

Post Endodontic Restoration with Novel Endocrown Approach: A Case Series

Priti Desai¹ Khyatiben Tailor² Pathik Patel^{3*} Payal Thakkar⁴

¹Professor, Department of Conservative Dentistry, Gurunanak Institute of Dental Sciences and Research, Kolkata, WB, India.

²Private Consultant, Surat, Gujarat, India.

³Private Consultant, Department of Conservative Dentistry, Ahmedabad, Gujarat, India.

⁴Private Consultant, Surat, Gujarat, India.

ABSTRACT

Background: To observe the performance of endocrown in badly carious teeth. Two patients with badly carious tooth in posterior region of mouth came to private clinic for treatment. Both patients were interested in conservative and permanent treatment of posterior teeth. Crown height and occlusion was not permissible to do conventional crown. So decision was taken to do endocrown for both patient, case-1 in tooth no26 and in case -2 tooth no 25. Both crowns were made with high strength pressable ceramic IPS emax and cemented with paracore resin cement. After cementation of endocrown clinical observation was done after one week, one month, three months and six months for retention, color changes, marginal ditching and partial or complete fracture and debonding of endocrown. According to observational parameter of clinical study both crown was intact after every observation, there is no color changes, marginal ditching, partial or complete fracture of both crown. Both crowns retain properly in place and both patients have no complain about its function. Endocrown is alternate treatment plan in clinical dentistry after root canal treatment where badly broken teeth are present.

Keywords: Endocrown, Resin Cement, Post, Ceramic.

INTRODUCTION

Recent years as demand for conservation of tooth is increased in population, Restoration after root canal treatment where lots of tooth structure is destroyed is challenged to all dentists. It requires to follow strict protocol for doing it. Depending of amount of lost tooth structure post endodontic restoration is decided. When two third of coronal tooth structure is lost then help from root canal is taken to reinforcement of coronal tooth structure by fabricating post and core and full cast crown. But this intracanal retainer support the coronal structure but they may require removal of lot of tooth structure ,causes stress development in root canal due to their rigidity and ultimately may lead to fracture of remaining weakened root of tooth¹. Because of advancement in adhesive dentistry, its

use is increasing day by day in clinical practice. There are varieties of resin cements with high bond strength and thin film thicknesses are available. And on other hand development of ceramic material has lead to the development of high strength ceramic material which are capable of being acid etched which are then luted with adhesive resin cements to get restoration with retention and resistance form. Thus, it became feasible to restore posterior teeth with extensive coronal tooth structure destruction.

There are different types of restoration like inlay, onlay, overlay, Richmond crown, sharonlay and post and core followed by full crown for endodontically treated tooth. With researches recently endocrown is introduced for restoration of endodontically treated teeth. Endocrown does not require the post in root canal but use the entire

Received: Jan. 18, 2016: Accepted: Mar. 12, 2016

*Correspondence Dr. Pathik Patel.

Department of Conservative Dentistry, Ahmedabad, Gujarat, India.

Email: pathik2289music@gmail.com



Fig 1: Pre-op occlusion before crown preparation.



Fig 2: Pre-operative before crown preparation.



Fig 3: Pre-op Xray – after obturation.

extension of the pulp chamber access cavity as a retentive resource.² Pissis¹² was the forerunner of the endocrown technique, described that it as the “**mono-block porcelain technique**”.³ In 1999 Bindl and Moßmann had described nomenclature endocrown for the first time. These crowns would be anchored to the internal portion of the pulp chamber and on the cavity margins, thus obtaining macromechanical retention provided by the pulpal walls, and micro mechanical retention would be



Fig 4: After endocrown preparation.



Fig 5: Occlusal clearance after endocrown preparation.



Fig 6: Post-op Xray after endocrown cementation.

attained with the use of adhesive cementation. These type of crown are indicated where excessive loss of hard tissues of the crown, interproximal space is limited so inadequate ceramic thickness, a short clinical crown, and traditional rehabilitation with post and crown is not possible because of



Fig 7: Post operative after endocrown cementation.



Fig 8: Post operative after endocrown cementation lingual view.



Fig 9: Post-operative after obturation.

calcified or curved canal, or short root canals that make it impossible to use posts.⁴

Herewith we would like to present case report in which molar teeth of patient treated with ceramic endocrown and follow up is done up to six months.

CASE REPORT 1

A 35 years old female came with chief complain of pain in upper left back teeth region since 1 month. On clinical examination, deep class II

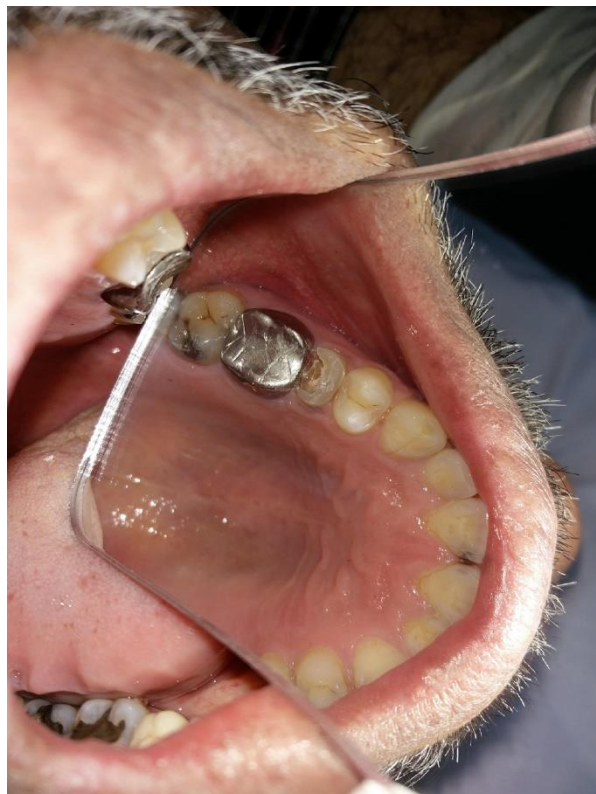


Fig 10: Pre-operative of premolar.



Fig 11: After tooth preparation.



Fig 12: Ceramic endocrown cementation.



Fig 13: Zirconia crown in first molar.



Fig 14: Post operative after crown cementation post-operative buccal view.



Fig 15: Post-op Xray after endocrown cementation.

caries was present. On radiograph it was very near to pulp. Patient had complained of night pain and extreme sensitivity to hot and cold stuff. So root canal treatment was done as per endodontic principle and Ceramic endocrown was planned after explaining the patient regarding benefits of not involving contacts of the other side of the tooth as well as superior aesthetics and polish compared to full cast crowns. Endocrown with Ceramic IPS emax press was prepared. (Figure - 1, 2, 3, 4, 5, 6, 7, 8).



Fig 16: Cementation materials.



Fig 17: Die cut buccal view.

CASE REPORT 2

A 50 years old male patient came with chief complain of pain in upper left back teeth region since 15 days. After clinical examination and radiograph it was found that there was deep distal caries in maxillary left premolar and stainless steel crown was present in tooth no 26. After removal of crown from 26, it revealed deep cervical caries approaching pulp. So decision was taken to do root canal treatment in both 25 and 26, followed by full

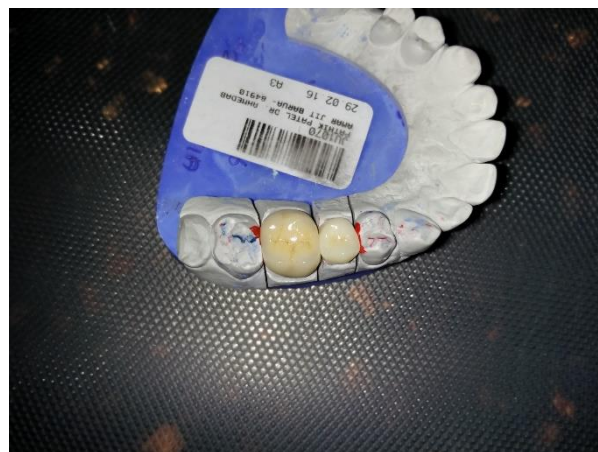


Fig 18: Die cut occlusal view.

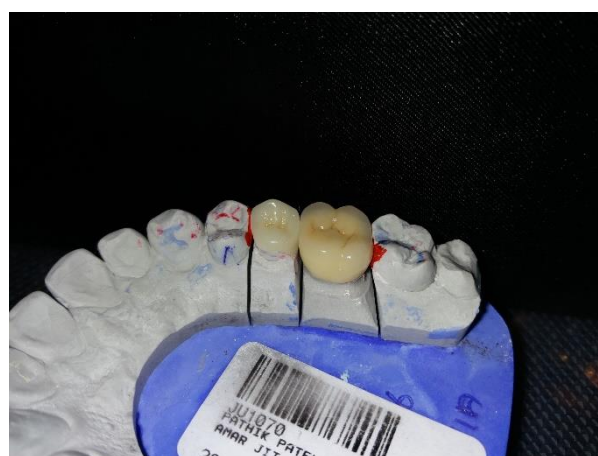


Fig 19: Die cut palatal view.

crown in 26 and Endocrown was selected for 25 because tooth was very narrow mesiodistally and thus after full crown preparation, the healthy tooth structure wouldn't have left much at the cervical area for retention. So Endocrown with Ceramic IPS emax press was prepared (Figure -7, 8, 9, 10, 11, 12, 13, 14). Before doing crown preparation floor of pulp chamber was filled with flowable composite tetric N flow up to 0.5 to 1mm to reach all wall of the pulp chamber. Cementation of endocrown for both cases was as followed:

After trial in of the endocrown, internal surface was etched with 10% hydrofluoric acid (ultradent) for 20 seconds, then rinsed with water. After air drying, Monobond S (ivoclarvivadent) was applied on etched surface of ceramic in two coats as silane coupling agent for bonding of ceramic crown to resin cement (Paracore, coltene and whalident, Germany). The cut tooth surface was prepared by first application of conditioner (green bottle), then

drying it after 15 seconds, mixing of Adhesive A and B (red plus yellow bottle) was done and the tooth surface was coated two times after drying 20 seconds each time. Then paracore luting cement was applied (dentin shade) over the tooth part and at the same time applied on the Endocrown internal surface, then immediately endocrown placed above the prepared tooth in alignment and light pressure was applied along with giving vibrations over the centre of Endocrown with ball burnisher for equal homogeneity and spreading of cement and then spot cure was done (5 secs light application) from all sides of crown tooth margin. Extra cement was then removed with curved probe and then again light curing was done from all sides 20 seconds each time.

After that finishing of the margin was done with finishing burs (yellow band Burs, Mani). And then polishing with Astropol polishing system from Ivoclar vivadent (Figure -15, 16, 17, 18).

Follow up of 6 months was taken for both cases showing well-maintained aesthetics, polish and marginal integrity of the endocrown.

DISCUSSION

A Change Occurring in Endodontically Treated Teeth (ETT) is due to many reasons. Reduction in stiffness and fracture resistance of ETT is the loss of structural integrity associated with carries, trauma and extensive cavity preparation, rather than dehydration or physical changes in dentin. Type of restorative materials used and an appropriate restoration that conserves tooth structure are the factors affecting the longevity of endodontic treatment. Quality and integrity of the remaining tooth structure should be preserved carefully in terms of providing a solid base required for restoration and increasing the structural strength of the restored tooth. Three different cases come in clinical practice where either Minimal Loss of Coronal Structure that is Up to One-Half of the coronal tooth structure missing, more than half of the coronal tooth structure is missing and most of the coronal tooth structure is missing.⁵

When extensive loss of tooth structure is there after endodontic treatment different treatment modality like inlay, onlay, overlay, post and core, Richmond crown, sharonlay is used for restorations to achieve long term success of

treatment. But all these restoration will support the tooth from outside so there is a chance with horizontal forces tooth get fracture at cervical line and if intracanal support is taken than fracture of root is common. Pre-fabricated posts, especially fibre posts, different in shape and material, are a contemporary alternative of cast posts and prefabricated metal posts. These root canal posts are designed for the retention of the coronal restoration but not for root reinforcement.^{6, 7} Other important problem in the prosthodontic rehabilitation of endodontically treated teeth is the insufficient inter-occlusal space for a tooth restoration and thus crown height needs to be reduced excessively which ultimately leads to retention issues of full cast crown.

Richmond crown was introduced before many years with a single-unit metal structure produced by casting the root and crown parts in a cap- or stand-shape.⁸ but it was abandoned relatively quickly due to the complicated and often impossible removal. But the idea of developing single unite restorations has remained in the minds of researcher that eventually lead to development of new strategies of restoration.

This type of crown is specially indicated in

1. When excessive loss of hard tissues of the crown,
2. Inter proximal space is limited,
3. Traditional rehabilitation with post and crown is not possible because of inadequate ceramic thickness or curved root or calcified and narrow canal.¹

GR Biacchi et al.(2012) compared the Fracture Strength of Endocrowns and Glass Fiber Post-Retained Conventional Crowns and they proved that Endocrown restorations presented greater fracture strength than indirect conventional crowns associated with glass fiber posts and resin composite filling cores and the failure pattern was characterized by fracture of the tooth associated with displacement of the restoration on the opposite side in both crowns.¹ They also said that his results were comparable to in vitro study done by Chaio Cet al.(2009)⁹

In a clinical study, Bindl and Mo'rman (2012) evaluated the performance of 208

endocrowns cemented to premolars and molars and observed that the premolars presented more failures than the molars. It is suggested that this occurs because premolars have a smaller adhesion surface when compared with molars. Additionally, premolars have greater crown height, which, consequently, compromises the mechanical properties of the endocrown. They suggested preparing endocrown with reinforced ceramics. But due to advancement in composite and availability of indirect composites with high strength is present, use of composite for endocrown is also increasing in recent years. This has been shown to be an advantageous technique because the procedure is easy.²

The development of reinforced ceramic materials is increasing in recent years like Emax pressable ceramic as well as CAD CAM ceramics which has reduced the brittleness of ceramic and increased their clinical performance in different applications. Especially dental CAD-CAM (computer-aided design and manufacturing) systems increase the possibility to produce single-unit restorations in short period of time with high strength. Roopak Bose Carlos in 2013 also did different cases with All-ceramic endocrown and concluded that endocrowns fabricated using CAD/CAM and pressable ceramic technology can be considered as a reliable option for the restoration of moderately mutilated endodontically treated posterior teeth.¹⁰

Banode Ankur Mahesh in 2015 also did case report study on endocrown and came to conclusion that the Endocrown fits perfectly with the concept of bio-integration and can serve as the most conservative and esthetic option for restoration of non-vital posterior tooth.¹¹

The endocrown preparation consists of a circumferential 1.0-1.2 mm depth butt margin and a central retention cavity inside the pulp chamber, constructs both the crown and core as a single unit monoblock structure, and does not take support from the root canals ^{3, 4}. The suggested dimensions are a 3 mm diameter cylindrical pivot and a 5 mm depth for the first maxillary premolars and a 5 mm diameter and a 5 mm depth for molars ³, but the precise dimensions for the preparation of central retention cavity were not clearly determined ⁹. The

thickness of the ceramic occlusal portion of endocrowns is usually 3-7 mm. An *in vitro* study by Tsai YL et al showed that the fracture resistance of ceramic crowns increases with increasing occlusal thickness.¹² Mörmann *et al.*(1998) reported in their research that the fracture resistance of endocrowns with an occlusal thickness of 5.5 mm was two times higher than that of ceramic crowns with a classic preparation and an occlusal thickness of 1.5 mm.¹³

Compared to conventional crowns, endocrowns are easy to apply and require a short clinical time. Low cost (compared to costly zirconias), short preparation time, ease of application, minimal chair time and aesthetic properties are the advantages of endocrowns.¹⁴ Composite endocrowns are a cheaper alternative to ceramic ones with the added advantage that they can be repaired if fractured under function but they limit the required polishability and wear strength to function under shear occlusal stresses for long duration.

While preparing endocrown we preserve the strength of roots and preparation according to pulp chamber anatomic shape. According to the literature, ceramic is used throughout the entire extension of the cavity and, because of its rigidity, which does not mimic dentinal tissue mechanically. Nevertheless, under oblique compression forces, higher strength values were detected when endocrown was made. The thickness and quantity of ceramic used in the restoration of endocrown were significantly greater than those used in conventional all ceramic crown. The lithium disilicate ceramics have high bonding capacity to the dental structure and the smaller numbers of bond interfaces in material itself probably make the dentin/enamel/ceramic more resistant when compared with the dentin/ enamel /post /resin /ceramic. ^{2,3}

CONCLUSION

Endocrown has proven to be an alternate treatment plan in clinical dentistry where badly broken teeth are present after root canal treatment. Endocrowns have opened up new horizons in the adhesive and conservative dentistry thus sparing the need of full cast crowns in atleast some of the cases where crown preparation wont leave much of remaining tooth structure or cases in which post

and core restoration wont be possible or successful. Perfect preparation without undercuts and with diverging walls, voidless rubber base impression, great laboratory support, adapting to strict cementation protocols and perfect finishing and polishing is utmost for the success of ceramic endocrowns. Further studies are required to see long term success rate of endocrowns.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. GR Biacchi_ RT Basting.Comparison of FractureStrength of Endocrownsand Glass Fiber Post-Retained ConventionalCrowns.Operative Dentistry, 2012, 37-2, 130-136
2. VeselinoviValentina, TodoroviAleksandar, Lisjak Dejan, LaziVojkan.Restoring endodontically treated teeth withall-ceramic endo-crowns– case report *StomGlas S; vol. 55, 2008-page-54-64*
3. Pissis P (1995) Fabrication of a metal-free ceramic restoration utilizing the monobloc technique. *Practical Periodontics and Aesthetic Dentistry* 7(5) 83-94.
4. Bindl A, & Mo¨rmann WH (1999) Clinical evaluation of adhesively placed Cerec endocrowns after 2 years—preliminary results *Journal of Adhesive Dentistry* 1(3)- 255-265.
5. Gaye SEVİMLİ, Seda CENGİZ, M. Selçuk ORUÇ.ENDOCROWNS: REVIEW: *J Istanbul Univ Fac Dent* 2015;49(2):57-63.
6. Bergman B, Lundquist P, Sjogren U, Sundquist G. Restorative and endodontic results after treatment with cast post and cores. *J Prosthet Dent* 1989; 61:10 – 15.
7. Sorensen JA, Engleman MJ. Effect of post adaptation on fracture resistance of endodontically treated teeth. *J Prosthet Dent* 1990; 64: 419 – 424.
8. Shillingburg TH, et.al. Fundamentals of fixed prosthodontics- third edition, Chicago: Quintessence publishing Co, Inc, 1997: pp194.
9. Chaio C, Kuo J, Lin Y, & Chang Y (2009) Fracture resistance and failure modes of CEREC endo-crowns and conventional post and core-supported CEREC crowns *Journal of Dental Sciences* 4(3) 110-117.
10. Roopak Bose Carlos, Mohan Thomas Nainan, Shamina Pradhan, Roshni Sharma, Shiny Benjamin,Rajani RoseRestoration of Endodontically Treated Molars Using All Ceramic Endocrowns. Case Reports in Dentistry: 2013, page-1-5
11. Banode Ankur Mahesh, Gade Vandana, Patil Sanjay, Gade Jaykumar, Chandhok Deepika5, Nathani Aatif6 Endocrown: Conservative Treatment Modality for Restoration of Endodontically Treated Teeth – A Case Report. *ENDODONTOLOGY* Volume: 27 Issue 2 December 2015
12. Tsai YL, Petsche PE, Anusavice KJ, Yang MC. Influence of glass-ceramic thickness on hertzian and bulk fracture mechanisms. *Int J Prosthodont* 1998;11(1):27-32.
13. Mormann WH, Bindl A, Luthy H, Rathke A. Effects of preparation and luting system on all-ceramic computer-generated crowns. *Int J Prosthodont* 1998; 11(4):333-339.
14. Dietschi D, Duc O, Krejci I, Sadan A.Biomechanical considerations for the restoration of endodontically treated teeth: A systematic review of the literature, part II (evaluation of fatigue behavior, interfaces and in vivo studies).*Quintessence Int* 2008;39(2):117-129.