, although it might be necessary to modify the restorative plan as treatment progresses. Long term clinical success of such clinical situation requires skilled integration of both endodontic and restorative disciplines^[1,2]

Restoration of pulpless teeth dates back to the 1740's where posts were fabricated of gold and silver and was held in the root canal space with a heat softened adhesive.^[3] Presently, the treatment modalities range from a simple composite restoration in the anterior teeth to a combination of custom or prefabricated post and core in severely damaged teeth. The necessity of dowel and core restorations for endodontically treated tooth has been well demonstrated. Dowels do not reinforce endodontically treated teeth but are indicated when there is inadequate tooth structure to retain a core for a coronal restoration.^[4]

Considerations in restoring an endodontically treated teeth.

An endodontically treated teeth has been the focus for a considerable period of time. Failure is still present, even though various methods have been highly successful in some aspects. An understanding of the anatomy, biology of root dentin and the root dentin supporting the restoration has to be given importance.^[5] It is on the part of the practitioner to support the endodontically treated teeth with special needs that exceed the requirements of teeth with vital pulp. These aspects are unique and include,

- A. Effect of endodontic treatment on teeth
- B. Anatomic and biologic considerations.

A. Effects of endodontic treatment on teeth

Endodontically treated teeth have special needs that exceed the requirements of teeth with viable pulps. The tooth structure that remains after endodontic treatment has been weakened and undermined by caries, fracture, tooth preparation and restoration. Endodontic procedures further remove important intra-coronal and intra-radicular dentin. Also, endodontic treatment changes the actual composition of dentin.

The combined result of these changes is increased fracture susceptibility and decreased translucency in non-vital teeth. Because restorations for endodontically treated, are designed to compensate for these changes, it is important to understand the effects of endodontics on the tooth and the significance of each factor.

The major changes in these teeth ^[2,3,6,7] include:

- 1. Loss of tooth structure
- 2. Altered physical characteristics
- 3. Altered esthetic characteristics

1. Loss of tooth structure

The loss of coronal tooth structure primarily causes a reduction in the strength of the endodontically treated teeth and is not a direct result of the endodontic treatment. Endodontic access into the pulp chamber destroys the structural integrity provided by the coronal dentin of the pulpal roof and allows greater flexing of the tooth under function. In cases with significantly reduced remaining tooth structure, normal functional forces may fracture undermined cusps or fracture the tooth in the area of the smallest circumference, frequently at the cemento-enamel junction. The decreased volumes of tooth structure from the combined effect of prior dental procedures create a significant potential for fracture of the endodontically treated tooth.

2. Altered physical characteristics

The tooth structure remaining after endodontic therapy exhibits irreversibly altered physical properties. Calcified tissues of pulpless teeth have 9% less moisture content than in vital teeth (Heifer et al, 1972) ^[8]. The collagen too has fewer mature and more immature cross links.

Changes in collagen cross linking and dehydration of the dentin result in 14% reduction in strength and toughness of endodontically treated molars, with maxillary teeth shown to be stronger than mandibular teeth and mandibular incisors to be the weakest ^[9]. The combined loss of structural integrity, loss of moisture and loss of dentin toughness compromises these teeth and necessitates special care in their restoration.

3. Altered esthetic characteristics

Esthetic changes also occur in endodontically treated teeth. Biochemically altered dentin modifies light refraction through the tooth and modifies its appearance.

Inadequate endodontic cleaning and shaping of the coronal area also contributes to this discoloration by staining the dentin from degradation of vital tissue left in the pulp horns. Medicaments used in dental treatment and remnants of

root canal filling material can affect the appearance of endodontically treated teeth. Endodontic treatment and restoration of teeth in the esthetic zone require careful control of procedures and materials to retain a translucent, natural appearance.

B. Anatomic & biologic considerations

For restoring endodontically treated teeth^[10] with post and core restorations careful attention to root anatomy should be paid in order to select the appropriate post design in terms of length and shape and its method of placement. To achieve this end, a thorough knowledge of root anatomy is important along with periapical radiographs at different angulations to determine the number of roots, their structure and curvatures. However, different teeth pose certain problems unique to their anatomy.

Maxillary teeth

Central and lateral incisors – Normally, their bulky roots easily accommodate a post. But excessive post lengths are to be avoided in roots that taper rapidly to the apex because the thinned out root walls at the apical extent of the post increase chances of root fracture.

Canines– Being wide faciolingually custom cast posts may be desired for better adaptation. Proximal invaginations may be present; hence thicker posts should not be used in order to avoid root perforation.

Premolars – The first premolar presents many challenging problems. It has thin root walls that are further weakened after removal of dentin. Roots taper rapidly to the apex, especially when two roots are present. Proximal invaginations and canal splitting are common. Facial curvature of palatal root and distal curvature of the roots may result in perforation during preparation or cementation.

The second premolar poses similar problems but due to greater bulk of the root shows fewer complications.

Molars – Only palatal root is suitable for post placement as it has the largest canal. In 85% of cases this root is facially curved. Invaginations may be present

on palatal and facial surfaces of this root, as a result of which, weakening or perforation of the root may occur during placement of long thick posts that, may not be disclosed on the radiograph. First molars have deep concavities on the furcal surface of 94% of the mesiobuccal roots, 31% of distobuccal roots and 17% of palatal roots. Placement of post in the narrow mesiobuccal or distobuccal canal is generally contraindicated.

Mandibular teeth

Incisors and canines – These teeth are difficult to treat. In fact, success rate has been shown to be higher without a post. They have thin root walls, proximal invaginations and often multiple canals, which complicate post placement. Additionally, significant bone loss may be present which contraindicates post and core restoration.

Premolars – These teeth have sufficient root bulk for post placement, though occasionally multiple canals may be present. In the first premolar the angle of the crown to the root is an important consideration. Perforation may occur on the facial surface of the lingually inclined root if preparation is made perpendicular to the occlusal surface.

Molars – Proximal invaginations are common. First molars have root concavities on the furcal surface of 100% of mesial roots and 99% of distal roots. Perforations may not be seen on radiographs. Their canals are narrow mesiodistally and wide faciolingually and may become considerably weakened if prepared for large, circular prefabricated posts. Distal canal is preferred for post placement as it is the largest. Fractures may occur during cementation or mastication. These fractures are termed ‘*odontiatrogenic*’ in origin and may appear radiographically as furcal bone loss or proximal angular defects.

Considerations for restoring anterior teeth

- a. Anterior teeth do not always need complete coverage as studies have shown that intact root treated anterior teeth are stronger than those restored with post and core.
- b. Post and core is not required when there is minimal coronal damage, intact marginal ridges, intact cingulum, intact incisal edge and one or two small proximal lesions. Here, the treatment should be restoration of access opening with composite resin or GIC. If the tooth is discolored a non-vital bleaching technique is advised over complete crown. However all cases may not be successfully treated with bleaching, such teeth need full coverage.

- c. When a full coverage restoration is to be given in intact endodontically treated anterior's a post and core is recommended because after crown preparation for a metal ceramic or all ceramic crown, the amount of remaining tooth structure is decreased and the tooth would be susceptible to fracture as anterior teeth are subjected to shear (lateral) forces.
- d. A post and core followed by full crown is indicated when there is significant coronal damage and undermined marginal ridges, or coronal fractures involving all of incisal edge and major part of crown. It is important that at least 2mm of tooth structure should be present apical to the resin core to provide resistance form.
- e. For small circular canals a prefabricated post and resin core is preferred. But when canal is elliptical or flared a custom cast post and core is indicated. In such cases intra-radicular rehabilitation i.e. buildup of the canal walls with composite and use of fiber-reinforced posts can also be done as an alternative to cast post and core.

Considerations for restoring posterior teeth

- a. All endodontically treated posterior teeth require a full occlusal coverage restoration. This is because due to loss of the roof of the pulp chamber (which provides structural integrity) the occlusal forces tend to wedge the cusps apart, which may lead to tooth fracture.
- b. A gold or ceramic onlay is sufficient when there is minimal coronal damage, low risk of fracture (i.e. occlusion protects tooth from heavy lateral occlusal functioning contacts) or minimal occlusal forces (as when opposing teeth are artificial) and facial and lingual cusps are intact.
- c. A foundation (core) restoration with complete occlusal coverage is indicated when there is moderate coronal damage or extreme curvature of root. Here one of the following foundations may be used:
 1. Amalgam coronal-radicular core.
 2. Pin-retained amalgam or resin composite.
- d. In posterior teeth the pulp chamber and canals provide adequate retention for foundation buildup and hence generally do not require a post, unless coronal damage is extensive. Molars resist primarily vertical forces, whereas premolars are more likely to be subjected to lateral forces during mastication. Their cross sectional areas at the CEJ is smaller than that of molars and so are more prone to fracture. Though they are bulkier than anteriors, they are often single rooted with small pulp chambers that may not provide adequate retention and resistance. That is why, they require posts more often than molars. The functional demands and the remaining tooth structure are the other determining factors.
- e. The canal anatomy again dictates the choice of post. For circular canals a prefabricated post with composite or amalgam core is acceptable. Extremely tapered or oval canals require custom cast post and core.

References:-

1. Weine S. Franklin. Endodontic Therapy: 6th ed, Mosby Inc.
2. Rosenstiel, Land, Fujimoto. Contemporary Fixed Prosthodontics. Mosby Inc; 2007.
3. Ingle, Bakland. Endodontics: 5th ed, Mosby Inc.
4. Assif D, Gorfil C. Biomechanical considerations in restoring endodontically treated teeth. J Prosthet Dent. 1994 Jun; 71(6):565-7.
5. Post & core/ dental implant courses by Indian dental academy. April 29, 2014.
6. Stock C, Walker R, Gulabivala K. Endodontics: 3rd ed, Elsevier Mosby.
7. Gutmann JL. The dentin-root complex: anatomic and biologic considerations in restoring endodontically treated teeth. J Prosthet Dent. 1992; 67:458-67.
8. Heifer A.R, Melnec, and Schilder H. Determination of the moisture content of vital and pulpless teeth. J Oral Surg 1972; 34:661.
9. McDonald AV, King PA. An in vitro study to compare impact fracture resistance of intact root treated teeth. Int Endodont. 1990; 23; 304.
10. Healey H. Restoration of the effectively treated pulpless tooth. J Prosthet Dent 1954; 4(6): 842-849.