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Case Report *Medical research*

Endocrowns: when less is more

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ABSTRACT

The need for replacement of crown in a grossly decayed endodontically treated tooth is a challenging task for most practitioners. Post and cores are the most widely recommended treatment option for such cases associated with extensive loss of tooth structure, which is eventually followed by fabrication of full coverage crowns supported by metal or adhesively bonded cores. In the past, it was believed that this procedure would help in reinforcing the remaining tooth structure.However, it is now evident that a post would only serve as a mechanical retainer for the core and does not strengthen the compromised tooth.Ideally, a post-endodontic restoration should protect and preserve the existing tooth structure, while restoring esthetics, form, and function. The aim is to achieve a minimally invasive preparation with maximum tissue conservation for restoring endodontically treated teeth. With the advent of adhesive dentistry it is now possible to limit the amount of tooth preparation required. The endocrown was first proposed by Bindl and Mormann, who suggested that it would produce a monblock effect by utilising the available surface in the pulp chamber and obtain retention through adhesive bonding.This case report highlights the successful post endodontic management of an extensively decayed molar using a ceramic endocrown.

Keywords: Ceramic endocrowns, Monoblock effect, Adhesive dentistry

INTRODUCTION

Post endodontic restoration has always played an important role in the rehabilitation of an endodontically treated tooth and the presence of an optimal coronal seal cannot be understated.[1] Clinical data based on the rehabilitation of grossly destroyed non-vital teeth has been based on varied philosophies and states that the strength of the tooth is dependent mainly on the remaining healthy tooth structure and its anatomic form.[2,3] The tooth integrity can be influenced by several factors such as caries, stages of endodontic therapy that includes access cavity preparation, chemical and biomechanical preparation which makes it susceptible to fracture.[2,4-6] Another factor that

can influence the longevity or the survival of an endodontically treated tooth is the presence of pericervical dentin (PCD). PCD is the critical zone extending 4mm above the alveolar crest and 4mm apical to the crestal bone. This zone is crucial as it transfers the load from the occlusal surface to the root and provides resistance to fracture [7,8] Keeping the aforementioned factors in mind, it is evident that the need to preserve the remaining tooth structure especially after endodontic therapy while achieving an optimal coronal seal with as minimal reduction ensures long-term success and longevity of the tooth.

Till date there has been a lot of ambiguity about the choice of restoration for an endodontically treated tooth. The most important factors that determine the choice of restorations are the functional requirement and the amount of remaining tooth structure. Endocrown is a conservative post endodontic restorative option when one half of the coronal tooth structure is missing [9]. This concept was first proposed by Pissis [10] in 1995 who suggested that the pulp chamber can be used to improve macromechanical retention when used in combination of heat pressed ceramics, creating a 'monoblock' effect. Bindl and Mormann[11] in 1999 gave the term 'endocrown' to an all ceramic restoration that obtained macromechanical retention from the pulp chamber and micromechanical retention by being adhesively bonded to the tooth [11,14].

The endocrown has been described as a monolithic ceramic bonded construction with a supra-cervical butt joint, retaining maximal enamel in order to enhance adhesion.[12,13] The tooth preparation for any endocrown includes a uniform occlusal reduction of 2mm and a 1-1.2mm butt joint margin. All cervical margins must be placed as supra-gingival as possible with an occlusal divergence of 7^{o}. The pulpal floor and the walls must be uniformly continuous with no undercuts. [2,15] The purpose of the following case report is to highlight the successful use of ceramic endocrowns in rehabilitation of grossly destroyed teeth that would otherwise require an intra-radicular post.

CASE REPORT 1

An eighteen-year-old female patient reported to the Department of Conservative dentistry and Endodontics with a grossly decayed lower right first molar. Clinical examination revealed a considerable loss of crown structure due to caries, hence a need for endodontic therapy followed by post endodontic rehabilitation. Multiple visit non-surgical root canal therapy was performed. Following caries removal and root canal therapy the residual tooth structure necessitated the use of a post for retention of a core, followed by a full coverage restoration [Fig 1a]. However, taking the patient's age into consideration and her need for a tooth colored restoration, a ceramic endocrown was deemed as a suitable substitute for the conventional post and core technique. Furthermore, the endocrown would prevent the unnecessary reduction of the remaining tooth structure, thereby preserving the pericervical dentin.

The occlusal reduction was carried out in order to obtain a clearance of 2mm using a wheel diamond bur along the long axis of the tooth and parallel to the occlusal surface [Fig 1b]. Any unsupported enamel was eliminated and enamel walls that were less than 2mm thick were eliminated. A long round end tapered diamond bur was used to create occlusally converging smooth axial walls that were continuous with each other and the pulpal floor. Any undercuts present on the axial walls and the pulpal floor were blocked out using composite resin (3M, ESPE Filtek Z350 XT) [Fig 1b, c]. Retraction cord was placed and impressions made with polyvinyl siloxane impression material (Aquasil LV, Putty/Light Body, Dentsply, Germany) using putty wash technique. A lithium disilicate (IPS e. Max Press) endocrown was then fabricated [Fig 1d].

The fit of the endocrown was confirmed before cementation to ensure the absence of any occlusal prematurities. The tooth surface to be bonded was etched with 35% phosphoric acid (3M, ESPE, Scotchbond) for 10 seconds followed by application of bonding agent (3M, ESPE Adper Single bond). The intaglio surface of the endocrown was surface treated using 5% hydrofluoric acid, followed application of a silane coupling agent (Calibra® Silane Coupling Agent). Equal amounts of the base and catalyst paste (Calibra® Esthetic Resin Cement, Dentsply, Sirona) were dispensed and mixed for 30 seconds. A uniform layer of luting agent was applied on the internal surface of the restoration and the endocrown was seated using firm finger pressure.

Any excess cement was cleared off using an explorer. The assembly was then tack cured and the excess 'gel' like cement was cleared from the margins. All the surfaces were then light cured for 20 seconds. The final restoration-tooth interface was finished and polished using Enhance® polishing system [Fig 1 e, f].

Fig 1 (A: post obturation image; B&C: tooth preparation for endocrown; D: Lithium Disilicate endocrown; E&F: post – cementation images)

CASE REPORT 2

A 28 year old male patient reported to the Department of Conservative dentistry and Endodontics, with a decayed upper left second molar. Clinical examination revealed a grossly decayed #27 with a widened periodontal space. Non-surgical endodontic treatment was advised followed by post endodontic rehabilitation. Conventional multi-visit endodontic therapy was performed and since remaining clinical crown height would not permit the retention of a core build up material an endo-crown was deemed as a suitable post endodontic restoration. Tooth preparation was performed similar to that of case 1. Undercuts were blocked out using resin composite. In maxillary molars the cavity outline is triangular, which was followed in this case [Fig 2 a, b] as compared to the rectangular outline of the lower mandibular molars. An elastomeric impression was made [Fig 2c] and a lithium disilicate endocrown was fabricated [Fig 2d]. The endocrown was then bonded to the tooth using the protocol mentioned in case 1 [Fig 2e].

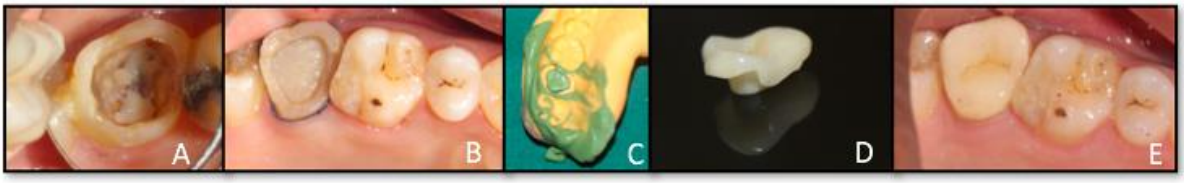

Fig 2 (A: post obturation image; B: tooth preparation for endocrown; C: elastomeric impression for endocrown; D: Lithium Disilicate endocrown; E: post cementation image)

DISCUSSION

Restoring structurally compromised endodontically treated teeth has always been a challenge to most clinicians. However, with the advent of adhesive dentistry and the use of high precision technology it is now possible to create accurate esthetic restorations that not only avoid unnecessary removal of tooth structure but also reduce the chair side time which can be achieved with the use of acid etchable ceramics (lithium and leucite disilicate- based ceramics), resin cements and dentinal adhesives. The endocrown is one such alternative that provides a more rational approach in treating teeth that would otherwise require a post. According to Fages et al [13] a minimum occlusal reduction of 2 mm is required when ceramics are used while, Roca et al [14] suggested that a reduction of 1.5mm is sufficient when composite resins are used.

Its advantages include minimal preparation of remaining tooth [13], preservation of the pericervical dentin, eliminating the need for a post thereby preserving the radicular dentin[13], reduced chair-side time [15], patient acceptance, monoblock effect [9], better distribution of masticatory stresses, the endocrown eliminates the horizontal peak loads within the root canal, which is caused by posts in the root canal. [12] In addition to the design of this restoration, the adhesive technique employed can prevent marginal leakage

and subsequent penetration of micro-organisms at the interface. [16,17]

Literature suggests that pre-treatment with 4.9% hydrofluoric acid can provide adequate micromechanical retention, which would enhance the bonding with the luting composite.[18]Biomechanically, this type of restoration permits good adaptation to strains at the bonded joint. The forces are well distributed at the cervical butt joint (compression forces) and along the axial walls (shear forces), thereby reducing the stresses acting directly on the pulpal floor.[13, 19] According to Biacchi and Basting, Lithium disilicate endocrowns demonstrated a greater resistance to compressive forces when compared to crowns supported by fibre posts. [21]

While most molars especially those that have clinically low crowns, slender roots or calcified root canals are good candidates for endocrowns.[2,21,22] Authors have also claimed its usefulness in rehabilitating premolars and incisors [11,17,9]In 2005, Bindl et al [24] reported that endocrowns when used in premolars, had a 31% failure incidence, which demonstrated a strong correlation with the amount of surface that was available for adhesion, while a systematic review conducted by J.A. Sedrez-Porto et al [26] revealed that endocrowns placed on pre-molars had a higher failure rate than molars due to the non-axial forces directed onto the premolars. Most researchers believe that endocrowns should be limited to molars. [12, 25, 26]

Since both the aforementioned cases required an esthetic occlusal rehabilitation in young individuals ceramic endocrown deemed to be the best minimally invasive option when compared to conventional post and core techniques. However, endocrowns have their limitations and have been contraindicated in the following cases: pulp chamber depth of less than 3mm or a cervical margin of less than 2mm, lack of tooth structure for adhesion [19], patients with para-functional habits or with group guided occlusion and a steep cuspal inclination.[2] Sometimes it may be necessary to smoothen or restore the irregularities on the pulpal floor and the walls of the pulp chamber with composite resin in order to remove the retentive areas that could hinder placement of the endocrown and generation of stresses.[2]

CONCLUSION

While the ideal treatment modality for rehabilitation of a mutilated posterior tooth is subject to controversy, it can be said that the amount of remaining tooth structure plays a pivotal role in the success of an endodontically treated tooth. The endocrown due its structural design enables preservation of the remaining tooth structure while eliminating the need for a core material and maintaining an optimal coronal seal. Hence in conclusion, endocrowns can serve as excellent post endodontic restorations especially in grossly damaged teeth with lack of clinical height.

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