Available Online at http://www.journalajst.com

ISSN: 0976-3376

ASIAN JOURNAL OF SCIENCE AND TECHNOLOGY

Asian Journal of Science and Technology
Vol. 16, Issue, 04, pp. 13632-13634, April, 2025

REVIEW ARTICLE

ENDOCROWN IN DENTISTRY – AN INSIGHTS INTO THE LITERATURE REVIEW

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ARTICLE INFO

Article History:
Received 11th January, 2025
Received in revised form
18th February, 2025
Accepted 27th March, 2025
Published online 30th April, 2025

Keywords:
Biomechanical advantages,
Macromechanical retention.

ABSTRACT

Endocrowns have emerged as a conservative and effective restorative option in endodontically treated teeth, particularly for posterior teeth with significant structural loss. This review aims to provide a comprehensive overview of endocrowns, highlighting their design principles, material choices, biomechanical advantages, clinical indications, and long-term performance. Compared to traditional post-and-core systems, endocrowns offer a minimally invasive approach by utilizing the pulp chamber for macromechanical retention and adhesive bonding for micromechanical stability. Advances in adhesive dentistry and CAD/CAM technologies have further enhanced their clinical applicability and success rates. The review also discusses current evidence regarding marginal adaptation, fracture resistance, and failure modes of endocrowns in comparison to conventional crowns. Despite some limitations, endocrowns represent a promising treatment modality that aligns with modern restorative philosophies focused on tissue preservation and functional longevity.

Citation: ***Dr. Mayank Sachdeva, Dr. Aishwarya Arya, Dr. Ridima Tiwari, Venkata Naga Vamseekrishna Kanduri, Dr. Vishnu S and Dr. Basantika.*** **2025.** "Endocrown in Dentistry – An insights into the Literature Review", *Asian Journal of Science and Technology*, 16, (04), 13632-13634.

INTRODUCTION

Endocrowns were first developed by Pississ in 1995 which is described "monoblock porcelain technique. The term endocrown was first coined given by Bindland Mörmann in 1999.[1] It is a monolithic (one-piece) full-composite or full ceramic overlays which restore partially or totally the coronal part of a devitalized tooth characterized by a supracervical butt joint, retainingmaximum enamel to improve adhesion and extended inside the pulp chamber and partially inside the root canal with a short —endo-core, could represent an alternative to classical treatments to restore endodontically treated teeth.[2] Endocrown is a one-piece restoration, usually indicated in cases with decreased crown height. The preparationcomprises "sidewalk" as the cervical margin and a preparation into the pulp chamber that may or may not extend into the root canals. It prevents interferences with periodontal tissues, due to the presence of supragingival position of the restoration margins. The rationale of this technique is to use the surface area available in the pulpal chamber to assume the stability and retention through adhesive procedures. Principally, endocrowns are full ceramic restorations.[1] It is a total porcelain crown that is luted to a root canal-treated posterior tooth using all resin cement. It is indicated in cases with excessive loss of tissue of the crown when interproximal space is limited; traditional rehabilitation with post and crown is not possible because of inadequate ceramic thickness or calcified, curved, or short rootcanals.

These restorations have macromechanical retention by being anchored to the internal portion of the pulp chamber and to the cavity margins and microretention by adhesive cementation. In endocrown, the internal portion of the cavity provides macromechanical retention while micromechanical retention is achieved by adhesive cementation. 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 , but the precise dimensions for the preparation of central retention cavity were not clearly determined.The thickness of the ceramic occlusal portion of endocrowns is usually 3-7 mm. Endocrown is a partial crown made from ceramic material or composite resin which is cemented with resin cement to the postendodontic teeth. This restoration is full occlusal coverage and takes advantage of the pulp chamber to increase the adhesive surface area. Materials used for making endocrown are feldsphatic and glass-ceramic, composite hybrid resin, and CAD/CAM ceramic and composite resin.[2]

Premolars restored with endocrowns: There is a lack of data about the influence ofthe endocrown design on the biomechanical behavior ofrestored endodontically treated premolars (ETPM).

Bindl *et al*, considered that endocrowns are unsuitablerestorative approach for premolars with a failure rate of31% while molars restored with endocrowns had 12% failure rate.

This difference in the failure rates isattributed to decreased surface area available for adhesion in premolars in addition to the unfavourable ratio between crown basis and crown height mightcause a moment of force. Even though it wassuggested by Pissis that endocrowns preparations mustbe of 5mm depth. As it seems reasonable tohypothesize that the deeper the pulp-cavity preparationfor an endocrown and the deeper the resultant intraradicularextension ―endo-core, the greater the surfacearea for adhesive retention and the better thetransmission of masticatory forces to the root.[3]

Indications of endocrown

1) As good restorative alternative in teeth with short, obliterated, dilacerated, or fragile root.
2) Limited interocclusal space
3) In cases it is not possible to procure adequate thickness of the ceramic covering on the metal or ceramic substructures
4) Excessively loss of coronal tooth structure.[4]

Contraindications of endocrowns

Endocrowns can‘t be used in the following scenarios:

(1) Less than 3mm pulp chamber depthor if the cervical margin is less than 2 mm wide for most of its circumference.
(2) When adhesion cannot be assured.
(3) If negligible remaining tooth structure is present

Advantages

1) Removal of lower amounts of sound tooth structure compared to other techniques and with much lower chair time needed .
2) It can be milled using CAD-CAM or moulded under pressure.
3) It can be used as an alternative to full crown and post and core in severely damaged tooth.
4) If retreatment is necessary, the removal of endo-crown is easy.

Disadvantages

1) Debonding
2) Risk of root fracrture because of the difference in modulus of elasticity in ceramic and softer dentin.

Mechanical properties of Endocrowns: In a study that compared the fracture strength of endocrowns and glass fiber post retained conventional crowns, the results showed significantly higher fracture strength for endocrowns 674.75 N when compared with conventional crowns 469.90 N. The failure pattern was characterized by fracture of the tooth associated with displacement of the restoration on the opposite side. Rocca *et al*., preformed fracture analysis using both stereomicroscope and ScanningElectron Microscopy (SEM) on endocrowns with 2mm and 4mm extension of the core within the pulpchambers below the ECJ and conventional crowns with a 5mm post and 3.5mm core.[5] All restorations experienced non-reparable fractures. Though, different fracture paths were observe. Endocrowns fractured mesio-distal vertical fracture which split the restoration ―wedge-opening fractures.In contrast, the conventional crown with post and core group displayedcatastrophic fractures in multiple pieces. Lin *et al*., reported that there was a significant difference ofthe stress values at the luting cement interface betweenthe endocrown (2 MPa) and the classical crown (15.36MPa). This indicates that the stress concentration withinthe cement occurred at the central groove area of theocclusal surface in the classical crown configuration.[6] Hence, the reduced effect of multiple interfaces in the restorative system of the endocrown configurationmight make the restored tooth more approximate to a ―monobloc and thereby reduce adhesive interfacefailure. Also, they concluded that failure probability and fatigue-load testing revealed that the endocrown and theclassical crown obtained nearly the same performance and endocrowns can be considered as a feasible, conservative, and aesthetic restorative approach.

In 2016, A systematic review and meta-analysis of endocrowns restorations was published. In thissystematic review endocrowns presented high clinical success rates (94 to 100% up to 36 months). Furthermore, the reason of failure was secondary caries, and no study reported fracture or retention loss ofendocrown.

CAD/CAM endocrowns

In regards to the material choice glass-ceramic restorations had a significantly higher failure rate thanall other materials ($P < .001$, 18.18%) and ceramics with aluminum and magnesium oxide (In-CeramSpinell) had the highest survival rate 96.8%. The luting cements did not appear to affect the outcome in the study cinducted by Burke et al. Also it concluded that the long-term survival rates for CAD/CAM technology– fabricated single-tooth restorations demonstrated clinically similar outcomes to conventionally manufactured restorations. Moreover, a study evaluated the marginal and internal discrepancies of endocrowns with differentcavity depths 2mm and 4mm fabricated using two different chairside CAD-CAM systems (CEREC ACand E4D) concluded that marginal and internaldiscrepancies increased depending on cavity depth andboth chairside CAD-CAM systems showed similar discrepancy in the endocrowns. In contrast, another study, that used lithium disilicate CAD-CAM ceramics to fabrication conventional crowns and endocrowns stated that the differences in the survival between the groups were not statistically significant after the application of thermo-mechanical fatigue loading. When it comes to survival rate and mechanical properties, endocrown restorations showed comparableor somewhat superior results to other conventional treatments using post and core followed by a crown orinlay/onlay restorations. Enodcrowns are more practical, conservative, and less technique sensitive.

CONCLUSION

In today’s era of esthetic and adhesive dentistry, endocrown serves as a conservativeand feasible alternative to conventional post and core crownsas it preserves root tissues and limits internal preparation ofthe pulp chamber to its anatomic shape. Endocrown indications include loss of extensive tooth structure, small intermaxillary spaces where rehabilitation using crowns is not possible because of insufficient thickness of ceramic material, and cases where postuse is contraindicated because there are anatomic variations of the roots. Endocrown has the advantage that its procedures are easy and have better mechanicalperformance than conventional crowns, lower costs due to fewer procedure stages, less time, and good esthetics.[2]

Summary

Endocrowns have emerged as good restorative alternative in teeth with short, obliterated, dilacerated, or fragile root. It is a total porcelain crown well adapted to root canal treated tooth, thus obtaining macromechanical retention (provided by the pulpal walls), and microretention (by utilizing adhesive cementation). It may also be utilized in situations of excessive loss of coronal dental tissue and limited interocclusal space, in which it is not possible to procure adequate thickness of the ceramic covering on the metal or ceramic substructures. Endocrown increases surfaces available for adhesion, therefore impacting positively the treatment long-term prosperity. In this case report, endocrowns were found to be a feasible option to full crowns or composite overlays for the restoration of nonvital posterior teeth, especially those with minimal crown height and sufficient tissue available for stable and durable adhesive cementation.

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