

Endocrown Restoration Of The Endodontically Treated Teeth By Using Cad/Cam: Case Series

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Abstract

Purpose: As a result of large coronal destruction in endodontically treated teeth, significant losses occur in the dentin tissue around the pulp, and the need for prosthetic treatment occurs. In this case series, endocrown applications produced in a single session with CAD/CAM system are presented as an alternative to crown restoration traditionally applied to premolar and molar teeth with excessive crown destruction.

Case Series: In the first case, 38-years-old male patient number 25, 46-years-old female patient number 36 in the second case, 21-years-old female patient number 46 in the third case, 26-years-old male patient number 46 in our fourth case, and in the last case 52-years-old male patient tooth number 15 has been applied to root canal treatment. According to the clinical/radiological examinations of the patients, it was observed that there were no systemic diseases. Endocrown restoration was considered appropriate and recommended to patients with less dentin tissue. Firstly, teeth are prepared for endocrown restoration. Afterward, the impressions were digitalized by scanning the jaws with an intraoral optical scanner (Cerec Omnicam, Dentsply Sirona, USA). The restorations were designed with the help of the CEREC 4.3 software (Dentsply Sirona, USA) and the milling process was carried out with feldspathic ceramic block (Vita Mark II, Vita Zahnfabrik, Germany) in the same session by CEREC inLab MC XL (Dentsply Sirona, USA). Later, the glazing process was applied and cemented with dual polymerized resin cement (RelyX Ultimate, 3M ESPE, USA).

Conclusion: Endocrown is a minimally invasive, conservative treatment approach that provides mechanical adhesion to the pulp chamber and cavity walls with adhesive resin cement and allows the preservation of the remaining tooth structure. For this reason, it is a treatment option that can be preferred instead of post-core and crown application in teeth with root canal treatment.

Key words: Endocrown; CAD/CAM; Adhesive Dentistry; Digital Dentistry

Introduction

Prosthetic restoration should be applied to posterior teeth with endodontic treatment and excessive crown destruction, for reasons such as reducing tooth breakage and bacterial contamination.¹ In these cases, post-core and crown restoration, which is a traditional treatment method, is generally applied. However, this treatment may reduce the fracture resistance of the tooth, cause root perforations and elongation of the chairside.² With the development of adhesive dentistry, endocrown restorations is preferable option for teeth that have been treated with endodontic treatment and lost a large part of the coronal tissue. Endocrown is a monolithic restoration that is supported by the cavity margins, including the pulp chamber and is adhesively bonded to the tooth tissue. The part for extending into the pulp chamber provides macromechanical retention, while adhesive cementation provides micromechanical reten-

tion.³ Endocrowns are indicated for teeth with short crown length, deficient interocclusal space, and considerable dental tissue damage that is not enough ferrule.⁴ Lander and Dietchi stated in their study that endocrown restorations can be applied in cases where vertical height and ferrule effect are minimal.⁵ Endocrown restorations are more conservative than traditional post-core restorations. The preparations made in the root and coronal tissue are eliminated and the tissues are protected.⁶ Endocrown preparation should have 2-3 mm interocclusal reduction, 90° margin edges, smoothed internal angle, 60° pulp chamber angle, and a flat pulp chamber floor with a closed canal entrance.² After the endocrown preparation, there are two options for the production technique. As the first option, the pressed ceramic technique can be applied by taking conventional impressions, while computer-aided design/computer-aided manufacturing (CAD/CAM) technique can be applied by taking digital impressions in a single session as the second option.⁷ Today,

with the developing technology, endocrown restorations produced with CAD/CAM reduce the time spent in the clinic and allow the treatment to be done in single session. Many different materials such as feldspathic ceramic, lithium disilicate glass-ceramic, hybrid ceramic, resin nanoceramic can be used for restorations to be applied with CAD/CAM.⁸ In this case series, endocrown restorations produced by CAD/CAM with a feldspathic ceramic block were applied to premolars and molars with excessive crown destruction after root canal treatment.

Case Series

In this case series, endocrown restorations were applied to five patients at İzmir Katip Çelebi University Faculty of Dentistry, Department of Prosthetic Dentistry with the need for prosthetic treatment as a result of root canal treatment and excessive crown destruction applied to their premolar or molar teeth. According to clinical/radiological examinations, it was seen that the patients did not have any systemic disease and prosthetic treatment was needed due to excessive crown destruction. Endocrown restoration was recommended for patients with less remaining dentin tissue as an alternative for causing more material damage with traditional crown application. Endocrown restorations were applied to the premolar teeth of two of the five patients and the molars of the remaining three patients. While two of the patients did not have only the distal wall, two had losses in the mesial, distal, and palatal wall, and one patient had losses in the distal and palatal wall. In the first case, a 38-year-old male patient applied because of the need for prosthetic treatment of his upper left second premolar tooth. Firstly, the temporary restoration applied to the patient was removed. Then endocrown preparation was performed and gingival retraction was applied. The impression of the area of restoration, opposing jaw, and bite was taken with an intraoral optical scanner (Cerec Omnicam, Dentsply Sirona, USA) and the impression was transferred to the digital environment. Restoration design was made on the transferred digital impression with the help of CEREC 4.3 software (Dentsply Sirona, USA). Then, the milling process was carried out using a feldspathic ceramic block (Vita Mark II, Vita Zahnfabrik, Germany) with a CEREC inLab MC XL (Dentsply Sirona, USA). The prepared restoration was glazed and fired with a Programat 300 (Ivoclar Vivadent, Switzerland) device. The marginal edge compatibility of the restoration was checked before cementation. Then, hydrofluoric acid and silane were applied to the inner surface of the restoration. Finally, the restoration was cemented using dual polymerized resin cement (RelyX Ultimate, 3M ESPE, USA) following the manufacturer's instructions. During the control sessions, no complication was observed. In the second case, a 46-year-old female patient in her tooth number of 36 with root canal treatment. The temporary restoration material on the tooth was removed and endocrown preparation was performed. The impression was transferred to the digital environment by scanning the jaws. Then the restoration was designed and milled using a feldspathic ceramic block. Glazing was performed and the intraoral compatibility of the restoration was checked. Then, the cementation process was completed using dual polymerized resin cement. In the third case, 21-year-old female patient applied with the need for prosthetic treatment in her tooth number 46. As a result of the intraoral examination, it was observed that only the distal and vestibule walls of the tooth were present. After preparation and retraction for endocrown restoration, the jaws were scanned and the impression was transferred to the digital environment. Then the restoration was designed and milled with a feldspathic ceramic block. After the glazing process, the cementation process was completed using dual polymerized resin cement. In the fourth case, 26-year-old male patient applied with the need for prosthetic treatment in tooth number 46. As a result of the examination, it was seen that only the distal wall of the tooth was absent. Preparation

was made for endocrown restoration. The impressions of the jaws were taken digitally with the intraoral optical scanner. After the design, milling, and glazing processes, the cementation process was completed using dual polymerized resin cement. In the fifth and last case, 52-year-old male patient applied with the need for prosthetic treatment in his tooth number of 15. As a result of the examination, it was seen that only the vestibule wall of the tooth was present. Gingivectomy was performed because the gingival level was higher in the palatal and mesial regions. Then, similar to the other cases, the preparation procedures were completed first. The upper, lower jaw, and bite impressions were scanned and transferred to the digital environment with an intraoral optical scanner. The restoration design was completed and the milling process was carried out. After the glazing process of the restoration, the cementation process was completed using dual polymerized resin cement. It wasn't observed that any complications occurred in the applied restoration at the control session.

Discussion

Restoration of root canal treated teeth is a challenging issue in reconstructive dentistry. Treatment options for teeth with root canal treatment and extensive coronal destruction are post-core crown restorations and endocrown restorations.³ In this case series, endocrown restorations were applied to premolar and molar teeth. In some studies, it has been stated that the performance of endocrown restorations applied to premolar teeth is not the same as molar teeth.^{9,10} It has been stated that the surface area bonded with the adhesive agent may be reduced due to the smaller premolar teeth.⁹ However, Thomas et al. reported that similar success rates were observed between endocrown restorations applied to premolar and molar teeth in their systematic review and meta-analysis study.¹¹ Endocrown preparation is a more minimally invasive approach that preserves tooth structure. Thus, risks such as vertical root fracture and root perforation are eliminated by making preparations in the root canals.¹¹ Preparation is an important factor for the success of endocrowns. The restorative material used affects the reduction in the occlusal surface. If monoblock ceramic material is to be used, 2 mm reduction is required, while 1-1.5 mm reduction will be sufficient when hybrid materials containing composite are used.⁸ According to Einhorn et al., endocrown preparations with a ferrule design may increase failure load.² It was noted that all endocrown restorations, with or without a ferrule design, were subject to a high rate of catastrophic failures against forces greater than normal masticatory function.² In other words, it was stated that the preparation of the endocrown with or without ferrule design did not make a difference in the fracture resistance.² Dental care should be taken during the preparation of the endocrown preparation. In cases such as ferrule addition, because of the increase in cavity depth, and intraradicular enlargement, inconsistencies may increase in the prepared cavity and this may cause a decrease in the adaptation of the restoration.⁸ All endocrown restorations were designed and fabricated with CAD/CAM in this case series. Today, the widespread use of digital technology has resulted in reduced treatment time and better marginal adaptation of restorations, and also the restoration can be produced faster and easier in a single session.⁶ Many different material options are available for the fabrication of endocrowns. Firstly, alumina or spinell reinforced non silica-based ceramics and feldspathic ceramics were used. Then, leucite and lithium disilicate reinforced ceramics and hybrid materials have been used in endocrown production.⁸ In this case series, all endocrowns were fabricated from a feldspathic ceramic block. In a study using three different CAD/CAM materials; feldspathic ceramic, lithium disilicate glass-ceramic, and resin nano-ceramic, no significant difference was observed between feldspathic ceramics and lithium disilicate glass ceramics in terms of fracture strength.⁴ In another study, fracture strengths of restorations made of lithium



Figure 1. Restoration stages of premolar tooth with Cad/Cam



Figure 2. Restoration stages of molar tooth with Cad/Cam

disilicate glass-ceramic, leucite glass-ceramic and feldspathic ceramic were investigated after adhesive and conventional cements-

tion. It was observed that feldspathic and lithium disilicate glass-ceramic restorations applied with adhesive cementation performed

similar results in terms of fracture strength.¹²

Conclusion

Endocrown restoration can be applied as an alternative treatment to post-core and crown restorations in premolar and molar teeth that have root canal treatment and excessive crown destruction. Endocrown restorations produced with the CAD/CAM method can be applied in a single session and this provides a significant advantage by reducing the time spent in the clinic and laboratory. It was not observed any complications in the follow-ups of the endocrown restorations applied in this case series.

None

Author Contributions

Author B.U.K and E.A. contributed to the manuscript equally.

Conflict of Interest

Authors declare that they have no conflict of interest.

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