

Prosthodontic Management in Endodontics

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Abstract

Introduction: The restoration of endodontically treated tooth is an essential aspect in dental practice, and its longevity has been dramatically enhanced by advanced development made in endodontic and prosthodontic restorative procedures and wide range of treatment option of varying complexity. A large number of endodontically treated teeth are restored to their original form and function with use of crown, bridge and most commonly intraarticular devices such as convention or prefabricated post systems. Since endodontically treated teeth suffer an extensive loss of crown structure, the post helps retain the coronal restoration. Thus, coronal restoration and posts can positively influence the long-term prognosis after the root canal treatment.

Aim of the Study: The article reviews the emphasis on significant decision-making elements and factors associated after root canal treatment, proper post selection and restoration of endodontically treated teeth.

Methodology: The review is comprehensive research of PUBMED and Medline since the year 1972 to 2014.

Conclusion: Most endodontically treated teeth require a post and core build-up for restoring the teeth to optimum health and function. Thus, selection of appropriate post and core system is utmost essential to satisfy interrelated biologic, mechanical and aesthetic factors. The prognosis of endodontically treated teeth depends not only successful root canal procedure but also on the remaining coronal and radicular tooth tissue, definitive restoration, and its properties as much similar to tooth tissue as possible, effective post adhesion. These are the most critical factors to decide the clinical performance of endodontically treated teeth.

Keywords: Endodontically Treated Teeth; Post; Core; Cement; Restoration

Introduction

Extensive loss of tooth structure is when it has lost substantial structure as a result of caries, fracture, failure of previous restoration and even the error in procedure during endodontic treatment. This loss of dental tissue represents a challenge to clinician in terms of prosthetic rehabilitation; thus, a clinician must assess the probability of restoring such teeth successfully [1-3].

Endodontically treated teeth dry out over time with their dentin undergoes changes in collagen cross-linking. Hence the endodontically treated teeth tend to be more brittle compared to the non-endodontically treated teeth which makes it more susceptible to fracture. Loss of tooth structure due to caries and trauma also contributes to fracture of endodontically treated teeth and subsequent failure of restoration such as crown or FPD [4-6].

The use of post and core system has two views regarding the strengthening of teeth. Some clinician believes post system to reinforce the root after endodontic treatment while some studies suggest weakening the tooth root with subsequent root fracture. Further studies suggest that post is indicated when insufficient tooth substance remains to support the final restoration. The primary function of post is to provide retention to core to support the coronal restoration. The new adhesive material used for securing post to dentin in root canal space, the core and final restoration having similar physical properties, all the component successfully bonded together; it may be claimed that post can strengthen and reinforce the root [7].

Types and indication of post

1. Active and passive post: Active posts are threaded and intended to engage the wall of canal whereas passive posts by a luting agent [8].
2. Parallel and tapered posts: Parallel posts are considered to be more retentive than tapered because there is less of wedging effect and is reported to be less likely to cause root fracture. Tapered posts are indicated in thin roots [9].
3. Custom cast post and cores: They are regarded as the gold standard for restoring extensively damaged teeth and is indicated when multiple teeth require posts, in misaligned tooth, small teeth such as mandibular incisors where there is minimal coronal structure [8].
4. Prefabricated post and cores: Made of up stainless steel, nickel, chromium alloy, titanium alloy. Titanium post was introduced because concerns about corrosion, have low fracture strength therefore not strong enough to be used in thin post channels [8].
5. Ceramic and zirconium post: Metal post are visible through the more translucent restoration; hence for esthetic reason, zirconium and ceramic posts were introduced. However, there are several disadvantages of these esthetic post like being weaker than metal post, zirconium cannot be etched therefore it is not possible to bond composite core material to post making it less retentive [10].
6. Fiber posts: Includes carbon fibers, quartz fibers, glass fibers, and silicon fiber post. These posts are more flexible than metal posts with same modulus of elasticity(stiffness) as dentine. Because of the favorable biochemical properties, fiber post simplifies post-endodontic restoration procedure as compared to other post systems [8].

Indication of post in posterior teeth

When premolar has increased functional stresses acting on the crown and is to serve as abutment for removable partial denture. In case of molar, a post is rarely required unless a large portion of coronal structure of tooth is missing, the post is usually placed in most massive canal i.e. palatal canal in maxillary molar and distal canal in mandibular molar [11].

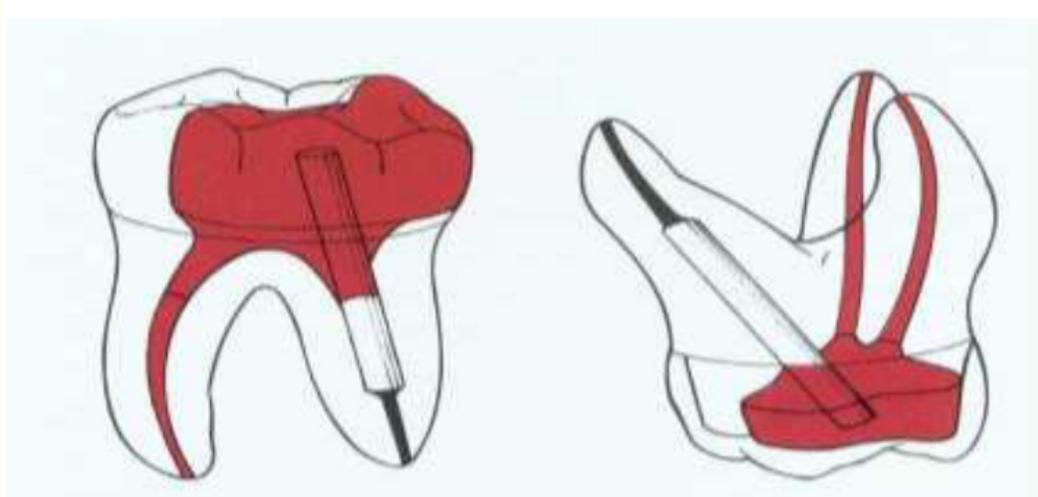


Figure 1: Post placement in distal canal of mandibular and palatal canal of maxillary molar [12].

Indication of post in anterior teeth

Due to the shearing forces acting on anterior teeth, anterior teeth are more frequently restored with posts than posterior teeth unless there is no functional or aesthetic requirement for a full-coverage restoration [11].

Factors influencing post selection [3]:

1. **Root length:** The length and shape of the remaining root decide the length of post. Ideally it is crucial to preserve 3 - 5 mm of apical gutta-percha to maintain the apical seal.
2. **Tooth anatomy:** Such as root curvature, mesiodistal width, and labiolingual dimensions helps in post selection.
3. **Post width:** Criteria for post width selection is the preservation of tooth structure, reduces perforation and resist fracture. Post width should not be greater than one-third of root width and its narrowest dimension and surrounded by minimum of 1 mm of sound dentine. The concavities in root should be kept in mind to avoid any perforation.
4. **Canal Configuration and post adaptability:** A well-adapted post provide increased resistance to post.
5. **Coronal structure:** The amount of tooth structure present is more important than the material of the post. The bulk of tooth above the restorative margin should be 1.5 to 2 mm to achieve the resistance form.
6. **Position of the tooth in arch:** Position of the tooth in oral cavity also determine the post selection, since there are more vertical forces and less shearing forces acting on molar than incisors, post is more commonly used in anterior teeth than posterior.
7. **Stress:** There are various forces such as compression, tensile, and shear force acts on post, of which shear force is important to determine the longevity of post. Increased length and minimum diameter of post are believed to reduces the stress forces.
8. **Torsional force:** The post-core-crown unit may lead to loosening and displacement of the post from the canal. Therefore, a small groove placed in the bulkiest portion of root can serve as anti-rotational element.

(Figure 3)

9. **Role of hydrostatic pressure:** Increase in stress within the root canal has been reported because of development of hydrostatic pressure that affects the seating of post and may lead to root fracture. Careful placement of post and proper post design with a cement vent to permit escape of the luting agent can reduce the hydrostatic pressure.
10. **Post design and material:** The post designs can be classified according to their shapes and surfaces characteristics (threads and serration in active posts) which engages the wall of dentine and provide better retention. Also, to achieve the optimum result, the post material should have similar physical properties to that of dentin, bond to tooth structure, biocompatible in oral environment and act as shock absorber by transmitting limited stress to tooth structure.
11. **Material compatibility:** Post corrosion and subsequent root fracture have been reported in literature. Ideally post and core are made of same alloy, but dissimilar alloys create galvanic action, which may lead to corrosion of less noble alloy.
12. **Bonding ability:** Adhesion of post to tooth structure improves the retention.

- 13. Core retention: Prefabricated metal posts with cores made up of glass ionomer, composite or amalgam provides less core retention than one-piece cast post and core because of the interface between post and core.
- 14. Retrievability: The post selection should be such that if it fractures or the endodontic treatment fails, the clinician can easily retrieve post without the substantial loss of the tooth. The carbon fiber post has advantage over metallic and ceramic post in rapid and easy removal.
- 15. Esthetics: Esthetics is of more profound concern in anterior teeth thus post and core material should be esthetically compatible with surrounding tissue. Custom cast post-compromise the esthetics and produce a grey tint of metal through the root wall; the overlying gingival tissue also appears darker. Thus, esthetics post made from reinforced resins or ceramic may eliminate this color deficiency.

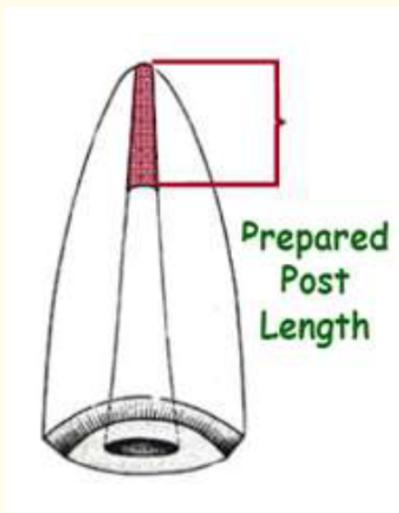


Figure 2: Apical seal maintained by preserving 3-5mm apical gutta-percha [12].

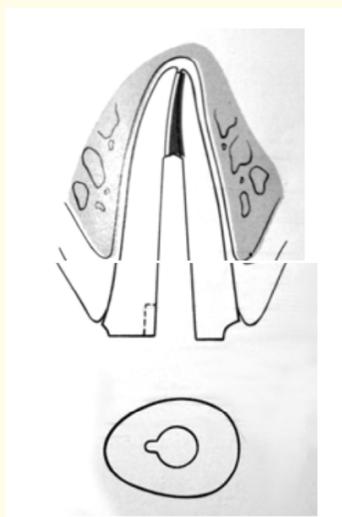


Figure 3: Groove placement in the round root canal to avoid torsional forces [13].

The ferrule effect

The ferrule can be defined as a metal band or ring used to fit the root crown of a tooth. It should be minimum 1 - 2 mm high, have parallel axial walls, completely encircle the tooth, end on sound tooth structure, and do not invade the attachment apparatus of tooth. The purpose of giving ferrule is to improve the structural integrity of pulp less tooth by counteracting functional lever forces, wedging effect and lateral forces exerted during insertion of post. Thus, a ferrule increases the mechanical resistance of post-core-crown unit by reducing all possible displacement and compressive stresses within labial dentin and canal wall [11,12].

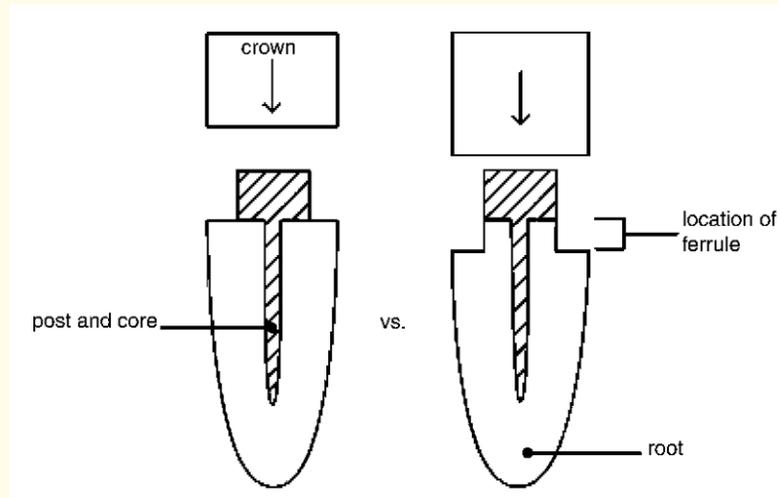


Figure 4: Comparison of teeth with and without ferrule [14].

Other aspects of prosthodontic management of endodontically treated teeth apart from the post and core system are as follow

Incidence of endodontic treatment required after tooth preparation for single crowns and fixed partial dentures

According to a study, the incidence of endodontic treatment after cementation of single crown is found to be 3% after 5 years while for the fixed partial dentures abutments it varies [15]. According to a study by Reuter and Brosco 3% of abutment teeth for FPD with little or no caries requires endodontic treatment. Thus incidence of endodontic treatment requires after tooth preparation ranged from 3 - 23%. Compare to single crowns fixed partial dentures and complex prosthesis had higher incidence which has probably been assumed because of greater tooth reduction requires to align the multiple teeth. Also, the incidence is much higher when prepared teeth have deep carious lesions with considerable bone loss [16].

Need of crown in endodontically treated teeth

On comparison of endodontically treated teeth with coronal coverage restoration (onlay, partial or complete metal crowns and ceramic crowns) with endodontically treated teeth with no coronal coverage, it was found that coronal coverage does no significantly improve the success of endodontically treated anterior teeth. However, some incisors and canine do need coverage crowns because of aesthetic concerns. A crown should generally be used on endodontically treated posterior teeth but not necessarily on sound anterior teeth [16].

Conclusion

The restoration of endodontically treated teeth is one of the most challenging situations in clinical practice, because it involves other areas such as operative dentistry and prosthetic dentistry. A clinician must be able to predict the probability of teeth to be restored of whether the coverage restoration is required in endodontically treated teeth or abutments used in FPD, teeth prepared for single crowns requires endodontic treatment. A wide variety post system is available from custom cast post to prefabricated post to provide appropriate retention to definitive restoration. Thus, the selection of post design and post system is important since it acts major deciding factor longevity of tooth and long-term success of endodontic treatment.

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