

# A Comprehensive Review of All-Ceramic Endocrown as Alternative Approach for Management of Root Canal Treated Teeth

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## Abstract

The preservation of tooth structure is critical from a biomimetic standpoint to enhance the mechanical and functional aspects. The main advantage of endocrown is that they do not require root dentine removal to achieve retention. A literature search was performed to investigate Endocrown in the literature from 1995 to May 2022. A manual search of the bibliographies of the studies discovered was supplemented by a search of three main research databases (PubMed, Cochrane, and Scopus) in English. Case studies were not included. The aesthetics and mechanical performance of endocrowns are superior to those of earlier techniques, and they are also less expensive and take less chair time to verify these results, controlled clinical trials with longer follow-up times are required to support this result. A "three-step assessment" was used to select the articles. In the first phase, all relevant published titles and abstracts were evaluated, taking into consideration the study's inclusion and ex-clusion criteria. In the second phase, the entire content of the selected articles was reviewed, assessed, and graded using the same criteria as previously. The third phase entailed critically evaluating the selected relevant research. The endocrown consider an excellent choice to treat the root canal canal-treated teeth with significant coronal tissue loss. Endocrown's marginal fit was superior to the traditional crowns. Consequently, there is a higher possibility of success when crowning endodontically treated teeth.

**Keywords:** Endocrown, Tooth preparation, Endocrown dental materials, CAD/CAM

## INTRODUCTION

Root canal-treated teeth are more susceptible to biomechanical complications such as loss of tooth structure during access cavity preparation and the loss of water content in non-vital teeth [1]. Endodontic treatment significantly reduces tooth strength by up to 63% when MOD restoration was present following root canal treatment [2]. Among the various restorative options for endodontically treated teeth, endocrowns are a trustworthy decision to reinstate endodontically molars with extensive tooth damage. Compared to conventional crowns, endocrowns can apply in short clinical crowns and curve roots in fewer steps and time with an acceptable survival rate and aesthetic outcome [3]. The pulp chamber in the endocrown design provides the macro retention while the cement provides the micro retention means to support the endocrown and preserve the remaining tooth structure [4]. Its main advantage is preserving a larger amount of sound tooth structure compared to other types of restorations. Utilizing CAD/CAM technologies for the fabrication of ceramic restorations offers a standardized manufacturing process [5]. Improvements in dental materials, especially the CAD/CAM technologies and materials enhance the success rate of endocrown. Different

CAD/CAM materials can be used for endcrowns fabrication, but lithium disilicate (LDS) is the most commonly used for its good mechanical properties and bonding capacity [6]. Endocrown becoming a common restorative option in today's modern dentistry. This study aims to conduct a comprehensive literature review regarding (Treatment Decisions: induction and contraindication of Endocrown, dental impression materials, and techniques for Endocrown,

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Materials for Temporary Endocrown, Tooth Preparation steps for Endocrown, Materials

Used for construction Endocrown, Cementation materials and techniques for Endocrown, Surface Treatment of Both Tooth Surface and Prosthetic Part, Clinical performance / Success Rates vs Failure Rates).

**MATERIALS AND METHODS**

A literature search was performed using the National Library of Medicine, Washington DC (MEDLINE–PubMed) searched for appropriate articles addressing the focused objective to find studies on this topic that included simulated laboratory models, animal studies, and human studies. Articles that were published within the last 10 years; conducted at least in MENA, Europe, or North America regions; indexed on either Wiley Online Library, PUBMED, BiblioMed, or, Google Scholar; were included. Articles written in any language other than English were automatically excluded. The following keywords were used: “endocrown”, “Treatment Decision”, “Surface Treatment”, “Tooth Preparation”, “Endocrown dental Materials”, “Endocrown Cementation materials”, “Endocrown Restoration Advantages”, “Digital Impression”, “Occlusal Preparation”, “CAD/CAM Endocrown”, “Pulp Chamber Extension” and the results were correlated. The most important studies were chosen based on their study design (e.g., prospective double-blinded, cross-sectional, case reports), sample size, and statistical analyses.

*Data Collection*

A "three-step assessment" was used to select the articles. In the first phase, all relevant published titles and abstracts were evaluated, taking into consideration the study's inclusion and exclusion criteria. In the second phase, the entire content of the selected articles was reviewed, assessed, and graded using the same criteria as previously. The third phase entailed critically evaluating the selected relevant research to establish the quality of each article. Each research was allocated a unique ID number for enhanced accuracy and convenience. Each clinical and laboratory study's information was divided into two groups: Title, Author, year of publication, Region, Journal, and Institution.

*Data Grouping and Filtering*

After the typical data extractions, all data was cleaned and double-checked to minimize any human or systemic mistakes.

**RESULTS AND DISCUSSION**

*Treatment Decision: Induction and Contraindication of Endocrown*

Endodontically treated tooth restoration (ETT) is a topic that has been widely and contentiously debated in the dental literature [7].

Due to dehydration of endodontically treated teeth, a full coverage crown and endo crown are indicated [8].

*General Background Comparing Between Endocrown and Conventional Crowns:*

Treating a dehydrated tooth with extensive damage is a great challenge to assure a long survival rate as preserving the remaining tooth structure plays a major role in the longevity of restoration among the non-vital tooth as much as the endocrown does [9].

*Endocrown Restoration*

Endocrown came up as a conservative method to restore endodontic-treated molars. Many in-vitro and in-vivo studies showed that the endocrown has a great prognosis and success rate [10] with no static differences among the classical crown in the area of the molars, whereas the posterior endocrown showed a good fracture resistance posteriorly than in the anterior area [11]. The survival rate of posterior endocrown is 87.1 percent in comparison to a classical crown showed a 97 percent survival rate after 55±15 months of follow-up. However, premolar endocrown showed less survival rate of 68.8 percent versus 94.6 percent for classical crowns [12].

*Endocrown Restoration Advantages*

The preservation of tooth structure is critical from a biomimetic standpoint to enhance the mechanical and functional aspects. The foremost benefit of endocrowns is reducing the threat of recontamination throughout post-preparation [13].

1. Maintain the gingiva in good condition as the impressions taken for supragingival structure.
2. Simple to use and requires minimal chair time [14].
3. Aesthetic properties with Low cost [15].
4. Having fewer preparation steps [16].
5. It can be milled using CAD-CAM an accurate crown can be delivered in less time [9].
6. Reinterventions can be performed more easily during an endodontic failure [13].
7. Endocrowns' monoblock nature would allow for greater stress loading than conventional restorations' multi-interfacial nature [17].

*Endocrown Restoration Indications and Contraindications*

**Table 1.** Indications and Contraindications of Endocrown Restoration

Endocrown Restoration Indications	Endocrown Restoration Contraindications
<ul style="list-style-type: none"> <li>• Excessive loss of crown tissue [18] with inadequate ferrule can be applied [13].</li> <li>• Endocrowns are used when there is a lack of interocclusal space [19].</li> <li>• A premolar endocrown is indicated when there is at least</li> </ul>	<ul style="list-style-type: none"> <li>• Smaller pulp chamber than 3 mm [19].</li> <li>• Thinner wall than 2mm [19, 20]</li> <li>• Subgingival finish line [13].</li> <li>• In the case of parafunctional habits that increase stress[13].</li> </ul>

- a 2 mm high wall and 3 mm pulp chamber space [19].
- Endocrowns are indicated for curved and narrow root canals [13].
- The endocrown is suitable for all molars, especially short clinical crowns [18].
- Anterior teeth or any teeth with a smaller pulp chamber [13].

### Endocrown Use Limitations

Premolar endocrown necessitates additional research, particularly clinical trials, to confirm the *in vitro* results [19].

Premolar endocrown use is not as well documented as molar endocrown use. Due to the limitation of the pulp chamber space that can be used in premolar endocrown [21]. The shape of premolar crowns creates an extended lever arm, reducing the prognosis of the endocrown among premolars in comparison to molars [22]. Salis *et al.* found out there are more fractured maxillary premolars than mandibular premolars endocrown. As a result, steep cusp in maxillary premolars [13]. Incisor endocrown seems illogical due to the lack of a pulp chamber that provides wide room to support the endocrown [19].

### Relation between Adhesion and Surface Treatment of Both Tooth and Prosthetic Restoration

#### Restoration Treatment

To reach optimum restoration surface treatment with a clear connection between restoration and cement, before choosing a surface treatment, it's important to consider the ceramic system's composition. A golden role to treat most of the system is by following:

1. Clean the crown using the ultrasonic cleaner for 2-5 min
2. Sandblast with aluminum particles ranging from thirty to fifty microns at five bars.
3. Use a nine percent hydrofluoric acid for two minutes, then wash it and dry it.
4. Apply saline on the fitting surface and let it dry for one minute.

#### Dentine Treatment

The application of optimal and durable adhesion is critical for no-post techniques such as endocrowns [23]. The immediate dentin sealing (IDS) approach has been shown to enhance the bonding strength of indirect prosthesis [24] which is also known as dual bonding, the clinical trials showed the success of this technique for adhesive inlays, onlays, veneers and endocrown [25].

### CONCLUSION

The endocrown consider an excellent choice to treat root canal-treated teeth with significant coronal tissue loss. Endocrown's marginal fit was superior to the traditional crowns. Consequently, there is a higher possibility of success when crowning endodontically treated teeth. The aesthetics and mechanical performance in addition to saving the chair

side time on endocrowns, make it superior to those of earlier techniques. Controlled clinical trials with longer follow-ups are required.

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**ETHICS STATEMENT:** The research proposal was approved by the Regional Research and Ethics committee of King Abdulaziz University.

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