

Rehabilitation of Fractured Maxillary Central Incisor : A Case Report

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Abstract

Endodontically treated teeth have significantly different physical and mechanical properties compared to vital teeth. It is assumed that endodontically treated teeth are weaker and more prone to fracture because of desiccation or premature loss of moisture supplied by a vital pulp. Posts have been advocated to strengthen weakened endodontically treated teeth against intraoral forces by distributing torquing forces within the radicular dentin to supporting tissue along their roots. Data from an in vitro investigation by Kantor and Pines reported that an intraradicular post doubled the fracture resistance of a root. However, recent studies have demonstrated that placement of a post can create stresses that lead to root fracture during post placement or function and that the strength of endodontically treated teeth was directly related to the remaining internal tooth structure. Successful functional and esthetic restoration of grossly decayed, fractured tooth with minimal coronal tooth structure is a challenging endeavor. Long term prognosis depends on amount of remaining tooth structure. The tooth with at least 2mm of remaining structure above gums has good prognosis. Every effort should be made to save as much of the coronal tooth structure as possible because this helps reduce stress concentration at the gingival margin. Different techniques can be used for fabricating pattern for custom cast post and core. This article presents a technique for pattern fabrication with self cure acrylic resin.

Keywords: Custom Cast Post and Core, Beading Technique, Grossly Carious teeth, fracture at gingival margin.

Introduction

Root canal treated teeth with extensive loss of substance have numerous problems due to significant reduction in the capability to resist a myriad of functional forces. Various techniques have been introduced to

address specific problems of coronoradicular stabilization, mainly focused on the dowel-core unit. The design of a dowel is a crucial factor affecting the dowel's mechanical behavior in tooth structure and long-term clinical success. Increases in length, diameter, and surface texture of the dowel and the creation of a ferrule effect improve the strength and retentive properties of the restoration. To maintain the structural integrity of the root under functional loading, homogeneous transmission of functional forces along the dowel is desirable. Increasing the length of the dowel reduces peak dentinal stress concentrations, whereas the diameter of the dowel does not have a determining effect on stresses. Due to their conformity with root form, unthreaded tapered dowels provide even distribution of occlusal forces and reduce stress magnitudes. Overall, the choice of dowel design should be in accordance with the biomechanical requirements of the remaining tooth structure. 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. When a large portion of the clinical crown has been lost, it often is impossible to achieve sufficient retention of a restoration. In such situations, a root-canal-retained restoration is required to retain restoration and protect the remaining tooth structure by proper force distribution. Two factors influence the choice of restoration technique: the type of tooth; and the amount of remaining tooth structure. The latter is probably the most important factor in determining the prognosis.

The custom made post and core has been regarded a "gold standard" in post and core restoration. Bregman reported 90.6% success rate after 6 years of service for custom cast post core. Fabrication of custom cast post core is a two-stage procedure (fabrication of post followed by core over the post)

Case Report

A 26 year old male patient reported to the Department of Prosthodontics Shree Bankey Bihari Dental College and Research Centre with considerable loss of coronal tooth structure of maxillary left central incisor (fig 1). After clinical and radiographic examination, root canal treatment was advised to the patient followed by custom cast post-core and full veneer crown. After root canal treatment, post core pattern fabrication was done with self cure acrylic resin (fig 2 and 3). The pattern was invested in phosphate bonded investment. After burnout, casting was done with base metal alloy. The casting was retrieved from mold and finished (fig 4).

The finished restoration was tried in the mouth and was cemented using Glass Ionomer Cement (Type 1) (fig 5a and 5b). After cementation, the patient was recalled and appropriation was done for a full-coverage restoration. A PFM Crown was fabricated and luted with Glass Ionomer Cement (Type 1) fig 6. The patient was then called for a follow up appointment and it was observed that he was well satisfied with the restoration.

Technique

A radiograph is essential to evaluate the root and post space to determine the length and diameter of the post. Post length must be evaluated for each situation. After determining post length, it is marked on peeso reamer. Pesos reamers are available in six size and numbered from 1 to 6. These are identified on the basis of ring present on the shank. Peeso reamer must be in rotatory motion when it is placed in canal and it must be rotatory motion when it is removed from the canal. It remove the GP by frictional contact with it. The Gutta Percha was retrieved from canal. apical 5mm of GP was left to maintain apical seal. The canal was prepared upto 5 no. pesos reamer (approximately 1.5mm in diameter) : Reduction of the coronal tooth structure was then done using a Tapered Flat end bur and a

Shoulder finish line was prepared on sound tooth structure for PFM crown beyond the post preparation margin to produce the desired ferrule effect for proper distribution of forces along the long axis of tooth. The canals were lubricated with petroleum jelly so as to prevent the adhesion of the Acrylic Resin to the prepared canals. The length of the prepared post space was marked on the custom acrylic dowel/post. The post should extend up to the full length of the prepared root canal and snugly fit into the prepared space. Neither should it be too tight nor should it be loose. If the acrylic dowel is tight, it should be trimmed accordingly; and if it is loose, it should be corrected by adding Self cure Acrylic Resin by Bead Technique (brush dipped in monomer followed by polymer and applying it to the acrylic post). A slightly oversized Core was fabricated in Self Cure Acrylic Resin and allowed to polymerize completely. The Core was then shaped like a natural tooth preparation (fig 2 and 3) to receive a PFM Crown. The Acrylic pattern was removed, Sprued, Invested and Casted (fig 4). After burn-out the Casting was retrieved, finished and tried in the patient's mouth. After all aspects of the restoration were verified satisfactorily, it was cemented to the prepared tooth (fig 5a and 5b). An impression was made in Addition Silicon for the fabrication of a PFM Crown which was cemented on the prepared tooth. The tooth was successfully restored aesthetically as well as functionally.

Discussion

A post and core are often required to retain a complete crown in endodontically treated teeth. Many techniques are available for post-and-core construction. The factors considered in the selection of a post system include: retention, stress distribution, resistance to root fracture, and post fracture. Cast posts and cores are custom-made and replace tooth structure; therefore they are indicated when the structure of the canal is not amenable to a prefabricated post. When the shape of the root canal and the absence of carious dentin enable minimal root canal preparation, the prefabricated post can be well adapted. Several in vitro studies support the opinion that preservation of tooth structure is one of the most important variables for the successful restoration of endodontically treated teeth. Root fractures

can be minimized by conservative endodontic techniques and by controlling stress during post placement. A recent in vitro study suggested that the retention of passively fitted dowels cemented with resin cements exceeds that of some active dowel systems.

FERRULE EFFECT as described by Sorensen and Engelman is 360 degree crown collar surrounding parallel walls of dentin and extending coronal to the shoulder finish line of the preparation. When a 2-mm ferrule is preserved, the fracture strength of a custom cast post-core restored tooth can be significantly higher than that of prefabricated post and resin core restored tooth. This finding is similar to other studies. Fraga et al found that roots restored with individual cast posts exhibited significantly higher fracture resistances than cemented prefabricated posts with composite cores. Sirimai et al compared resistance to vertical root fracture of extracted teeth treated with 6 post-core systems, including prefabricated post and resin cores, and found that custom cast post and cores provided the best fracture resistance of the 6 post-core systems evaluated. Because a custom cast post-core can be made to fit the post space better than a prefabricated post, it is reasonable that the former will transfer occlusal stress better. Three-dimensional finite element analysis on maxillary central incisors subjected to endodontic treatment and various post and core applications showed that cast gold post and core application yielded the best result. Custom cast post core has been regarded a "gold standard" for restoring the teeth with minimally tooth structure. Bregman reported 90.6% success rate after 6 years of service for custom cast post core. Posts and cores can be fabricated either intraorally on the tooth or indirectly on the die. Fabrication of custom cast post core is a two-stage procedure. Post is formed first followed by core. Post should fit snugly; it should not be too tight or too loose. In case of multi-rooted teeth, the primary post is usually placed in the canal which is longer, straight and has the greatest circumferential diameter E.g. Distal root of mandibular molar, Palatal root of maxillary molar and the Accessory Post which is shorter in length, resists torque forces and prevents the rotation of Core, is usually placed in the

shorter canal. In this case primary post was placed in distal canal and accessory in the mesiobuccal and mesiolingual canal.

Conclusion

Retention and resistance to fracture are two important factors that must be achieved with post-and-core retained restorations. Nevertheless, retention often requires the removal of tooth structure, a procedure that may reduce the strength of the root. When placing a post, the dentist must evaluate each tooth individually to determine the best approach to obtaining the maximal fracture resistance. Because a single post system is unlikely to satisfy retentive requirements for all clinical situations, a variety of post systems are suggested to achieve the optimal balance between post retention and resistance to root fracture. This flexible approach allows the dentist to successfully restore most endodontically treated teeth. Custom made post and core restorations are a good treatment option for treating teeth fractured near the gingival margin or those with minimal tooth structure.

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LEGENDS

- Fig 1. Pre operative
- Fig 2. Chemically cured acrylic resin pattern
- Fig 3. Pattern in patient's mouth
- Fig 4. Custom cast post and core
- Fig 5a. After post cementation
- Fig 5b
- Fig 6. PFM crown