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# Endocrowns: A Review

[1]Dr. Yesha Shah, [2]Dr. Dipti Choksi, [3]Dr. Barkha Idnani, [4]Dr. Zorayas Vasania

[1-4]Department of Conservative Dentistry and Endodontics, Dharamsinh Desai University, Nadiad, Gujarat

**Corresponding Author:** Dr. Yesha Shah, Post Graduate student, Department of Conservative Dentistry and Endodontics, Dharmsinh Desai University, Nadiad, Gujarat.

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**Abstract**

Endodontically treated teeth (ETT) have been the subject of extensive and controversial discussion over the optimum restoration.

Dental structure is necessary to increase the number of surfaces that are ideal for adhesion, mechanically stabilise the integrity of tooth restoration, and ultimately contribute to long-term success. ETT are more prone to biomechanical failure than vital teeth. The requirement for post-core restorations has decreased along with the introduction of adhesive materials.

For a general practitioner, it can be difficult to restore teeth that have undergone endodontic treatment (ETT) and have more than one cusp missing or with thin remaining walls. Although the use of posts in conjunction with full covering restorations is a well-known strategy, yet they do not follow adhesive dentistry's minimally invasive concepts. Endocrowns are indirect Monoblock restorations that retain material via the ETT's pulp chamber.

This article provides detailed literature on how Endocrowns have been employed as an alternative to the standard post-core and fixed partial dentures, particularly for the restoration of significantly destructed ETT as well as the benefits of endo-crowns over conventional procedures like good aesthetics, improved mechanical performance, lower costs, and shorter clinic visit times.

**Keywords:** Endodontically treated teeth (ETT).

## Introduction

Due to the removal of caries, old restorations, and further use of files, the tooth becomes structurally weak after receiving root canal therapy. Using too many files during the biomechanical preparation leaves the tooth structure fragile and at risk of breaking under occlusal pressure. Therefore, it is crucial to restore the tooth with a suitable material to ensure that the endodontically treated tooth has a good prognosis, can regain full function, and can, if necessary, serve satisfactorily as an abutment for a fixed dental prosthesis or a removable partial dental prosthesis.[1]

The placement of a traditional post and core followed by a crown is the most frequently advised treatment approach for patients accompanied with considerable loss of two or more dentin walls[2]. But there is a requirement for a firm core filling, especially in situations involving posterior teeth where the masticatory forces are directed parallel to the tooth's long axis. This is because, according to several studies, the use of intra radicular posts alone may not promote the preservation of the restoration[3]. Additionally, post has a number of drawbacks, including: (1) It requires precise skill, (2) Its placement is limited in cases of severely curved or dilacerated canals, (3) In cases of poor post selection, it might not be effective, and (4) it requires further removal of healthy sound dentin for its effective placement, which might compromise the root dentin stability in an already weakened tooth, making it more susceptible to fracture.[4]

Figure 1shows how endocrowns connect the post, the core, and the crown as a single component or monoblock restorations.[5,6] It is distinct from the traditional method with intraradicular posts. Endocrown restorations provide both macro and micro-mechanical retention by being anchored to the interior of the pulp chamber and on the cavity margins.[7,8]

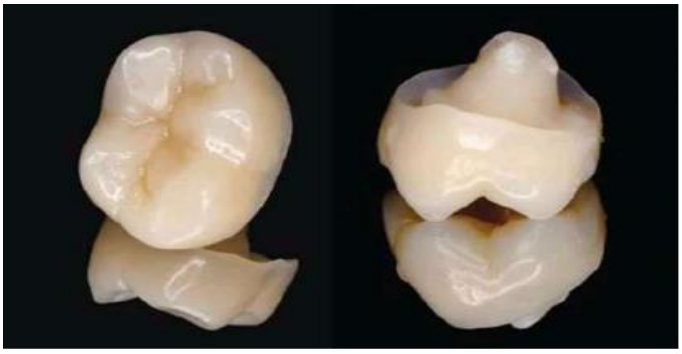

Figure 1

The purpose of this article is to describe the preparation and insertion of endocrowns as well as the materials used to achieve a reliable and durable result.

**Endocrown restorations**

The advent of adhesion, fueled by the creation of efficient dentin adhesives, marked the real improvement in the restoration of endodontically treated teeth. The primary advantage of adhesive restorations is that, as long as enough surface is provided, macroretentive substances are no longer mandotary. When using traditional restorative procedures, the insertion of radicular posts is now the exception rather than the rule. In fact, the "gold standard" for restoring ETT is currently least-invasive preparation with maximum tissue conservation.[9]

In a study of 3D Finite Element Analysis of molars restored with endocrowns and posts during masticatory simulation, teeth restored by endocrowns were potentially more resistant to failure than those with fibre reinforced posts.[10]

**Preparation technique for endocrowns**

The endocrown preparation builds the crown and core as a single unit monoblock structure and does not rely on the root canals for stability. It consists of a circumferential 1.0-1.2 mm depth butt margin and a central retention cavity inside the pulp chamber.

**Occlusal preparation**

It is necessary to reduce the occlusal height by at least 2mm in the axial direction(Figure 3). The ceramic material that will cover the occlusal surface of the tooth typically ranges in thickness from 3 to 7 mm with an increase in occlusal thickness, all ceramic restorations become more fracture resistant. The reduction is carried out by cutting orientation grooves of 2 mm depth, followed by occlusal reduction using a diamond wheel with coarse grit. The diamond is always oriented parallel to the occlusal plane and along the long axis of the tooth. The diamond form guarantees the requisite flat surface and appropriate reduction alignment.[11]


Figure 2: Occlusal Preparation for Endocrowns

Ideally, the margins should be kept supragingival everywhere, but if aesthetic or clinical considerations necessitate a difference in level, there should be no more than a 60° slope between the various cervical levels. Enamel that has been compromised and is less than 2 mm thick needs to be removed. The cervical sidewalk serves as the restoration's cornerstone because the goal is to create a broad, level surface that will be resistant to compressive load.[12]

Figure 3

**Axial preparation**

Undercuts in the access cavity are removed at this procedure. The pulp chamber and endodontic access cavity are made in continuous alignment using a cylindrical-conical course grit diamond bur with an occlusal taper of roughly 7 degrees. The pulpal floor is left intact, the diamond is held parallel to the tooth's lengthy access, and undue pressure is avoided. The cavity must be at least 3 mm deep. The mechanical qualities of the restoration will be better the larger the pulp chamber is.[13]

For the initial upper premolars, the recommended endocrown measures are a 3 mm diameter cylindrical pivot and a 5 mm depth, and for the molars, a 5 mm diameter and a 5 mm depth.[14]

Premolars exhibit greater failures than molars due to adhesion failure, according to Bindl and Mörmann's evaluation of the premolars and molars' Endocrown performance. Premolars with deep occlusal fissures are more flexible than those with shallow or fewer cracks. Premolar endocrowns need to have a flatter occlusal table to reduce the crown height and cuspal slopes leading to shorter fissures to lessen cuspal bend and the possibility of fracture during grinding.[15]

**Polishing the cervical band**

Although the bur used in this phase has a larger diameter and finer particle size than the one used in axial preparation, it has the same taper. It should be manoeuvred all the way around the cervical band to smooth out any minor flaws and create a flat, polished surface.[15] The margin line needs to have a straight, regular edge. (Figure 4)

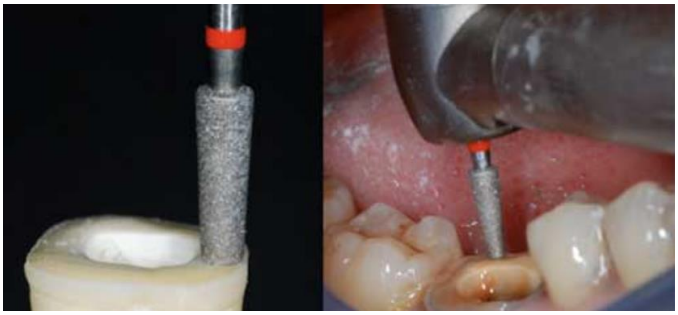

Figure 4


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

**Preparation of the Cavity Floor**

The pulpal canal's access is opened. To benefit from the saddle-like structure of the cavity floor, gutta percha is removed to a depth of no more than 2 mm. To protect the integrity of the canal's access, this should be done with a nonabrasive tool. No drilling of the dentin is done.

**Indications**

1. When the interproximal space is constrained, the crown tissue is lost excessively, and conventional post-and-crown rehabilitation is not viable due to insufficient ceramic thickness.
2. Molars having clefts that are too low.
3. In cases of calcified root canals or extremely thin roots.

**Contraindications**

1. Less than 3mm pulp chamber depth.
2. When adhesion cannot be assured.
3. If only negligible remaining tooth structure is present.

Other advantages of endocrowns are easy to apply and require a short clinical time, low cost, short preparation time, ease of application, minimal chair time and increased aesthetic properties. Tooth Preparation for Endocrown restoration as suggested by Bindl and Mormann. After completion of the root canal preparation some preparation / modification is required for proper fabrication of endocrowns. There are no guidelines present in the literature which can be used for preparation but they certain steps have have to followed in preparation of endocrowns.

- Circumferential 1.0-1.2 mm depth butt margin
- 5 mm depth for the first maxillary premolars and a 5 mm diameter and a 5 mm depth for molars
- The thickness of the ceramic occlusal portion of endocrowns is usually 3-7 mm.

**Restorative Material Selection**

Wide cavities in posterior teeth can also be restored using indirect composite and porcelain laboratory techniques. manufactured in. Inlays made in a lab from indirect porcelain or composite resin restore mechanical and biological function while enhancing aesthetics with little to no tooth preparation. Excellent marginal fit, optimum proximal contacts, high wear resistance, minimal polymerization shrinkage, and ideal aesthetics are all guaranteed by porcelain and indirect resins.

By processing the feldspathic ceramic blocks, ceramic restorations can be created in a lab or with CAD/CAM technologies. When compared to dental ceramic materials manufactured in the lab, industrially improved feldspathic ceramics utilised in CAD/CAM systems have better fracture strength and structural homogeneity[20]. The preparation is appropriate for both traditional and contemporary preparation designs. A single session can be used to finish the restoration, and good marginal fit and aesthetics are achieved.[21]

The fracture resistance and failure mechanisms of CEREC endocrowns and traditional post-core supported CEREC crowns on maxillary premolars were compared by Chang et al. According to reports, CEREC endocrowns demonstrated greater fracture resistance than conventional crowns, however there was no discernible difference between the two groups in terms of failure patterns.[19]

Resin nanoceramic endocrowns have significantly higher fracture resistance and more favourable fracture mode than feldspathic porcelain and lithium disilicate endocrown, but they also have higher dye penetration and more microleakage, according to an in vitro study that evaluated marginal leakage and fracture resistance of three different CAD/CAM fabricated ceramic endocrowns on maxillary molars.[22]

With the advent of fibre-reinforced composite solutions, intracoronal restorations have given way to crown and bridge restorations. They are a good alternative to ceramic and resin materials because of their physical, mechanical, and aesthetic qualities. However, in terms of marginal adaption, CAD-CAM crowns made from millable composite resin blocks provide an advantage over all-ceramic crowns.[23,24,25]

**Cementation**

The majority of resin cements with an inorganic filler matrix and Bis-Glycidyl methacrylate or urethane dimethacrylate resin matrix are utilised to cement the endocast. In order to prevent eugenol-containing sealers from impeding the polymerization of resin cement, the entire pulp chamber needs to be cleaned. Before bonding, precision fit and marginal adaptation of endocrowns is evaluated. Cementation surfaces of endocrowns were etched with 5% hydrofluoric acid for 20 seconds, rinsed with water for 30 seconds, ultrasonically cleaned in distilled water for 3 minutes, and dried. A silane coupling agent (RelyX Ceramic Primer, 3M ESPE) is applied and allowed to dry for 1 minute. Then light cured for 10 seconds.

**Conclusion**

Based on the patient's economic and aesthetic needs, endodontic crowns seem to be a promising treatment choice for posterior teeth that have had endodontic therapy but have suffered significant coronal tooth structure loss and have a limited amount of interocclusal space. Metal ceramic-based endocrowns (PFM), on the other hand, can potentially be seen of as a worthwhile treatment choice, particularly for individuals for whom financial limitations are a limiting concern. Before implementing PFM-based endocrown in clinical settings, all the aforementioned clinically significant criteria should be examined in order to produce positive results. Since this straightforward idea is more consistent with the philosophy of biointegrated prostheses, restorative dental practitioners should be more aware of and employ this kind of reconstruction, which is still uncommon.

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