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CASE REPORT

MANAGING FRACTURED INCISOR WITH RICHMOND CROWN- A CASE REPORT

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ABSTRACT

Fabricating a crown with inadequate interocclusal space may be challenging to the clinician. Endodontically treated teeth with the loss of coronal tooth structure when left untreated for a long period may cause supraeruption, tipping, and rotation of adjacent and opposing teeth. This may be challenging to the clinician, when tooth with less remaining crown height is indicated for post and core followed by crown to restore normal anatomy, function and esthetics. Patients with reduced interocclusal clearance and having very steep incisal guidance are most difficult to manage. Richmond crown is a feasible approach for such cases that can be performed with very less incisal clearance to accommodate post, core and crown thickness. In this article diagnosis, treatment planning for such case has been discussed along with fabrication technique of Richmond crown.

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INTRODUCTION

Most common encountered problems in dental practice is patients with fractured anterior tooth and having very steep incisal guidance. Such cases are restored endodontically when involved with pulp. Tooth with very less remaining crown height is indicated for post and core with crown over it to restore the normal function, anatomy and esthetics. Richmond crown is very much indicated in single tooth situations with very less incisal clearance to accommodate core and crown thickness or with very less remaining clinical crown.In this case diagnosis, treatment planning for the case has been discussed along with fabrication technique of Richmond crown. Dentistry since ages have always focus on preservation of what that remains & after endodontic treatment restoration of the tooth with crown is always recommended. Whenever crown structure remains insufficient to retain crown lengthnening or post & core becomes necessary to obtain retention and resistance form of the tooth (Rosenstiel *et al.*, 1998). However post and core procedure can give rise to complications such as dislodgement of assembly, loss of restorative seal, fracture of post/root and periodontal injury (Bartlett, 1968). When there is deep bite with no/very less overjet in anterior teeth; as oblique forces are maximum and core reduction should be adequate to provide indicated thickness for ceramic/metal ceramic crown to achieve desirable esthetics.

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Richmond crown is best indicated solution in such conditions (Franklin, 2003). The Richmond crown was introduced in 1878 and incorporated a threaded tube in the canal with a screw retained crown. It was later modified to eliminate the threaded tube and was redesigned as a one piece dowel and crown (Cheung, 2004). Several main causes of failure of post-retained restorations have been identified, including: recurrent caries, endodontic failure, periodontal disease, post dislodgement, cement failure, post-core separation, crown-core separation, loss of post retention, core fracture, loss of crown retention, post distortion, post fracture, tooth fracture, and root fracture (Antariksha Dod, 2016; Bhushan *et al.*, 2014; Rupika *et al.*, 2009; Mishra *et al.*, 2015). Resistance to fracture is directly related to the thickness of remaining dentin, especially in the buccolingual direction. Therefore excessive flaring during endodontic treatment or overpreparation of the canal space for a post can increase the risk of failure (Hudis, 1986). There are many techniques of restoring a badly broken molar tooth after successful endodontic treatment which should be complemented by a sound coronal restoration. This should ideally meet the requirements of function and aesthetics. There are two main categories of post: custom-fabricated and prefabricated. In the late 19th century, the "Richmond crown," a single-piece post-retained crown with a porcelain facing, was engineered to function as a bridge retainer. Richmond crown is not post and core system but it is customized, castable post and crown system as both are single unit and casted together. It is easier to make cast metal restorations with the aid of posts for retention and lasting service. However, whenever possible the

metal can be camouflaged by veneering with tooth colored restorations (Rupika *et al.,* 2009; Fernandes and Dessai, 2001; Smith *et al.,* 1998).

Case report

18 year female patient reported to our department (conservative dentistry & endodontics pacific dental hospital, udaipur) with a complain of fractured upper front teeth and she desired to get it restored. She gave history of trauma 6 years back with the same tooth as she had fell down and broke her front two teeth. She gave no history of pain in any of her teeth. she gave no significant medical and family history .she was well built and coperative. Clinical examination revealed Ellis class 2 fracture with 11 and Ellis class 3 fracture with 12. Fig.1a. Dental caries in16,17,26,27,36,37. Radiographic examination revealed incisal radiolucency involving enamel and dentin with 11and radiolucency involving enamel,dentin and pulp with 12. Fig.1b. Centric occlusion was found and patient had deep bite and less overjet. Pulp vitality test was performed and cold test revealed negative response with 12 and positive response to all adjacent teeth. Diagnosis was made as Ellis class 2 fracture with 11 and Ellis class 3 fracture with 12 along. With chronic generalised gingivitis. As the patient had a deep bite Richmond Crown with 12 was planned for this much indicated case for good asthetics. Composite restoration was planned with 11 and restoration was planned with 16,17,26,27,36,46

Fig. 1a. pre-operative image

Fig. 1b. pre-operative radiograph

Root canal opening was done with a round and tapered bur, working length was determined at 19mm with the help of an apex locator and this was radiographically confirmed. Fig 2(a) Biomechanical preparation was performed till 70 k file along with continiousrecaptulation and copious irrigation was done with sodium hypochlorite and saline. Masterconeselction was done as Guttapercha of 70 size and obturation of the canal with lateral condensation technique was done with the help of zinc oxide eugenol sealer.

Post space preparation

Post space was prepared with Peeso reamer (size 3) to remove guttaperchaupto one-third off roots length (care was taken not to disturb apical seal) Fig.2(b). Undercut areas within the canal were blocked with glass ionomer cement and preparation was ended with the use of H-file (circumferentially) to smoothen the walls of the post space.

Fig. 2a. Root canal opening

Fig. 2b. Post space preparation

Crown structure preparation

Firstly, remaining crown structure was prepared circumferentially for metal ceramic crown with shoulder finish line buccally and chamfer on palatally and this was prepared with the help of a flat end tapered bur and a chamfer bur. Fig.3

Fig. 3. Crown preparation

Shade selection

Shade selection was done with help of shade guide (shofu) as b2. Fig. 4a. Composite restoration was done with 11. Fig. 4(b)

Fig. 4a. shade selection

Fig. 4b.Composite buildup with 11

Post and core fabrication: Vaseline application was done inside the canal and over the prepared crown.

WAX Pattern (direct method)

Intra canal length was measured and wooden tooth pick was cut and modified according to the length and width of the canal. Intracanal impression was captured by flowing green stick wax over tooth pick and placing it inside the canal. Core structure was build up along with full coverage extension all over prepared crown. Fig 5(a). Casting through wax pattern was done at the same day.

Fig. 5a. Wax pattern

Fig. 5b. Casting

Crown fabrication

Prepared post and core with coping assembly was casted in been metal alloy and after finishing metal trial was done to check fitting. Finish line was adjusted to equigingival and checked for ceramic clearance. Fig.6 (a),(b),(c)

Fig. 6(a),(b). Try in radiographic view

Fig. 6(c).

Gingival retraction cord was placed below the finished margins of the tooth with the help of a cord packer. Fig.7

Fig. 7. Gingival retraction cord

Impression making was done with putty after proper selection of impression trays. Fig.8(a).

Final impression

Area of interest was scraped and again impression was taken with the light body after apllication of vaselline inside the canal impression for lower arch was made with alginate. Fig.8(b)

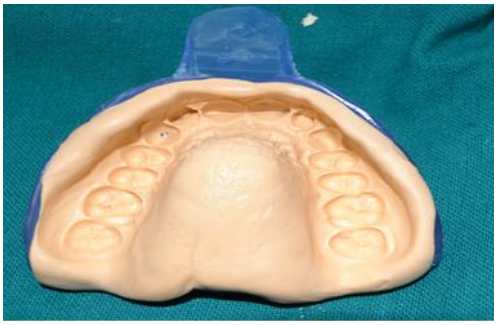

Fig.8(a) impresion making with putty

Fig.8(b) Final impression

Diagnostic cast was made and RICHMOND CROWN was prepared. Fig.9

Fig. 9. Diagnostic cast with richmond crown

After Ceramic build up was carried out, final prosthesis was checked for fit and occlusion. Assembly was cemented with glass ionomer cement used in luting consistency. Fig.10(a),(b)

Fig.10(a),(b). Richmond crown after cementaion

DISCUSSION

Endodontic treatment has been in practice since ages with high success rate but restorative part was not much understood previously. Whenever, a considerable amount of tooth structure is lost because of fracture/caries/secondary decay around previous restorations/during endodontic treatment, then remaining crown structure is not sufficient enough to retain large prosthetic crown (Hudis and Goldstein, 1986). In such cases special procedures are needed with objective to increase remaining crown length so that it manage arc of rotation under oblique forces (function) and there are crown lengthening (either surgically or by orthodontic extrusion) or post placement with core build-up.Surgical crown lengthening is indicated whenever there is esthetic and cosmetic need but disadvantage is it reduces root length and requires surgery with long healing period. Orthodontic extrusion also reduces root length and is time consuming too. Post and core procedure is most commonly used method for such cases (Fernandes and Dessai, 2001). Also, corrosion of metallic posts has been proposed as a cause of root fracture.The concept of increasing remaining crown structure (core) and strengthening it by using retention from root (post) is not new (Smith *et al.,* 1998). Richmond crownis not post and core system but it is customized, castable post and crown system as both are single unit and casted together. Design include casting of post and crown coping as single unit over which ceramic is fired 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 anti-rotational 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 (Bhushan *et al.,* 2014). Few indications for Richmond crown are grossly decayed or badly broken single tooth where remaining crown height is very less and in cases 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 (Bhushan *et al.,* 2014).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 esthetic results (Rupika *et al.,* 2009). The advantages of this design are custom fitting to the root configuration, little or no stress at cervical margins, high strength, availability of considerable space for ceramic firing and incisal clearance, 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. If ceramic fractures then it is difficult to retrieve and can lead to tooth fracture. Such case should be managed using intraoral ceramic repairing kit. (Mishra *et al.,* 2015). 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 (Christensen *et al.,* 1998).

The restoration of the endodontically treated tooth is an important aspect of successful endodontic therapy. There are wide ranges of treatment options of varying complexity. The clinician must be able to predict the probability of restoring such teeth successfully. In general, endodontically treated teeth experience significant coronal destruction as well as loss of radicular dentin, secondary to endodontic treatment. There is evidence that these teeth have reduced levels of proprioception, which could impair normal protective reflexes. A post and core retained crown may be indicated to fulfill these requirements. Clinical longevity of the post and core restoration can be influenced by many factors including magnitude and direction of the occlusal load, design of dowel, thickness of remaining dentin, quality of cement layer and creation of ferrule effect to enhance structural durability of the final restoration (Goodacre *et al.,* 1994). Comprehensive studies of the literature and cases have led us to draw meaningful conclusions as to how the endodontically treated tooth must be handled. The primary goal of retaining the treated tooth must be planned strategically as per the present condition of the tooth for best and long-term results (Assif *et al.,* 1993).

Conclusion

Although implant popularity is increasing by each passing day, yet post and core has its own importance in restoring grossly decayed or badly broken teeth as it require less time/cost and provide better esthetic results. There are many post-and-core materials/ techniques available to the clinician for a variety of clinical procedures and thus each clinical situation should be evaluated on an individual basis. Richmond crown is very much indicated in situations with very less incisal clearance to accommodate core+cement+crown thickness.

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