



CASE SELECTION FOR CUSTOM POST

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ABSTRACT

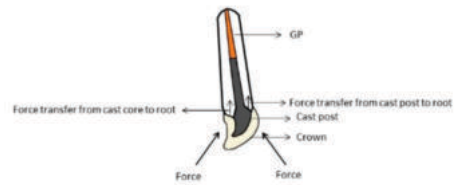
Endodontically treated teeth should be restored to regain form function and esthetics. The loss of tooth structure during the endodontic procedure makes the subsequent restoration difficult requiring post and core for retention. Factors to be considered during case selection of post placement are lateral forces, ferrule, biological width, root form, root length and apical seal. Evaluation of centric and eccentric contacts and possible interferences should be corrected. Occlusal dynamics plays an important role in retention of post, root fracture and premature wearing of tooth. There is higher variation of success/survival rate seen in restored teeth with no ferrule, when compared to those with adequate coronary length. Orthodontic extrusion and surgical crown lengthening preserves the BW. Longer the post better would be the retention. Preservation of 4-5 mm gutta-percha provide a reliable apical seal. Retention of post is determined by post diameter, post length, Anti rotational features, shape and surface characteristics of post,

KEYWORDS : Ferrule, Post diameter, post length, Biologic width

INTRODUCTION

Post-endodontic restoration is crucial for the success of endodontic therapy. Endodontically treated teeth are weak due to loss of tooth structure as a result of caries or non-carious lesions, restorations, access cavity preparation, flaring of the root canal during shaping. Further, loss of moisture in the dentin of these teeth results in a decreased resilience, strength and toughness¹. Restorability analysis must be done and teeth should be restored with an aesthetic, functional and cleansable restoration. If there is insufficient coronal tooth tissue remaining for retention of the crown then a post and core is required. The primary purpose of a post is retention of a core in a tooth with extensive loss of coronal tooth structure². Posts can be either custom-made or pre-fabricated. Prefabricated posts lack accurate fit, they hinder transmission of occlusal stress to root and fracture at decreased loads. Fiber reinforced composite (FRC) post's modulus of elasticity (MOE) is same as dentin, whereas metal post's MOE is 10 times as that of dentin resulting in debonding and root fracture. Pre fabricated Metal and FRC posts result in excessive removal of tooth structure hence custom posts are better. Cast posts are custom made and securely anchors in the root canal space providing longevity, stability and function³. Previously cast post was fabricated with gold alloys resulting in high success rate. They were easy to fabricate with good mechanical properties and they were considered as gold standard. These days we have base metal alloys which are stiffer than dentin hence creates lots of stress along with release of substance which could be harmful. Castable glass ceramics and glass infiltrated ceramics have superior esthetics and translucency and mimic natural tooth. Castable zirconia post shows higher fracture resistance but modulus of elasticity is high hence transfer the stresses to root dentin resulting in root fracture and they are difficult to retrieve during retreatment.

interferences. During centric and excursive movement of mandible, tooth and restoration are loaded with stresses together or separately depending on occlusal area of tooth and morphology of tooth. In eccentric load compressive stress on one side is more than the tensile stress on the other side in facio-lingual direction of root⁴. Hence occlusal dynamics would determine the retention of post, root fracture and premature wearing of tooth.



Ferrule:



Ferrule means iron bracelet in latin. It strengthens the object and prevents splitting or wearing. Sorensen and Engleman defined ferrule as circumferential ("360°) metal collar of the crown surrounding the parallel walls of the dentine and extending coronal to the finish line.

Factors To Be Considered During Case Selection For Post Placement

Lateral Forces:

The occlusal forces exerted during mastication could impact the load distribution within the supporting tooth and post. We should evaluate centric and eccentric contacts and possible

Libman and Nicholls described it as the metal band or ring used to fit the root or crown of the tooth. It improves the structural integrity of the non vital tooth and counteracts functional lever forces, wedging effect of tapered posts and lateral forces exerted during post cementation. The prognosis is good if healthy dentin extends 1.5-2mm coronal to this margin. If 360° ferrule is not possible due to caries, fracture or previous restoration, incomplete ferrule provides better stress distribution than one without ferrule. When it comes to severely damaged tooth structure then orthodontic extrusion should be opted rather than surgical crown lengthening⁵. A systematic review revealed that higher variation of success/survival rate was in restored teeth with no ferrule (0-97%), when compared to those with adequate coronary length(66.7%-100%)⁶. It improves the resistance form and retention form of the post.

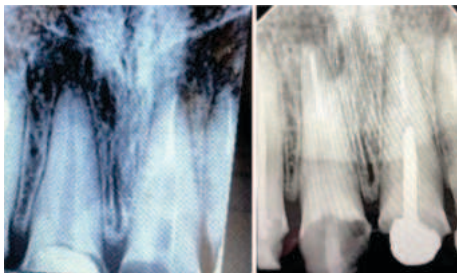
Biologic Width (BW):

When the teeth are compromised due to caries, fracture BW encroachment becomes a major concern during restoration of teeth. Sub crevicular physiology refers to BW and it comprises of connective tissue apparatus and junctional epithelium. Normal crest is seen in 85% of cases. The proximal measurement of BW is 3-4.5mm, mid facial measurement is 3 mm. Low crest is seen in 13% of cases. In such cases the proximal measurement of BW is 4.5mm, mid facial measurement is 3 mm. High crest seen in 2% of cases. The proximal measurement as well as mid facial measurement of BW in such cases is less than 3 mm. Procedures like orthodontic extrusion and surgical crown lengthening preserves the BW⁷.

Root Form and Root Length:

Root length and root canal shape are important factors which determine the retention of post. Teeth with curved roots, fluting on external root surface, thinner roots, presence of lateral canals should be avoided in case selection. Longer the post, the better would be the retention. When the root is short and curved it would be difficult to have a long post, clinician should decide to use a longer post or to maintain the recommended apical seal. In multi rooted teeth it is recommended to have multiple post for retention. Predominately root canal shape is ovoid and the walls of prefabricated post are parallel, hence it may not fit properly. Cast post would adapt well to the wall and hence would provide better retention.

Apical Seal

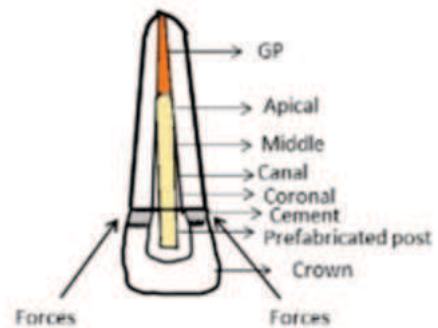


If root canal treatment is done elsewhere revise the same and then proceed for post placement. Preservation of 3-5 mm gutta-percha provides a reliable apical seal. Some authors considered 3mm apical seal was not sufficient and resulted in unpredictable seal. There is difference of opinion in leakage studies depending on the sealers used for obturation, with some stating epoxy resin has lower leakage than zinc oxide sealer⁸, others reporting both having same amount of leakage⁹. There was no difference in apical leakage between lateral condensation and low temperature thermoplasticized Gutta percha obturation⁹. There is no consensus in endodontic treatment and ideal post space preparation timing. Some recommending immediate preparation⁸, and others recommending different time intervals¹⁰. Guttapercha

removal should be safe, efficient and should not disturb apical seal. There are 3 different methods for GP removal namely, thermal, chemical and mechanical. With respect to guttapercha removal method there was no difference between chemical or mechanical if 4 mm of GP is left according to some¹¹, some stated mechanical was better than chemical¹². During mechanical preparation of the post space, the root canal filling material may be dislodged creating voids in the obturation, and the filling material may be twisted or vibrated. There could be displacement of remaining filling material, when this material is insufficient or not correctly condensed.

Factors Influencing The Retention Of Cast Post:

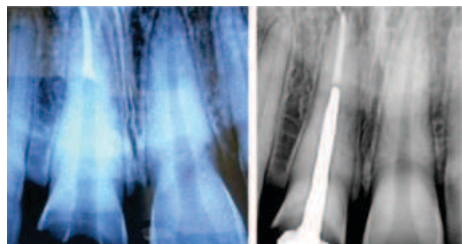
Post retention refers to the ability of a post to resist vertical dislodging forces. Retention of the post in the tooth root is critical for the success and durability of the final restoration. The ability of the cement to retain the post can significantly influence the prognosis of the tooth. The retention value is used as a conventional method for comparing posts. Posts that have a greater retention are less functional concerning normal chewing functions. The wearing out of cement occurs as a result of the constant burden of tension. The clinical post and crown are put under repeated tension, compression, torsion and torque. The posts will be dislocated when the cement wears away and the connection with the dentin is finally lost.



Diameter of Post

Post should be wide enough so that it does not deform under loading. Retention can be increased slightly by enlarging the post diameter, but the loss of tooth structure would weaken the tooth. Therefore, this is not a recommended method to increase retention. Excessive post diameter could result in perforation. It depends on the alloy used for fabrication of the post. Proportionist's theory suggests that the post diameter should not be greater than the root width at its narrowest diameter, it should be 1/3rd of the diameter of root. Preservationist's theory dictates that circumferentially 1.5 mm dentin should be preserved. Conservationist's theory suggests post space should be minimal in an effort to conserve as much of remaining tooth as possible and reducing the risk of fracture¹³.

Length of the Post



Longer and wider the posts, the greater their resistance and retention, but not in excess to avoid weakening of the root due to excessive wear¹⁴. Length should be as long as possible, however 5 mm of the apical seal must be maintained at the tooth apex to prevent reinfection of the previously treated

canal¹⁵. According to Shillingburg the length of the post inside the canal must be equal to or greater than that of the crown, or two-thirds the length of the root to achieve maximum retention. Post length could be in the range 7.5 to 10mm depending upon the root length. However authors defer in the length of the post from cemento enamel junction to the apical extent. A minimum of half to a maximum of three fourth the root length is generally accepted. As the length of the post increases the spreading forces decrease resulting in maximum preservation of root dentine. Short posts provide less retention and can cause root fractures¹⁶. The post must be long enough to avoid excessive internal stresses on the root. To do so, it must reach at least half of the root length contained in the alveolar bone.

Antirotational Features:

To conserve intact tooth structure, antirotational features are added to provide resistance to torsional forces. It is essential to preserve the tooth structure, one of the important design features is antirotation which is incorporated by slots, pins and additional post.

Luting Cements:

The ideal cement thickness for maximum retention lies in the range 25-35 μ m. However, variations in cement film thickness had only a moderate influence on retention, and that retention was decreased by only 33 per cent as the film thickness increased from 20 to 140 μ m.

Over time, the materials used to cement posts into the canal have evolved. Zinc phosphate or an adhesive resin system can be used to cement metal posts. Adhesive cementation is preferred over zinc phosphate because it results in less microleakage, increased retention, and greater fracture resistance. However, the most satisfactory cement for luting custom cast post is zinc phosphate cement. More installation forces is seen in tapered post.

Shape of the Post

The post shape also appears to influence biomechanical behavior, since cylindrical posts resist the pulling forces four times more than conical posts. However, they have acute angles in their apical portion, concentrating tensile stress in the root canal. In addition, the preparation for placing these types of post makes the apical portion thinner¹⁷. Parallel design is more retentive but it would remove more tooth structure. On the other hand, conical posts concentrate tensile stress in the cervical region of the root due to the wedge effect¹⁸. Tapered design is still favoured for cast post.

Surface Characteristics of Post

Screw-shaped posts have been used as intraradicular anchorage it is retentive but results in higher installation forces resulting in fracture of tooth. Another post geometry is serrated posts, with macro retentions which are supposed to increase the mechanical retention between resin cement and post. However, these retentions considerably reduce the flexural strength due to the reduction in the actual post diameter¹⁹. Parallel design is more retentive but it would remove more tooth structure. Smooth surface lacks retention but it is easy to fabrication. Retention can be improved by surface Irregularities, notching, Sand blasting, air abrasion of radicular part.

Location of the Tooth in the Dental Arch:

Because of the different force directions, biomechanical considerations suggest that anterior teeth, premolars, and molars will behave differently. Because of the greater horizontal forces, the maxillary region is considered a high-risk area for technical failures²⁰. According to Torbjörner et al, the angulation of the teeth, which leaves them vulnerable to shear stresses and eccentric loading, is one explanation for why anterior teeth fail more frequently. As a result, not only the component choice but also the tooth's location must be taken

into account when making a post²¹

CONCLUSION

The following points summarize the key factors in post fabrication: Most conservative option it is customized precisely to root anatomy. It improves structural integrity of teeth and be used when there is need to change crown root angulation as well as coronal tooth structure loss completely or partially. Used for any root canal anatomy including oval canals and it is easily retrievable.

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