ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

*International Journal of Dental Science and Innovative Research (IJDSIR)*

*IJDSIR : Dental Publication Service*

*Available Online at: www.ijdsir.com*

*Volume – 6, Issue – 5, September - 2023, Page No. : 192 - 198*

# Endocrowns a conservative approach: A review

[1]Dr. Rashmi Misra, BDS, MDS, Professor, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry Nerul, Navi Mumbai, Maharashtra, India.

[2]Dr. N. Vimala, BDS, MDS, Professor, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India

[3]Dr. Nikita Toprani, BDS, MDS, Senior Lecturer, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry, Nerul, Navi Mumbai, Maharashtra, India.

[4]Dr. Omkar Bhosale, BDS, Postgraduate student, Department of Conservative Dentistry and Endodontics D Y Patil University School of Dentistry Nerul, Navi Mumbai, Maharashtra, India

[5]Dr. Hitesh Pawar, BDS, MDS, Lecturer, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry Nerul, Navi Mumbai, Maharashtra, India.

[6]Dr. Pauravi Hegde, BDS, MDS, Lecturer, Department of Conservative Dentistry and Endodontics, D Y Patil University School of Dentistry Nerul, Navi Mumbai, Maharashtra, India

**Corresponding Author:** Dr. Omkar Bhosale, BDS, Postgraduate student, Department of Conservative Dentistry and Endodontics D Y Patil University School of Dentistry Nerul, Navi Mumbai, Maharashtra, India

**Citation of this Article:** Dr. Rashmi Misra, Dr. N. Vimala, Dr. Nikita Toprani, Dr. Omkar Bhosale, Dr. Hitesh Pawar, Dr. Pauravi Hegde, “Endocrowns a conservative approach: A review”, IJDSIR- September - 2023, Volume – 6, Issue - 5, P. No. 192 – 198.



**Type of Publication:** Review Article

**Conflicts of Interest:** Nil

## Abstract

This review article offers a deep and insightful analysis of the revolutionary dental approach known as the "Endocrown. Through synthesis of current literature and clinical studies, the article provides a comprehensive overview of the Endocrown technique's applications, benefits, and potential limitations. By exploring a wide range of case examples and outcomes, the review underscores the technique's efficacy in preserving tooth integrity while achieving optimal functional results.

In addition to the clinical aspects, the article deals with the underlying principles and scientific rationale behind the Endocrowns approach. It discusses the biomechanical considerations that make the technique a viable alternative to conventional crown restoration.

**Keywords:** Endocrown, Biomechanical, Crown Restoration.

## Introduction

Restoring teeth that have undergone endodontic treatment poses difficulties for clinicians. Physiological changes in dentin microstructure takes place, making them susceptible to various risks like decreased retention and stability, increased fragility, compromised substrate adhesion, and prosthesis failure. (1). Teeth that have undergone endodontic treatment are at a higher risk of experiencing biomechanical deterioration. It is primarily due to the substantial loss of tooth structure, which affects the long-term prognosis of the tooth (2). New treatment options, particularly Endocrowns, have been developed for the restoration of endodontically treated teeth as adhesive techniques and minimally invasive principles have advanced. (3). Endocrown restorations are anchored to the internal portion of the pulp chamber and on the cavity margins, thereby providing both macro and micro-mechanical retention. (4-6) Endocrowns represent monolithic conservative restorations introduced as an alternative to the conventional prosthodontic approach for severely compromised endodontically treated teeth. The anchorage of the endocrowns is into the pulp chamber or at the emergence of the root canal, without extending into it. (7)

**Background**

In 1999 Bindl and Mormann coined the word endocrowns for the first time and proposed it as an alternative to full post and core supported endodontically treated teeth. (5) The Monoblock technique was accepted before the Endocrown. They described an adhesive monolithic ceramic restoration anchored in the pulp chamber, exploiting the micromechanical retention properties of the pulp-chamber walls. Endocrowns assemble the intra-radicular post, the core and the crown in one component, thus representing Monoblock. (8)

**Indications**

- In teeth where interproximal space is limited and traditional rehabilitation with post and crown is not possible. (8)
- Endocrowns are also an alternative in teeth with short clinical crowns, calcified, curved root canals where the post application is not possible. (8)
- An endocrown is indicated for premolars when the cementation surface area is sufficient: remains 1–2 mm of wall above the periodontium to enable proper cementing, when the walls are 2 mm or more thick, and when the pulp chamber is at least 3 mm deep. (8)
- Molar teeth with short and fragile roots. (9)
- Endocrowns are indicated when there is limited interocclusal space. (10)
- Indicated in cases of inadequate clinical crown length and extensive loss of dental tissues in which an adequate ferrule cannot be applied. (11)

**Contraindications**

- If the depth of the pulp chamber is < 3 mm (12)
- If the thickness of the peripheral walls is < 2 mm. (12)
- Endocrowns are contraindicated in an unfavourable occlusal setting (parafunctions). (12)
- when there is evidence of increased functional and lateral stresses. (13)
- If adhesion is not assured. (13)
- Cervical margin is less than 2mm wide for most of its circumference. (14)
- In case of severe dental tissue removal in which after preparation the finish line of the Endocrown is completely below the cement-enamel junction. (14)

**Advantages**

- It is a minimally invasive technique that causes less tissue disruption, proving to be less intrusive compared to post and core restorations, as the stability offered by the pulp floor is substantial, especially when combined with high-quality adhesive materials under appropriate circumstances. (8)

- Within conventional restoration methods, there exists a potential hazard of inadvertently perforating the root during the process of canal cleaning. This thing is non-existent when implementing endocrowns. (8)
- Endocrowns has advantages such as cost-effectiveness and straightforward application procedures. (15)
- The requirement for minimal chair time is another noteworthy attribute. (15)
- Furthermore, endocrowns exhibit commendable aesthetic qualities. (15)

**Preparation Technique for Endocrowns**

The primary objective for employing endocrowns is to achieve a bonded rehabilitation that preserves root canals with minimal invasiveness. Consequently, the preparation of endocrowns differs from the traditional approach of complete coverage crowns. Numerous investigations have outlined the endocrown preparation protocol based on the Bindl and Mormann methodology. However, a handful of studies have introduced certain adaptations to the initial preparation technique. (16)

**Occlusal preparation**

The primary objective during preparation is to achieve a minimum 2 mm reduction in the axial direction of the occlusal surface. This reduction can be achieved by creating 2 mm deep grooves as guidelines as shown in [figure (2)] and subsequently utilizing a green diamond wheel bur to decrease the occlusal surface. (17)

To ensure the continuous alignment of the coronal pulp chamber and the endodontic access cavity, an occlusal divergence of 5 to 7° is necessary (18).

The diamond bur is positioned along the long axis of the tooth, maintaining parallelism with the occlusal plane. The shape of the diamond bur guarantees proper alignment for reduction and the desired flat surface, where the cervical margin or cervical sidewalk is established as shown in [figure 1] (19)It is preferable for the margins to remain supragingival throughout the preparation process. In areas where aesthetic considerations are important, a slope of no more than 60° should exist between different cervical levels. Any compromised enamel with a thickness less than 2 mm should be removed. (19)

The cervical sidewalk serves as the cornerstone of the restoration, aiming to achieve a broad, consistent, and stable surface capable of withstanding compressive stress. (19)

**Effects of ferrule incorporation:**

The addition of a uniform or no uniform ferrule to preparation increases the dentine surface available for bonding, but it has its drawbacks. The addition of ferrule would enact sufficient dentine removal of the endocrown preparation, so that the entire complex would be weakened. (19). The presence of ferrule in full coverages crowns supported by post and core was thoroughly investigated and well acknowledged to increase fractures resistance and fatigue cycles to failure. Adding ferrule to preparations increased the dentin surface available for bonding. However, there were milling limitations in reproducing the endocrown's inner surface. (20)

Figure 1: Preparation of the cervical margin or "cervical sidewalk" using a wheel bur held parallel to the occlusal plane.

Figure 2: Making the guide grooves in an isolated tooth.

**Axial preparation**

Axial arrangement necessitates the removal of any indented areas within the entry point. Employing a cylindrical conical green diamond drill bit with an overall convergence angle of 70° ensures the seamless continuation of the pulp chamber and endodontic access cavity in the upper part. The depth of the opening should measure no less than 3mm. The suggested measurements comprise a 3mm diameter cylindrical pivot and a 5mm depth for primary maxillary premolars, and a 5mm diameter and 5mm depth for molars. As for the ceramic occlusal section of endocrowns, it usually maintains a thickness ranging from 3mm to 7mm (21). The diamond should be aligned parallel to the tooth's long axis, maintaining the integrity of the pulp floor without exerting excessive force. It's crucial to ensure a minimum cavity depth of 3 mm. [refer to Figure 3] (21)

Figure 3: Axial preparation using a cylindro-conical drill to make the coronal pulp chamber continuous with the access cavity.

**Polishing the cervical band**

The bur used in this step has the same taper as one in the axial preparation but a larger diameter and a finer particle size. It should be guided around the entire cervical band to remove micro-irregularities and produce a flat polished surface. The margin line should appear as a regular margin with a sharp edge. [refer to Fig no. 4 and no.5] (20)

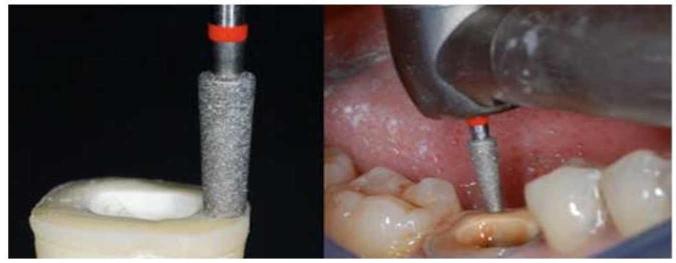

Figure 4: Polishing the cervical band.


Figure 5: Cervical margin before (a) and after (b) polishing.

**Preparation of the cavity floor**

The gutta percha is extracted to a maximum depth of 2 mm to make use of the saddle-shaped structure of the cavity base. The pulp chamber is meticulously cleansed, after which the endocrown is attached using bonding agents like or alternative resin cements. (22)

**Impression technique**

Either a conventional impression with rubber base impression material or a digital impression of the prepared tooth can be taken. [refer fig 5](20)

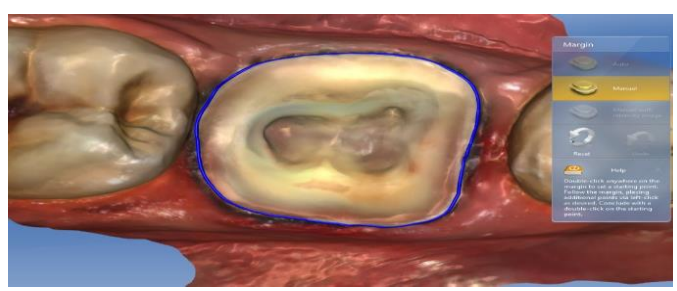

Figure 6: Optical impression using Omnicam

**Manufacturing**

Endocrown rehabilitations can be fabricated using CAD/CAM innovation, in the field of restorative dentistry, computer-aided design (CAD) and computer-aided manufacture (CAM) technology has developed tremendously, allowing to fabricate endocrown restorations (3) [refer to Fig 7]. (Computer-aided Design/Computer-aided Manufacturing), which reduces the necessity for clinical modifications and the inclusion of imperfections during the groundwork phase. This technology also enables the procedure to be carried out within a sole appointment. The CAD-CAM system incorporates a bio-generic feature, an extensive database that facilitates the choice of occlusal structure that seamlessly conforms to the scanned groundwork and opposing anatomy. Consequently, there's no requirement for preliminary wax modelling. (23) The choice of a ceramic system such as monolithic lithium disilicate is an adequate technique for fabricating the provisional restoration, which guarantees gingival health and avoids movement of the tooth, and precise impression-taking with good quality material. (24)

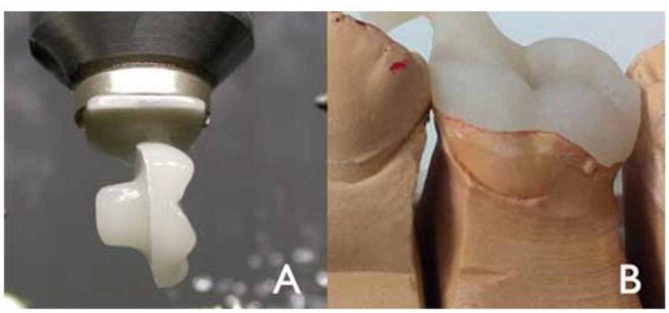


Figure 7: An endocrown machined using computer-aided design and computer-aided manufacture (a). A pressed endocrown, with sprue attached, positioned on a master mold (b)(27)

**Cementation**

Predominantly, resin cements comprising a matrix of Bis-Glycidyl Methacrylate or urethane dimethacrylate resin, coupled with inorganic filler particles, constitute the prevailing category of cements utilized for bonding endocrowns. (23) It is imperative that the complete pulp chamber is thoroughly cleansed to prevent any interference by eugenol-containing sealers that could impede the polymerization process of the resin cement. (25) Due to the persistent difficulty in achieving effective dentine adhesion, the literature strongly advocates for the utilization of the immediate dentine sealing technique. This approach enhances dentine adhesion and reduces the occurrence of microleakage. (26) The new nanocomposite resins and lithium disilicate seem to have advantages in the fabrication of endocrowns [refer fig 7] (2)

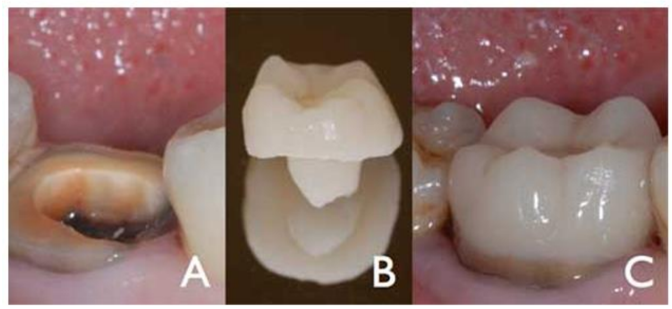


Figure 8: (a)Prepared tooth, (b) Endocrown and (c) final result after bonding.

**Premolar**

Insufficient information exists regarding how the configuration of the endocrown affects the biomechanical performance of premolars that have undergone endodontic treatment (ETPM).

Bindl et al. observed that employing endocrowns as a restoration method for premolars resulted in a failure rate of 31%, while molars restored with endocrowns exhibited a failure rate of 12% (10).The variance in these failure rates is ascribed to the diminished bonding surface accessible in premolars, along with the unfavourable proportion between the foundation of the crown and its height, which could potentially lead to a moment of force.(26) It is believed that the smaller dental structure area of the pulp chamber and consequently of the adhesive surface of premolars limits the bond strength of adhesive systems and resin cements.(26) The lever impact is accentuated by the off-axis forces, which are less commonly encountered in molars but are mainly borne by premolars, leading to a decline in their susceptibility to fractures. Research by Salis et al. demonstrated a heightened occurrence of fractured upper premolars in contrast to their lower counterparts. Hence, the structural configuration of the endocrown applied to upper premolars should incorporate a more level occlusal surface. This adjustment aims to decrease the crown's elevation and the slant of its cusps, subsequently creating shallower fissures. The intended outcome is the reduction of cuspal deviation and the vulnerability to fracturing while engaging in chewing activities. (26) The lack of data on endocrowns on incisors and the varied results obtained mean that a clinical indication for restoring anterior teeth with endocrowns cannot yet be stated. (2)

**Conclusion**

This review article offers a deep and insightful analysis of the revolutionary dental approach known as the "Endocrown." Through synthesis of current literature and clinical studies, the article provides a comprehensive overview of the Endocrown technique's applications, benefits, and potential limitations. By exploring a wide range of case examples and outcomes, the review underscores the technique's efficacy in preserving tooth integrity while achieving optimal functional and aesthetic results.

**References**


1. Hargreaves KM. Cohen's pathways of the pulp. St. Louis: Mosby. 2011.
2. Govare N, Contrepois M. Endocrowns: A systematic review. J Prosthet Dent 2019.
3. Alomran W. Endocrowns: A review article. Sch J Dent Sci 2018;5(5):306-9.
4. Biacchi GR, Mello B, Basting RT. The endocrown: an alternative approach for restoring extensively damaged molars. J Esthet Restor Dent. 2013 Dec;25(6):383-90.
5. Bindl A, Mormann WH. Clinical evaluation of adhesively placed Cerec endo-crowns after 2 years-preliminary results. J Adhes Dent. 1999 Sep 1; 1:255-66
6. El-Damanhoury HM, Haj-Ali RN, Platt JA. Fracture resistance and microleakage of endocrowns utilizing three CAD-CAM blocks. Oper.Dent. 2015 Mar;40(2):201-10.
7. Sorensen JA, Engelman MJ. Ferrule design and fracture resistance of endodontically treated teeth. J Prosthet Dent. 1990; 63:529-536.
8. Atash R, Arab M, Duterme H, Cetik S. Comparison of resistance to fracture between three types of permanent restorations subjected to shear force: An *in vitro* study. J Indian Prosthodont Soc 2017;17 :239-49.
9. Goodacre CJ, Campagni WV, Aquilino SA. Tooth preparations for complete crowns: an art form based on scientific principles. J Prosthet Dent. 2001 Apr 1;85(4):363-76.
10. Bindl A, Mormann WH. Clinical evaluation of adhesively placed Cerec endo-crowns after 2 years--preliminary results. J Adhes Dent 1999;1(3):255. PMID: 11725673.
11. Biacchi GR, Mello B, Basting RT. The endocrown: an alternative approach for restoring extensively damaged molars. J Esthet Restor Dent 2013;25(6):383–390. DOI: 10.1111/jerd.12065.

12. Fages M, Bannesar B. The Endocrown: A Different Type of All-Ceramic Reconstruction for Molars J Can Dent assoc 2013;79:d140.
13. Sevimli G, Cengiz S, Oruc MS. Endocrowns. JIstanbUnivFac Dent. 2015;49(2):57
14. Zhu J, Rong Q, Wang X, et al. Influence of remaining tooth structure and restorative material type on stress distribution in endodontically treated maxillary premolars: a finite element analysis. J Prosthet Dent 2017;117(5):646–655. DOI: 10.1016/j.prosdent.2016.08.023.
15. Goodacre CJ, Campagni WV, Aquilino SA. Tooth preparations for complete crowns: an art form based on scientific principles. J Prosthet Dent. 2001 Apr 1;85(4):363-76.
16. Yalamanchili, Sai & Magaravalli, Samrat & Rangaswamy, Purushothama & Sujith, Dr & Govindappa, Kavitha. (2021). Reinstating the function of grossly mutilated Posterior teeth through endocrown: Case reports. IP Indian Journal of Conservative and Endodontics. 6. 54- 58. 10.18231/j.ijce.2021.012.
17. Elagra M. Endocrown Restoration: A review. International Journal of Applied Dental Sciences 2019;5(1): 253-6.
18. Bindl A, Richter B, Mormann WH. Survival of ceramic computer-aided design/manufacturing crowns bonded to preparations with reduced macroretention geometry. Int J Prosthodont 2005;18(3):219–224. DOI: 10.1016/j.prosdent.2005.09.002.
19. Fages M, Bennasar B. The endocrown: a different type of all-ceramic reconstruction for molars. J Can Dent Assoc. 2013 Oct; 29;79: d140.
20. Singh, Akanksha, Kanesha Abrol, Swatantra Agarwal and Ravi Madan. “Endocrown Restorations: A Review.” (2020).
21. Elagra ME. Endocrown preparation. Int. J. Appl. Dent. Sci. 2019; 5(1): 253-256.
22. Barallat L, Arregui M, Fernandez-Villar S, Paniagua B, Pascual-La Rocca A. Fracture Resistance in Non-Vital Teeth: Absence of Interproximal Ferrule and Influence of Preparation Depth in CAD/CAM Endocrown Overlays-An In Vitro Study. Materials (Basel).
23. Ciobanu, Paul, Manuela Maria Manziuc, Smaranda Buduru and Diana Dudea. “Endocrowns – a literature review.” Medicine and Pharmacy Reports (2023): n. pag.
24. Menezes-Silva, Rafael, Carlos Andres Villavicencio Espinoza, M Atta, Maria Fidela de Lima Navarro, Sérgio Kiyoshi Ishikiriama and Rafael Francisco Lia Mondelli. “Endocrown: a conservative approach.” Brazilian dental science 19 (2016): 121-131.
25. Shah YR, Shiraguppi VL, Deosarkar B, Syed M T, Pandey A, Shelke UR. Endocrowns A Review. Journal of Interdisciplinary Dental Sciences. Jan-June 2020;9(1):07-12
26. Papalexopoulos, Dimokritos & Samartzi, Theodora-Kalliopi & Sarafianou, Aspasia. (2021). A Thorough Analysis of the Endocrown Restoration: A Literature Review. The Journal of Contemporary Dental Practice. 22. 422-426. 10.5005/jp- journals-10024-3075.