



Review Article

Different factors that affects the longevity of tooth reconstructed with post and core material

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ABSTRACT

A lot of difficulties encountered during restoration of grossly carious or decayed tooth or teeth. That may lead to the failure of prosthesis, if the procedure not performed ideally, it will indirectly affects the mental attitude of the patient toward the dentist. So a thorough knowledge of the factors that affects the longevity of the reconstructed tooth/teeth is must.

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1. Introduction

Greater tooth loss in case of teeth/tooth that is endodontically treated is mostly due to caries, pathological disease, previous treatment/ restoration. Loss of tooth structure usually compromises the retention of the subsequent restoration and that might increase the tendency of fracture during functional loading/ mastication.

The longevity of endodontically involved teeth has been greatly enhanced with the use of intra radicular devices varying from conventional custom cast post to prefabricated post system. The teeth that were endodontically treated earlier has a very good prognosis with post and core system. As they serve well in function, and can act as an abutment in FPD or in RPD as well.¹

Post and Core can be defined as a one piece foundation restoration for an endodontically treated tooth that comprises a post with in the root canal and a core replacing missing coronal structure to form the tooth

preparation.

1.1. Feature evaluated before going for post and core

1. Restorability of the tooth, going to be restored.
2. Role of the tooth in the oral cavity, i.e. whether it is present in the aesthetic zone or in the masticating zone.
3. Whether the tooth going to be restored is periodontically sound or not.
4. Functional loading of the tooth.

1.2. Ideal tooth condition to accept post and core

1. There should be optimal or adequate apical seal present.
2. Absence of any exudate from the tooth itself.
3. There should be no inflammation and no sign of inflammation should be present with the tooth.
4. There should be no sensitivity to percussion on the tooth.
5. There should be no periodontal disease associated with the tooth.

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6. Adequate amount of bone should be present around the tooth.
7. There should be adequate or sound tooth structure present coronal to the alveolar crest.
8. There should be no fracture at any position of the root.

- b. Plastic post
- c. Glass fiber post
- d. Carbon fiber post
- e. Quartz fiber post
- f. Zirconia post

1.3. Some conditions where post should be avoided

1. If there is poor apical seal.
2. Poor quality of obturation done.
3. Signs of inflammation present.
4. Presence of fistula or sinus.
5. When tender on percussion is positive for the tooth.
6. If in case the adequate retention of the core material can be achieved by the presence of natural undercuts of the crown.
7. If there are cracks in horizontal direction in the coronal portion of the tooth/ teeth.
8. When there are presence of lateral stresses of bruxism or quite heavy incisal guidance.

2. Purpose of use of post

1. Post helps in retaining the core in its position.
2. Post helps uniformly distribution of stresses inside the radicular portion of the tooth.

3. Basic requirements of the post

1. It should provide maximum protection of the root to resist the fracture of the root.
2. It should provide adequate retention of the core as well to the crown.
3. Should be easy to place.
4. Should be less technique sensitive.
5. Should have high strength as well as high fatigue resistance
6. It should be visible radiographically. Should be bio compatible
7. Should be easily retrievable, whenever it is required.
8. Should be aesthetically accepted.
9. Should be easily available.
10. Should not be very much expensive.

4. Classification of posts

4.1. Posts can be classified as

4.1.1. Prefabricated post

a. Metal prefabricated post (made up of)

1. Gold alloys
2. High platinum alloys
3. Cobalt- Chromium alloys
4. Stainless steel
5. Titanium and Titanium alloys

4.1.2. Custom made post

a. Custom cast metal posts:- they are usually made up of:

1. Gold alloys
2. Platinum- Palladium alloys
3. Base metal alloys
4. Cobalt – Chromium alloys
5. Nickel- Chromium alloys

b. Ceramic custom posts:- are made up of all ceramic materials.

4.2. Posts can also be classified as

4.2.1. Active post

Are those that mechanically engage the walls of the canals. They are usually retentive in nature but have the tendency to generate the stresses during their placement and during functional loading.

4.2.2. Passive post or cemented post

They don't engage the walls of the canal. They are usually less retentive in nature and also produce less stresses during placement and functional loading.

4.3. Post can also be categorized by Post design

1. Smooth post
2. Serrated post
3. Parallel sided post
4. Tapered post
5. Combination of above

5. Various factors to be considered while going for post and core

5.1. Factors affecting post retention

1. Length of the post
2. Diameter of the post
3. Design and taper of the post
4. Luting agent
5. Canal shape
6. Position of the post in the dental arch

5.2. Factors affecting post resistance

1. Presence of ferrule
2. Antirotational feature
3. Rigidity of the post
4. Length of the post

5.2.1. Post length

The longer the post in the canal, more retentive it is. But increased length also increase the risk of fracture of the root as well as higher chances of perforation. The length of the post also influences the stress distribution, therefore affects its resistance to fracture. When the length of the post is equal to or more than the crown, the success rate is more in endodontically treated tooth/teeth and a higher failure rate is seen vice versa i.e. when the post length is short⁵ An increased length of the post improves resistance to fracture of the restored tooth² In a photoelastic test, reduction of stresses reduction of stress concentration was observed, when there is adequate post length is being used.³

5.3. Some guidelines for determining post length are as follows

1. Post should be equal to clinical crown length.
2. Post should be equal to $\frac{1}{2}$ or $\frac{1}{3}$ of the length of the remaining root.
3. Post should end halfway in between the root apex and crestal bone.
4. Post should be as long as possible without disturbing the apical seal.

5.3.1. Post Diameter

The diameter of the post and the remaining dentine, act as variables that influence the resistance to fracture of endodontically treated tooth/teeth.⁴ According to Harris, the diameter of the post should never exceed 0.16 inch. According to Robbin, the diameter of the post should kept as small as possible, to increase the resistance to fracture by minimizing the loss of tooth structure. According to an observational study, the greater the amount of remaining dentine, the greater will be the resistance to fracture.⁵

Presently three different philosophies have been given regarding the post diameter:

1. **The conservatismist:** It suggests the narrowest diameter that allows the fabrication of the post to the desired length. It also allows minimal instrumentation of the canal for post space preparation. According to this, teeth with smaller dowels exhibit greater resistance to fracture.
2. **The preservationist :** Stated that at least 1mm of sound dentine should be maintained circumferentially to resist the fracture.
3. **The proportionist:** this advocates that post width should not exceed $\frac{1}{3}^{rd}$ of the root width at its narrowest dimension to resist fracture.

5.3.2. Post Design

The endodontically treated teeth are restored either with a cast post-core or prefabricated post. Various types of pre fabricated post are available in the market with various

designs like,

1. Tapered, smooth sided (least retentive)
2. Tapered, serrated type
3. Parallel smooth sided
4. Parallel serrated type
5. Tapered notched type
6. Parallel threaded type
7. Parallel notched type.

Generally parallel sided are more retentive than tapered ones and threaded posts are more retentive than cemented ones. The tapered post shows more amount of stress concentration at the coronal portion and less concentration of stress at the apex.⁶ Research demonstrated that tapered post shows wedging effect⁷ Some investigators stated that parallel sided posts uniformly disperse the stresses along its length except at the apex.

5.3.3. Luting Agent

Most commonly used luting agents are zinc phosphate, polycarboxylate, glass ionomer cement, resin based composite and hybrid of resin and ionomer. Among all of these zinc phosphate has shown the longest history of success. GIC is also one of the frequently used luting agent after zinc phosphate. Now a days resin based composites are becoming increasingly popular because of its potential to bond to the dentin. But on the other hand bonding resin cement to the dentin wall of root canal space must be done carefully to improve bonding and minimizing microleakage. Many of the newer resin cements are claimed to bond effectively to dentin and to metal⁹Mendoza et al,² showed that resin cements give additional resistance to fracture compared to brittle, nonbonding zinc phosphate cement. They also reported that resinous cements are difficult to manipulate. According to several studies,^{2,4} the introduction of cement into the root canal during the cementation procedure is essential to achieve a uniform, bubble-free layer of cement that distributes the stresses evenly throughout the entire root canal.

5.3.4. Luting Method

Plays an important role in the longevity of endodontically treated tooth/teeth with post and core. Since luting agents are susceptible to moisture present in the canal, so canal should be absolutely dry.

Method of cementation of post

1. The canal must be totally dry.
2. Mixing of the cement done according to the manufacturing instructions.
3. Uniformly place the cement in the canal
4. Place the post in the canal with least possible force to reduce the stress.
5. Vent should be made so that the hydrostatic pressure should be released when the post thrust back.^{8,9}

5.3.5. Canal Shape

Knowing the root anatomy of different teeth is important before starting canal preparation for the insertion of post. To determine the appropriate post length and width to avoid root perforation, one must consider conditions such as root taper, proximal root invagination, root curvature and angle of the crown to the root during preparation of the post space.^{3,10-13}

5.3.6. Position of the tooth in the dental arch

Affects the post retention, for e.g. maxillary anterior region is at high risk of failure because of effect of compressive, tensile, shearing and torquing forces specially at the post dentin interface.⁵

5.4. Preservation of tooth structure

One should try to preserve the maximum of the coronal as well as radicular tooth structure, whenever or wherever possible. Minimal removal of additional radicular dentin for post space preparation is the criteria. Further enlargement of the post only weakens the tooth. Minimal enlargement of post space means a post must be made of a strong material that can withstand functional and para functional forces.

5.4.1. Ferrule Effect

Ferrule is the encircling collar of metal band or ring used to fit the root or crown of the tooth. Basically it braces the tooth and protect it against the wedging stresses and vertical root fracture. Thus it primarily provides resistance and increases the longevity. It has been seen that a ferrule with 1-2 mm of vertical tooth structure doubles the resistance to fracture than in teeth without any ferrule effect.

Failure of post and core can occur in form of

1. Root fracture
2. Post fracture
3. Core fracture
4. Dislodgement of the post
5. Failure due to aesthetics

6. Conclusion

Preservation of the remaining tooth structure is a must. Posts should be used only when there is a need to retain the core, not with the intention of reinforcing an endodontically treated tooth.

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8. Conflict of Interest

Authors has no conflict of interest whatsoever.

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