ENDOCROWNS: A REVIEW

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ABSTRACT: Various restorative techniques and materials have been in use since long time for the restoration of endodontically treated teeth. Restoration of endodontically treated teeth is important because the success of the endodontic treatment relies on the coronal restoration. Endocrowns are indicated for the restoration of the severely damaged teeth especially molars.Endocrowns are a type of monolithic, monoblock, ceramic adhesive restoration which requires minimal tooth preparation, thus helping to conserve the remaining tooth structure which is left after endodontic treatment. This simple and efficient type of reconstruction, which is still uncommon, should be widely known and used. The aim of this article is to provide a deep insight about endocrown preparation, indications, contraindications, advantages and disadvantages.

KEYWORDS

Endocrown, monoblock, endodontically treated teeth.

INTRODUCTION

Restoration of endodontically treated teeth is still a clinical challenge because of the large amount of coronal destruction and loss of strength which can be attributed to the removal of pulp tissues and sound dentin structure [1]. Therefore, to achieve coronal retention, intraradicular posts combined with or without core materials may be required [2]. The only disadvantage of this system is the excess removal of the sound hard tissue needed for fitting the post into the root canal [3]. Endocrowns (figure 1) unite the post, the core, and the crown in one component which represents monoblock restorations [4,5,6]. It is different from the conventional approach using intraradicular posts. 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 [7-9].

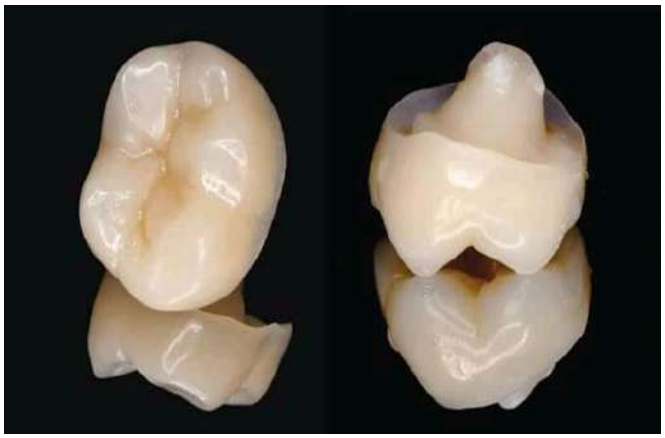

Figure 1

ENDODONTICALLY TREATED TEETH

There has been a general notion that the endodontically treated teeth are more brittle and are subject to fracture more than the vital teeth. There are various reasons cited for the loss of strength after a tooth has been endodontically treated [10-13].

1) Moisture loss

The amount of moisture in the coronal dentin possesses is approximately 13.2%. The free water content of the tooth hydrates the inorganic ions and this gets reduced after a tooth is been endodontically treated. In 1956, Battistone and Burnett demonstrated that the moisture loss from the endodontically treated tooth is irreversible [14,15].

2) Architectural changes

Endodontic procedures reduce the tooth stiffness by a mere 5% but the mesiocclusodistal cavity preparation reduces the tooth stiffness by more than 60% [16]. That's why the aim is notonly good endodontic treatment but also a long-lasting coronal restoration after endodontic treatment. Excessive removal of the radicular dentin during shaping and cleaning or during post space preparation compromises the root [17-19].

3) Dentinal toughness

Dentin under bending and torsional forces has been identified as an isotropic material [20]. The fracture toughness of dentin varies with the orientation of tubules, force and angle of load applied, velocity of the crack and orientation of the collagen fibrils [21]. A study by Carter et al demonstrated 14% reduction in the strength and toughness of cervical dentin in endodontically treated teeth [22].

4) Collagen alteration

Dentin mainly consists of type 1 collagen. Collagen fibrils achieve rigidity and resistance to stretching and high tensile strength due to its cross linkages [23]. A study by Rivera et al have demonstrated that there are fewer mature and more immature cross linkages of collagen in root filled teeth which could be responsible for decrease in the tensile strength of dentin in endodontically treated teeth [24].

Endocrowns

Endocrown was first proposed by Bindl and Mormann in 1999 as an alternative to full post and core supported endodontically treated teeth [8]. It is a one-piece ceramic construction based on the concepts which were developed by Pissis [25]. The main objective after endodontic treatment is proper coronal restoration which gives strength to the tooth for bearing the occlusal and masticatory loads. The coronal restoration must be an adhesive restoration which does not involve root canals for anchorage as the use of root canals for anchoring has been an important factor in weakening of the tooth [26-28]. Endocrown is different from the conventional complete crown in many aspects [29]. Endocrown is described as a monolithic ceramic bonded prosthesis characterized by supra gingival butt joint, preserving maximum enamel which improves adhesion (figure 2). The endocrown involves the pulp chamber but not the root canals. It is generally milled using computer aided techniques and by moulding the ceramic materials under pressure [29-30].

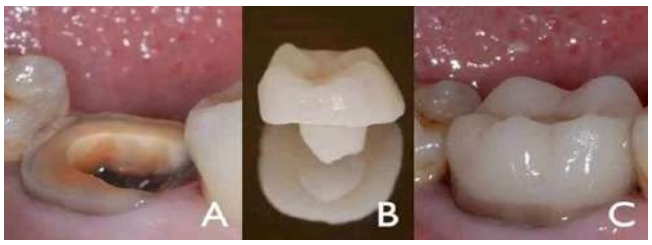

Figure 2 Occlusal Preparation for Endocrowns

A minimum of 2mm occlusal height reduction in axial direction is required (figure 3). The thickness of the ceramic material which will occupy the occlusal surface of the tooth is generally 3-7mm. The fracture resistance of all ceramic restorations rises with the increase in the occlusal thickness. The reduction is done by making 2mm depth orientation grooves and then occlusal reduction is done with a coarse grit wheel diamond. The diamond is always directed along the long axis of the toothand parallel to the occlusal plane. The diamond shape ensures the proper reduction alignment and the desired flat surface [30]. Ideally, the margins should be kept supragingival everywhere but in areas where the esthetic requirements or clinical factors requires a difference in level, a slope of no greater than 60° should be between the different cervical levels. Undermined enamel with less than 2 mm thickness should be removed. The cervical sidewalk is the foundation of the restorationas the objective is to accomplish a wide, uniform, steady surface which will be resistant to compressive stress [31].

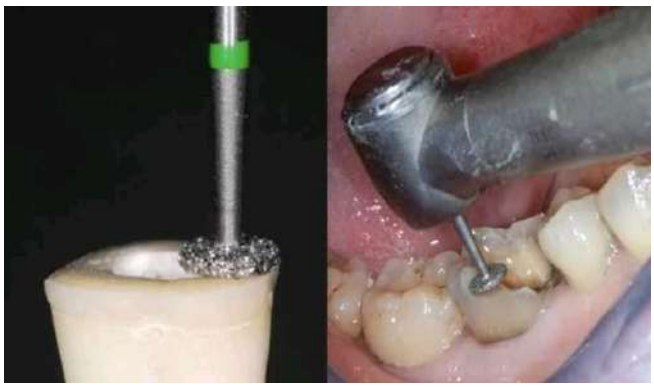

Figure 3

Axial Preparation

During this step, undercuts in the access cavity are eliminated. A cylindrical-conical course grit diamond bur with an occlusal taper of approximate 7 degrees is utilized to make the pulp chamber and endodontic access cavity in continuous alignment. Diamond is held parallel to the long access of the tooth;pulpal floor is kept untouched and excessive pressure is avoided. The cavity depth must be atleast minimum 3 mm. The greater the extent of the pulp chamber better will be the mechanical properties of the restoration. The recommended endocrown measurements are a 3 mm diameter cylindrical pivot and a 5 mm depth for the first upper premolars and a 5 mm diameter and a 5 mm depth for molars. Bindl and Mörmann evaluated the performance of premolars and molars Endocrowns and confirmed that the premolars showed more failures than the molars, that was due to the adhesion failure on them. Premolars that have deep occlusal fissures have higher flexibility than ones that are shallow or fissure less. Premolar endocrowns must have a flatter occlusal table to minimize the crown height and the cuspal slopes resulting in shallower fissures to decrease cuspal bend and the chances of fracture during grinding [32].

Advantages

1) Removal of lower amounts of sound tissue compared to other techniques and with much lower chair time needed [29-30].
2) It can be milled using CAD-CAM or moulded under pressure [29-30].
3) It can be used as an alternative to full crown and post and core in severely damaged tooth [29-30].

Indications

1) Molar teeth with short and fragile roots [29-30].
2) Excessive loss of coronal structure of tooth [29-30].

Contraindications

1) If adhesion is not assured [31-32].
2) Pulp chamber is not 3mm deep [31-32].
3) Cervical margin is less than 2mm wide for most of its circumference [31-32].
4) Premolar teeth [31-32].

Cementation

Mostly resin cements containing Bis-Glycidyl methacrylate or urethane dimethacrylate resin matrix and inorganic filler particles are the most common type of cements used to cement the endocrown. The entire pulp chamber must be cleaned so that eugenol containing sealers do not hamper the polymerization of resin cement [32].

Discussion

Bindl and Mormann evaluated the adhesively placed endocrowns after 2 years and concluded that the clinical quality of endocrowns was very good [8]. Bernhart et al. summarized thatendocrowns represent a very promising treatment alternative for endodontically treated molars [33]. In 2012, Biacchi and Bastingcompared the fracture strength of 2 types of full ceramic crowns: indirect conventional crowns which were retained by glass fibre posts and endocrowns. They concluded that endocrowns were more resistant to compressive forces than conventional crowns [34].

Conclusion

The preparation for endocrowns is simple and can be performed quickly. It preserves the marginal periodontium as it margins are supragingival which facilitates impression making and also there is minimal loss of sound tooth structure during preparation. So, it is an excellent restorative option for endodontically treated teeth.

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9769394946.

How to cite this Article:

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**