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Restoration of Severely Damaged Tooth by Zirconia based Endocrown: Case Series

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ABSTRACT

Following endodontic (root canal) treatment, teeth loss their mechanical properties, and the teeth become fragile because of the removal of pulp and dentin. Hence, prosthetic restoration of root canal-treated teeth is a challenge. Endocrown is a single restoration, and it is considered an excellent alternative restoration for teeth with large coronal destruction and root canal treatment difficulties. Zirconia endocrowns are reliable materials for root canal-treated molars with extensive loss of crown structure. This case series presents four cases of restoration of severely damaged molars presenting various symptoms and prosthetic restorations were done by zirconia-based endocrown. The prognosis in all patients was good.

KEY WORDS

Crowns, Endocrown, Root canal treatment, Zirconia

INTRODUCTION

Following endodontic (root canal, RC) treatment, teeth lost their mechanical properties and the teeth become fragile because of the removal of pulp and dentin.[1,2] Hence, prosthetic restoration of RC-treated teeth is a challenge. In RC-treated teeth, preservation of the integrity of the remaining teeth tissue forms an important aspect and appropriate restorative material should be selected for their structural strengths.[3,4] Traditionally, a post-and-core and crown were used, but these procedures have disadvantages; reduce the mechanical strength and resistance of the tooth and increase the chance of root fracture and perforation during the root preparation for the post.[5,6] Endocrown is a single restoration, and it is considered an excellent alternative restoration for teeth with large coronal destruction and presenting RC treatment difficulties.[7] They are made from a monoblock consisting of a coronal portion with an apical projection that fills the pulp chamber space.[8] They are good alternative restoration for large coronal destruction.

With the advancement in all-ceramic zirconia restorations, endocrowns have been developed as an excellent alternative to post-core systems to restore severely damaged teeth.[5,9] Zirconia presents a high-strength biomaterial and forms an ideal choice for the endocrowns.[10-12] Endocrown made from monolithic zirconia present an effective restoration for posterior teeth following the RC therapy and they have good clinical performance and gingival health.[13-15] Zirconia endocrowns are reliable materials for RC-treated molars with extensive loss of crown structure.[10,13] This article presents four cases of restoration of severely damaged molars by zirconia-based endocrowns and the prognosis was good.

CASE REPORT

We present four cases in which endocrowns were fabricated. In all cases, general steps were followed to fabricate the endocrown. Following preparations were done for the endocrowns.

Occlusal preparation: Occlusal reduction was done approx. 2 mm. At first, 2 mm deep grooves were drilled, and then reduction was done. A finer diamond bur was used to polish the surface.

Axial preparation: A diamond bur (cylindrical-conical shaped) was used for the axial reduction with 7° occlusal

convergence to make the coronal pulp chamber. The undercuts of the access cavity were eliminated. The cavity depth was made at least 3 mm. Polishing was done with the cervical band and finer diamond bur.

Cavity floor. The pulpal canal was opened using a round bur and gutta-percha (GP) was removed using a nonabrasive instrument. Ultrasound was used to clean the pulp chamber.

Bonding. Self-adhesive cement, i.e., Rely X (3M) or Peak-ZM (Ultradent) was used to bond the endocrown.

Case 1: In a 56-year-old women patient, grossly decayed tooth #16 was RC treated and planned for the endocrown. Following the tooth preparation, zirconia endocrown was fabricated using CAD-CAM technology and inserted in the patient (Fig. 1).

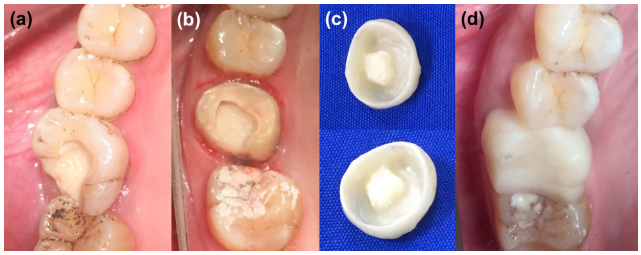

Figure 1. Endocrown on the upper right first molar. Decayed teeth showing temporary restoration following the root canal treatment (a), tooth preparation done (b), fabrication of zirconia endocrown (c), cementation of the endocrown (d).

Case 2: A 58-year-old woman patient with severe damage of tooth #27. The tooth was RC treated and planned for the endocrown. Following the tooth preparation, endocrown was fabricated with monolithic solid zirconia block and it was inserted in the patient (Fig. 2).

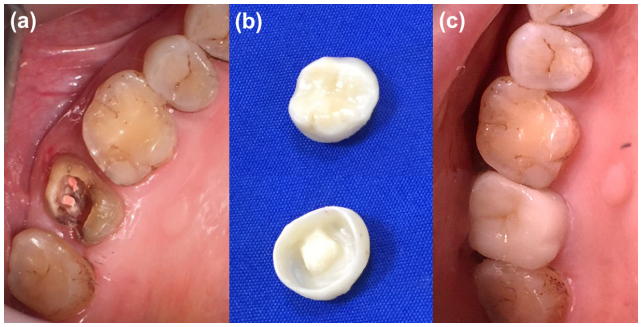

Figure 2. Endocrown on upper right second molar. Teeth showing the completion of root canal treatment (a), fabrication of zirconia endocrown (b), cementation of the endocrown (c).

Case 3: A 63-year-old women patient presented with fractured tooth # 26 due to caries. Root canal treatment was done. Then endocrowns were fabricated and the broken cusp was replaced (Fig. 3). The chewing function was improved in the patient.

Case 4: A 51-year-old man patient presented tooth sensitivity following severe enamel erosion causing a fracture of tooth #37. Then RC treatment was done on #37 and zirconia endocrown was fabricated and cemented (Fig. 4). The symptoms were improved following the endocrown insertion.

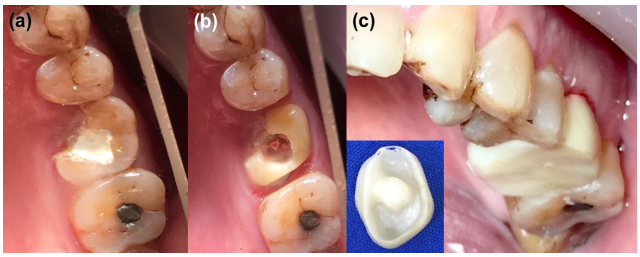

Figure 3. Endocrown on the upper left first molar. Decayed teeth showing temporary restoration following the root canal treatment (a), completion of root canal treatment (a), fabrication and cementation of the zirconia endocrown (d).

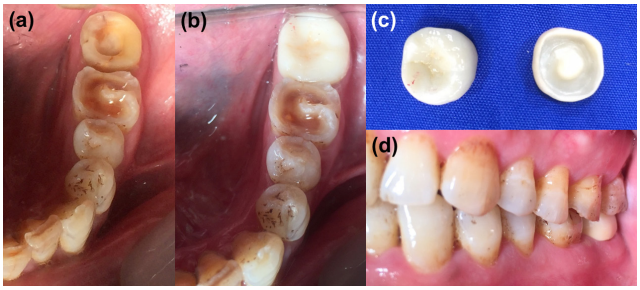

Figure 4. Endocrown on the lower second first molar. Tooth preparation for endo crown following the root canal treatment (a), fabrication and cementation of the zirconia endocrown (b), (c) and (d).

Patients were recalled 1 week and 1 month following the insertion and all the patients were satisfied with the treatment outcome and prognosis.

DISCUSSION

Endocrowns are basically indicated in excessive crown structure loss, limited interproximal or interocclusal space, and when it is not possible for the post and crown restoration due to inadequate ceramic thickness. Nowadays, the restoration of RC-treated teeth became simpler due to the inventions of new biomaterials advancement, bonding systems, and digital technologies. Advantages of endocrowns include ease of application, conservative preparation design, low cost, minimal tooth wear, less clinical time, excellent esthetic properties, and strengthening of the tooth.[16,17] Furthermore, they are alternative restoration for short clinical crowns, and curved, calcified or short narrow RCs.[8]

All 4 cases were happy with the treatment outcome and prognosis. Hence, zirconia endocrowns are a good option for grossly damaged teeth. In a study, Sham et al. studied the biomechanical behavior of RC-treated maxillary premolars restored with endocrown compared with the conventional one using finite element (FE) analyses.[4] They found that zirconia endocrown presented better biomechanical behavior for the tooth with severely destructed RC-treated teeth.

The treatment outcome in our cases was supported by previous studies. Sedrez-Porto et al. did a systematic review and they studied the survival (clinical) and fracture-strength (in vitro) endocrown restorations compared to

conventional ones (intrar-radicular posts, resin composite, or inlay/onlay restorations).[18] It showed that endocrowns perform similarly or better performance compared to the conventional ones. Similarly, Biacchi and Basting compared the fracture strength of ceramic endocrowns with indirect conventional ceramic crowns retained by glass fibre posts and they concluded that endocrowns were more resistant to compressive forces.[19]

Similarly, Dartora et al. studied the biomechanical properties of RC-treated teeth restored using various extensions of endocrowns inside the pulp chamber and they found that the greater extension of endocrowns provided better mechanical performance.[20] A 5 mm extension showed less intensity and a better stress distribution than a 1 mm extension.

Tribst et al. evaluated the stress distribution in 'restorative material' and 'dental remnant' and they found that both factors influenced the stress distribution for all structures.[5] Higher stress was noted on the restoration with a higher elastic modulus of the material. Greater crown remnant resulted in higher stress concentration on the restoration, thus, they advised preserving the remaining dental tissue. In addition, better results were found in lithium disilicate ceramic endocrowns.

The contraindications of endocrown include parafunctional habits, < 3 mm depth of pulp chamber, and < 2 mm wide cervical margin. Disadvantages of endo-crown include the risk of debonding and risk of root fracture because of the difference in the modulus of elasticity between the ceramic (harder) and dentin (softer). In all four cases, the prognosis of the endocrowns was good but long-term follow-up of the cases is still needed to confirm the present findings and long-term use in severely compromised RC-treated teeth.

Zirconia endocrown is a reliable option for the restoration of root canal-treated posterior teeth. Long-term follow-up and longitudinal clinical studies are required to study their long-term success.

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REFERENCES

1. Dogui H, Abdelmalek F, Amor A, Douki N. Endocrown: An Alternative Approach for Restoring Endodontically Treated Molars with Large Coronal Destruction. *Case Rep Dent*. 2018 Aug 30;2018:1581952.
2. Polesel A. Restoration of the endodontically treated posterior tooth. *G Ital Endod.* 2014;28(1):2-16.
3. Köseoğlu M, Furuncuoğlu F. Effect of Polyetheretherketone and Indirect Composite Resin Thickness On Stress Distribution in Maxillary Premolar Teeth Restored with Endocrown: A 3D Finite Element Analysis. *J Biotechnol Strateg Health Res.* 2020;4(3):298-305.
4. Shams A, Elsherbini M, Elsherbiny AA, Özcan M, Sakrana AA. Rehabilitation of severely-destructed endodontically treated premolar teeth with novel endocrown system: Biomechanical behavior assessment through 3D finite element and in vitro analyses. *J Mech Behav Biomed Mater*. 2022;126:105031.
5. Tribst JPM, Dal Piva AMO, Madruga CFL, Valera MC, Borges ALS, Bresciani E, et al. Endocrown restorations: Influence of dental remnant and restorative material on stress distribution. Dent Mater. 2018 Oct;34(10):1466-73.
6. Naumann M, Schmitter M, Krastl G. Postendodontic Restoration: Endodontic Post-and-Core or No Post At All? *J Adhes Dent.* 2018;20(1):19-24.
7. Irmaleny, Zuleika, Ardjanggi S, Mardiyah AA, Wahjuningrum DA. Endocrown Restoration on Postendodontics Treatment on Lower First Molar. *J Int Soc Prev Community Dent.* 2019;9(3):303-10.
8. Sevimli G, Cengiz S, Oruc MS. Endocrowns: review. *J Istanb Univ Fac Dent*. 2015 Apr 29;49(2):57-63.
9. Kanat-Ertürk B, Saridağ S, Köseler E, Helvacioğlu-Yiğit D, Avcu E, Yildiran-Avcu Y. Fracture strengths of endocrown restorations fabricated with different preparation depths and CAD/CAM materials. *Dent Mater J.* 2018 Mar 30;37(2):256-65.
10. Zou Y, Bai J, Xiang J. Clinical performance of CAD/CAM-fabricated monolithic zirconia endocrowns on molars with extensive coronal loss of substance. *Int J Comput Dent.* 2018;21(3):225-32.
11. Kongkiatkamon S, Booranasophone K, Tongtaksin A, Kiatthanakorn V, Rokaya D. Comparison of Fracture Load of the Four Translucent Zirconia Crowns. *Molecules*. 2021 Sep 1;26(17):5308.
12. Sahebi M, Ghodsi S, Berahman P, Amini A, Zeighami S. Comparison of retention and fracture load of endocrowns made from zirconia and zirconium lithium silicate after aging: an in vitro study. *BMC Oral Health*. 2022;22(1):41.
13. Zou Y, Zhan D, Xiang J, Li L. Clinical research on restorations using CAD/CAM-fabricated monolithic zirconia endocrowns and post and core crowns after up to 5 years. *Int J Comput Dent*. 2022 Sep 20;25(3):287-94.
14. Sedrez-Porto JA, Münchow EA, Valente LL, Cenci MS, Pereira-Cenci T. New material perspective for endocrown restorations: effects on mechanical performance and fracture behavior. *Braz Oral Res.* 2019 Feb 11;33:e012.
15. Khattab NMA, Makawi YMFE, Elheeny AAH. Clinical Evaluation of CAD/CAM Ceramic Endocrown Versus Prefabricated Zirconia Crown in the Restoration of Pulpotomized Primary Molars: A Two-Year Spilt-Mouth Randomized Controlled Trial. *Eur J Dent*. 2022 Jul;16(3):627-636.
16. Dejak B, Młotkowski A. Strength comparison of anterior teeth restored with ceramic endocrowns vs custom-made post and cores. *J Prosthodont Res.* 2018 Apr;62(2):171-176.
17. Pedrollo Lise D, Van Ende A, De Munck J, Umeda Suzuki TY, Cardoso Vieira LC, Van Meerbeek B. Biomechanical behavior of endodontically treated premolars using different preparation designs and CAD/CAM materials. *J Dent*. 2017 Apr;59:54-61.
18. Sedrez-Porto JA, Rosa WL, da Silva AF, Münchow EA, Pereira-Cenci T. Endocrown restorations: A systematic review and meta-analysis. *J Dent.* 2016 Sep;52:8-14.
19. Biacchi GR, Basting RT. Comparison of fracture strength of endocrowns and glass fiber post-retained conventional crowns. *Oper Dent.* 2012 Mar-Apr;37(2):130-6.
20. Dartora NR, de Conto Ferreira MB, Moris ICM, Brazão EH, Spazin AO, Sousa-Neto MD, et al. Effect of Intracoronal Depth of Teeth Restored with Endocrowns on Fracture Resistance: In Vitro and 3-dimensional Finite Element Analysis. *J Endod*. 2018 Jul;44(7):1179-1185.