

# Richmond's Crown: The Ancient Dental Art

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**Abstract:** *Endodontically treated teeth with the loss of coronal tooth structure when left untreated for a long period of time may cause supraeruption, drifting, tipping, and rotation of adjacent and opposing teeth. Tooth with very less remaining crown height is indicated for post and core with crown over it to restore the normal anatomy, function, esthetics. Richmond's crown is very much indicated in single tooth situation with very less incisal clearance. This case report describes two cases with fractured central incisors and reduced interocclusal space treated with Richmond crown.*

**Keywords:** Richmond's crown, Post endodontic restoration, Overjet

## 1. Introduction

Present era of dentistry is focusing on conservation of natural tooth and since old ages endodontic dentistry is playing major role in restoring tooth function and after which prosthetic dentistry brings its function and esthetics back. Wherever remaining crown structure is insufficient to retain full coverage crown then post and core is required to increase retention and resistance form of tooth.<sup>1</sup>

During the treatment procedure, a structurally compromised tooth can give rise to complications such as root fracture, loss of restorative seal, dislodgement of core, and periodontal injury due to biological width invasion during margin preparation.<sup>2</sup>

Post and core procedure can give rise to complications such as dislodgement of assembly, fracture of post/root, loss of restorative seal and periodontal injury. Such situations further get complicated 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. Richmond crown is best indicated solution in such conditions.<sup>3</sup>

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 1-piece dowel and crown (Hampson EL et al; 1958, and Demas NC et al; 1957), which lost its popularity quickly because they were not practical. This was obviously evident when divergent paths of insertion of the post space and remaining tooth structure existed, especially for abutments of fixed partial dentures. One piece dowel crown restorations also presented problems when the crown or FPD required removal and replacement. 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. 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.<sup>4</sup>

Richmond crown is fixed denture with post and crown (single unit) systems, where the post part goes into the root canal and its crown covers the entire of the original tooth crown surface. Indications for Richmond crown are not many, usually it is done on a tooth which has been badly damaged and remaining tooth structure is very less, or in case of incisal inclination repair (deep bite and less overjet). Due to the remaining tooth structure in the cervical third when the load gets distributed, this design protects the cervical part of post and core system than the others, so it protects the tooth crown margin and reduce the possibility of restoration leakage.<sup>5</sup> In this article, two case reports have been discussed along with fabrication technique of Richmond crown.

## 2. Case report

### Case 1

A 27 years old female patient named Mubina Baloch reported to the department of Conservative Dentistry and Endodontics at Narsinhbhai Patel Dental Collage and Hospital with the chief complain of pain and sensitivity in upper front teeth region of jaw. On clinical examination generalized erosion was observed which was markedly pronounced in the maxillary right central incisor (fig-a & b).

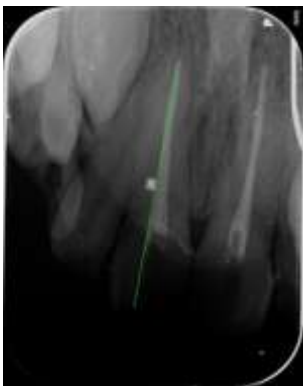


a. preoperative



b. preoperative radiograph

On clinical examination of centric occlusion it was found that the patient had deep bite and less overjet. So the treatment plan was decided as to undergo for fabrication of Richmond's crown in relation to maxillary right central incisor after doing the complete root canal treatment(fig-c).



c. completed root canal treatment

After doing the standard root canal treatment the following procedure was performed.

**Post space preparation:** post space was prepared with Pecho reamer to remove guttapercha upto one third of roots length (care was taken not to disturb apical seal). Under cuts within the canal were blocked with glass ionomer cement and preparation part was ended with the use of H-file (circumferentially) to smoothen the walls of the post space(fig-d).



d. post space preparation

**Crown structure preparation:** Firstly, remaining crown structure was prepared circumferentially for metal ceramic crown with shoulder finish line (sub-gingival) buccally and chamfer on palatally.

**Post and core fabrication:** Intra canal length was measured and wooden tooth pick was cut and modified according to the length and width of the canal. Intra canal 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-e).



e. wax pattern fabrication

**Crown fabrication:** Prepared post and core with coping assembly was casted in base metal alloy (fig-f) and after finishing metal trial was done to check fitting. Finish line was adjusted to equigingival and checked for ceramic clearance. Ceramic build up was carried out(fig-g) and final prosthesis was checked for fit and occlusion. Assembly was cemented with glass ionomer cement used in luting consistency(fig-h & i).



f. metal casting



g. final prosthesis



**h. postoperative radiograph**



**i. postoperative**

The case was followed for 6 months in which no root fracture, no loosening or dislodgement of post, and no secondary caries were recorded.

**Case 2**

A 21years old male patient named Mahendra Thakor reported to the department of Conservative Dentistry and Endodontics at Narsinhbhai Patel Dental Collage and Hospital with the chief complain of broken tooth in upper front teeth region of jaw. History reveled episode of fall before few years with maxillary left central incisor. On clinical examination Elli's class III fracture was diagnosed in maxillary left central incisor(fig-j & k).



**j. Preoperative**



**k. Preoperative Radiograph**

On clinical examination of centric occlusion is was found that the patient had deep bite and less overjet. So the treatment plan was decided as to undergo for fabrication of Richmond's crown in relation to maxillary right central incisor after doing the complete root canal treatment (fig-l).



**l. Completed root canal treatment**

Treatment included standard root canal treatment followed by fabrication of the Richmond's crown. The clinical procedure was same as described in the case 1(fig-m to r).



**m. post space preparation**



**n. wax pattern fabrication**



**o. Metal Casting**



p. final prosthesis



q. postoperative radiograph



r. postoperative

### 3. 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. 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 is most commonly used method for such cases.<sup>6</sup>

As early as 1728, Pierre Fauchard described the use of “tenons” which were metal posts screwed into the roots of teeth to retain bridges. In the mid-1800s, wood replaced metal as the post material, and the “pivot crown” a wooden post fitted to an artificial crown and to the canal of the root, was popular among dentists. 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, cast able 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 inside 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. A major technical drawback of this design is excessive tooth preparation in making two different axis parallel which results in weakening of tooth and also this design increases stresses at post apex causing root fracture.<sup>7</sup>

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. Also, corrosion of metallic posts has been proposed as a cause of root fracture.<sup>8</sup>

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. 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).<sup>9</sup>

The disadvantages with the Richmond crown are as follows: they are time-consuming, so more appointments are needed for the patient; cost is more and their modulus of elasticity is higher than dentine; and in the case of ceramic fractures, it is very difficult to retrieve and may lead to tooth fracture.<sup>10</sup>

Hence, the clinician must judge every situation and select the procedure that meets the requirement of both function and esthetics. Although there were other techniques that involved procedures to be carried out on the patient, we planned to change the morphology of the crown in order to place the restoration within the interocclusal space that was present between the upper and lower tooth.

## 4. Conclusion

This case report highlights the importance of post and core system in restoring badly broken or grossly decayed teeth in spite the massive popularity of implants nowadays as it is less time consuming and cost effective. Richmond crown is very much indicated in situations with very less overjet to accommodate core+cement+crown thickness.

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