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Richmond crown: Restoration of badly broken endodontically treated posterior teeth - A case report

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Abstract

Restoration of endodontically treated grossly destructed teeth is one of the biggest challenges in restorative and prosthetic dentistry. It is generally agreed that the successful treatment of these teeth with pulpal disease depends not only on good endodontic therapy, but also on good prosthetic reconstruction of the tooth after the endodontic therapy is complete. Often, we come across an endodontically treated tooth with little or no clinical crown in routine clinical cases. In such cases, additional retention and support of the restoration are difficult to achieve. Richmond crown (post-core & crown as a single unit) give this additional amount of retention & support & proves to be very promising in long term. A case report is discussed here where structurally compromised; endodontically treated, posterior teeth were restored using the Richmond crown.

Keywords: Cast post; Endodontic; Restorations; Richmond crown; Teeth; Therapy.

Introduction

The longevity of endodontically involved teeth has been greatly enhanced by continuing developments made in endodontic therapy and restorative procedures. It has been reported that a large number of endodontically treated teeth are restored to their original function with the use of intraradicular devices. These devices vary from a conventional custom cast post and core to one visit techniques, using commercially available prefabricated post systems.

There are many techniques of restoring a badly broken molar tooth after successful endodontic treatment which should be complemented by a sound coronal restoration. In the late 19th century, the "Richmond crown," a single-piece post-retained crown with porcelain facing, was engineered to function as a bridge retainer. Richmond crown is not post and core system but it is customized, cast able post and crown system as both are single unit and casted together. With the advent of scientific endodontic therapy in the 1950s, the challenges increased for restorative dentistry. Teeth that were extracted without hesitations were now successfully treated with predictable endodontic therapy; and a satisfactory restorative solution was necessary. In this article, a case report has been

discussed along with fabrication technique of Richmond Crown.

Case Detail

A 40 year-old patient reported to the Private Dental clinic, experiencing pain in the upper right back tooth region.

On examination of oral cavity it was found that tooth 25&26 had extensive caries with crown fracture. It was tender on percussion and palpation present w.r.t 26 as shown in fig.1

Intraoral periapical radiographic revealed deep caries involving the pulp space with fracture on the cusp on 26. So Root canal treatment was done under local anesthesia.

In this case report, Richmond crown was planned on 26 as it can be a better option instead of prefabricated posts because of major loss of tooth structure and lack of occlusal clearance for conventional PFM (porcelain fused metal) crown11.

Gutta percha was removed from palatal canal with gates glidden drill (size 1 to 4), care was taken not to disturb the apical seal. Post space preparation was done with peso reamer drill up to size #04.

Root preparation in the palatal canal was done as conservatively as possible. For making final impression, palatal canal was coated with light body impression material (Impressiv) and then a small piece of wooden stick, coated with light body was placed in the canal. Coronal portion was fabricated with sticky wax later impression material (putty material) was loaded in stock tray and

Fig.1

Fig.2

Final impression is made as shown in fig.2. The impression was examined for defects in recording of post space. It was then poured with die stone and wax pattern was fabricated. Metal crown with post was fabricated as shown in fig.3

Fig. 3

Fig. 4

Finally Cementation was done as shown in fig.4.

Discussion

The core becomes an integral part of the load-bearing structure of the damaged tooth, it should provide a satisfactory properties for retention and resistance of a cast restoration. All of the direct placement core materials require bulk of material for strength.[6, 7]

Since the post is primarily responsible for transmitting the occlusal forces to the remaining tooth structure and fundamentally serves to retain the core buildup, the physical properties of the post are critical. If the functional occlusal forces exceed the elastic limit of the post it will cause separation of the core due to permanent deformation of the post. No matter how tough the core material, eventually the core will breakdown resulting in either caries or dislodgement of the crown or fixed prosthesis.

The different coefficients of thermal expansion of the various components create yet another potential source of deleterious effects on the bonds between the tooth-post-core-cement-crown complexe. The combined effects of thermal cycling, fatigue loading and aqueous environment test the bond between materials and break down the materials. This is why it is desirable to unify the post and core in one material for long-term stability. A cast metal post and core (Richmond crown) is currently the only method that allows this goal.[8]

In early 1700s, Fauchard inserted wooden dowels in root canal of tooth with the concept that over a period of time wood would absorb fluids and expand, resulting in enhancement of retention of post but excessive expansion was frequently causing root fractures.[2] Even endodontic treatment failure was very common in that era so development of new designs and material was very slow but in the 19th century metal posts came into existence over which porcelain crowns were screwed. A device developed by Clark in the mid-1800s was extremely practical for its time because it included a tube that allowed drainage from the apical area or the canal. The Richmond crown was introduced in 1878 and was incorporated as single piece post-retained crown with porcelain facing.[2,3] Initially it was having a threaded tube in the canal with a screw retained crown, which was later modified to eliminate the threaded tube and was redesigned as a 1-piece cast dowel and crown. This design had major flaw of not considering different longitudinal axis of root and crown and soon it lost its popularity because of its technically incorrect design. As root and crown have different longitudinal axis and making them parallel require excessive cutting both for crown and root.

These difficulties led to development of a post and core restoration as a separate entity with an artificial crown cemented over a core and remaining tooth structure. This two-step technique improved marginal adaptation and allowed for a variation in the path of insertion of the crown. In coarse of time till today, different designs/techniques/materials have been evolved; however, no single system provides the perfect restorative solution for every clinical circumstance, and each situation requires an individual evaluation. Although in present time the simplified "one-visit" prefabricated post are most commonly used; yet custom posts have their own advantages and indications so are still in use. [10] Richmond crown [2, 3, 4] is not post and core system but it is customized, castable post and crown system as both are single unit and casted together. Design includes casting of post and crown coping as single unit and cemented onside canal and over prepared crown structure having same path of insertion. Ferrule collar is incorporated to increase mechanical resistance, retention apart from providing antirotational effect. Major technical drawback of this design is excessive cutting in making two different axis parallel which results in weakening of tooth and also this design increases stresses at post apex causing root fracture. Few indications for Richmond crown are grossly decayed or badly broken single tooth where remaining crown height is very less and incases with steep incisal guidance (deep bite and very less overjet). As less cervical tooth structure subjected to flexion forces under function and this design provides more cervical stiffening than other post system and is needed to protect the crown margins and to resist leakage. Case selection is very important here. The bulk of the remaining tooth above the restorative margin should be at least 1.5mm to 2mm to achieve resistance form. Even cases with steep incisal guidance are also subjected to more flexion forces along with very limited space for restoration. Such tooth if given with post and core first over which crown is cemented, needs adequate thickness which is a limitation here. To compensate this inadequacy if core is made thin then it is weak and also presents sharp margins and edges acting as stress points for overlying crown. Metal free crowns are predisposed to fracture whereas metal ceramic crowns tends to be a bulky crown in giving required thickness for metal coping and ceramic over it resulting in compromised esthetics. Richmond crown is best possibility in both these conditions as less crown cutting is required to make two axis parallel in grossly decayed tooth and also it require less thickness for best results. The advantages of this design are custom fitting to the root configuration, little or no stress at cervical margin, high strength, eliminate cement layer between core and crown so reduces chances of cement failure. Although certain disadvantages are time consuming, more appointments for patient, high cost, high modulus of elasticity than dentine (10 times greater than natural dentin), less retentive than parallel-sided posts, and acts as a wedge during occlusal load transfer.it is difficult to retrieve and can lead to tooth fracture. The clinician must judge every situation on its individual merits and select a procedure that fulfills the needs of the case while maximizing retention and minimizing stress. Although any number of post designs may be used in a clinical situation, success is dictated by the remaining tooth structure available after endodontic therapy.

Conclusion

There are situations in which Richmond crown are indicated or contraindicated, as well as features that should be considered in deciding that one is the treatment of choice for restoring a grossly decayed or badly broken tooth.

Richmond crown can be used as a treatment option for the badly broken endodontically treated tooth with less occlusal clearance but should be used judiciously.

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