Case Report

Redemption of a Broken Castle: A Case Report on Endocrown

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Abstract

Successful restoration of an endodontically treated tooth with large coronal destruction is still a dilemma for the dentist. Conventionally, endodontically treated teeth with extensive coronal loss were restored by fabricating full crowns supported on cast metal cores for their functional and esthetic recovery. However, with the development of intraarticular posts made of glass fiber and the technique of bonding to dentin by resin-based materials, the restoration of endodontically treated teeth became: simpler more economical and biocompatible. One such special kind of restoration for endodontically treated posterior teeth which utilize the advantage of adhesive dentistry is endocrowns. The endocrown is an onlay restoration on endodontically treated teeth, which is more conservative than the traditional post and core system and uses the adhesive resin with a mono-block technique. The principal concept of endocrown is to engage the large pulpal chamber of the root of treated molar teeth with the ceramic etched restoration which provides cuspal coverage.

Keywords: Adhesive dentistry, Conservative approach, Endocrown, Endodontically treated teeth, Esthetic.

Introduction

The fracture of a restored tooth is a significant clinical problem, because it often results in extraction. This condition is more imperative in a root-filled tooth because, compared to teeth with healthy pulps, endodontically treated teeth are considered more susceptible to fracture. Endodontic treatment generally results in a reduction in the resilience and fracture resistance of teeth. The primary factors which lead to loss of tooth structure comprise dental caries, endodontic access preparation, and root canal preparation.[1]

Extensive coronal destruction may require restoration with intra-canal post,[2] but it does have its shortcomings.[3] More recently, indirect restorations such as ceramic inlays, and overlays have become popular, not only due to improved esthetics but also because they provide tooth strength and allow for a reduction in the volume of resin composite that is used only as a luting agent. Endocrown is one such novel restoration pioneered by Pissis in 1995[4] and later popularized by Bindl *et al.*[5] It is an adhesive monoblock full ceramic restoration which concurrently plays the role of a post, core, and crown.[2,6] The restoration is secured to the internal walls of the pulp chamber with an adhesive cement to improve the macromechanical and micromechanical retention, respectively.[7,8]

The current case report, thus, chronicles a clinical case, in which an esthetic and conservative endocrown was fabricated to restore a mandibular tooth post-endodontic treatment, with a considerable amount of coronal tooth structure loss.

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A 49-year-old male patient was referred to the Department of Conservative Dentistry and Endodontics of the Dental College and Hospital with a chief complaint of pain in the lower left back tooth region. On clinical and radiographic examination, a diagnosis of irreversible pulpitis with respect to #36 was made (Figure 1a). It was also found that the tooth suffered from major coronal destruction (Figure 1b). Based on the amount of remaining tooth structure, it was, thus, decided to restore his tooth with an endocrown fabricated with lithium disilicate, following root canal treatment. A pre-emptive shade selection was done under natural ambient light using the adjacent tooth as a reference using the 3D Master shade guide (VITA Zahnfabrik, Germany) and the shade 2L-1.5 was selected. Endodontic treatment ensued and after obturating all the canals, 2 mm of gutta-percha was removed from the coronal

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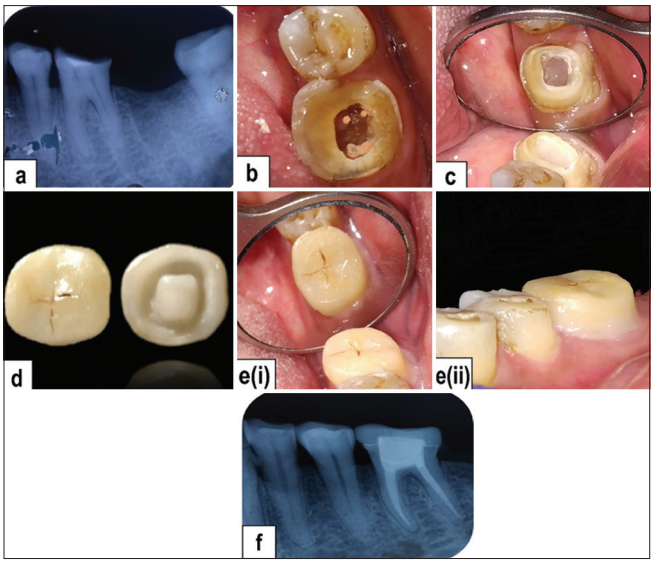

Figure 1: Procedural steps: (a) Pre-operative radiograph, (b) post-obturation clinical image, (c) tooth preparation (d) lithium disilicate endocrown (cameo and intaglio surfaces), (e) bonded endocrown restoration: i) occlusal view, and ii) buccal view, and (f) post-operative radiograph

portion of the canals and the canal entrances were lined with resin-modified glass-ionomer cement (RMGIC, GC Fuji II LC, USA). A coarse diamond point was used to prepare the central cavity with a butt-joint margin with a depth of 3 mm from the pulp chamber roof up to the cavosurface margin intra-coronally. A cylindrical-conical diamond point (TR-14, Mani. Inc, Japan) was used to prepare the occlusal surface, followed by a diamond wheel bur (WR-13, Mani. Inc, Japan) to achieve a flat surface, and ultimately a 2 mm interocclusal clearance. In addition, a ferrule of 1 mm in height was placed circumferentially. The extra-coronal finish lines were placed supra-gingivally (Figure 1c). A putty-wash impression with additional siloxane impression material was made and was sent to the laboratory for the fabrication of the restoration. Provisional restoration was made and was cemented using temporary cement. After receiving the prosthesis (Figure 1d), a try-in was done to check the proper seating of the prosthesis. Following this, the intaglio surface was etched with 10% hydrofluoric acid for 10 s and then rinsed thoroughly with water for another 20 s, and then placed in an ultrasonic bath for 2 min to remove the insoluble residual salts which form due to etching. After this, the treated surface of the prosthesis was coated with a silane coupling agent (Monobond Plus, Ivoclar Vivadent, AG) with a micro brush for 60 s, simultaneously dispersing the excess with a strong stream of air. The prepared tooth was isolated using a rubber dam and was etched with 37% phosphoric acid for 15 s, rinsed with water, and dried with a mild stream of air. Next, the dentin was conditioned with the primer (Multilink Primer A/B, Ivoclar Vivadent, AG) by scrubbing it on the prepared tooth surface for 30 s, which was polymerized by the self-cure mechanism. Following this, a thin layer of dual-cure polymerizing resin (Multilink N, Ivoclar Vivadent, AG) was applied to the prosthesis and was placed on the tooth. The prosthesis was tack cured for 5 s on all surfaces to remove the excess, while the cement is in a gel state. After this, the cement was cured on all surfaces for 60 s. Occlusion was checked and no discrepancy was noted. Figure 1e(i) and (ii) and Figure 1f show the post-operative clinical and radiographic view, respectively.

Discussion

Endodontic treatment is a common clinical procedure, which is provided to retain teeth in an irreversibly infected or necrotic pulp. Endodontic procedures involve mechanical and chemical events that may interfere with the natural stress-strain distribution in the tooth structure, making the teeth prone to failure. Thus, restoring the endodontically treated teeth as early as possible is of paramount importance. One early study by Ray *et al*. reported a provocative finding, in which the effect of the post-endodontic restoration was found to have a statistically greater effect on the radiographic success than a good root canal obturation.[9]

Full coverage restorations warrant the long-term success rate for endodontically treated posterior teeth as posterior teeth are more disposed to cuspal deflections, which if not taken care of, may lead to catastrophic coronal fractures.[10] Recent advancements in dental materials and adhesion strategies have enabled the restoration of biomechanical function of the tooth without cutting away the sides of the tooth, thus protecting the *bio-rim*. The *bio-rim* is the circumferential area of the tooth which lies beneath the maximum point of convexity. It has been suggested that if the occlusal enamel is considered as the *bio-dome,* analogous to a castle or a cathedral compression dome, then the *bio-rim* are the walls that support this dome. Retention of this *bio-rim* by placing an adhesive restoration will eventually reduce the risk of fracture and also the severity of failure when compared to a full-coverage restoration which requires preparation of all the walls until the cervical portion.[11,12] An endocrown is one such promising alternative to the conventional full crown which respects the above-mentioned principles. In addition, as the margin exists supra-gingivally, it allows for better impression making, besides protecting the periodontal tissues.[13,14] The use of ceramic in fabricating this prosthesis makes it excellently biocompatible and bio-mimetic.[8]

A survival rate of 87.1–94.6% has been reported after 55 months for molar teeth restored with this prosthesis.[5] Furthermore, Belleflamme *et al*. reported an 89.9–99.9% 10-year survival and success rate for this restoration.[15]

Adhesive dentistry has induced a paradigm shift in the preparation of the tooth to receive a restoration, thereby reducing the need for macroretentive features in the tooth preparation. The tooth preparation to receive an endocrown, thus, incorporates the natural retention that the pulpal chamber provides, especially the trapezoidal cavity shape in mandibular molars and the rhomboidal shape in the maxillary molars.[7] Moreover, the saddle form of the pulpal cavity also enhances

stability, besides facilitation of equalized stress distribution by the "cervical butt-joint" of ceramic endocrown and classical crown and observed that end crowns had greater resistance to fracture than the latter.[12,13,16] Similarly, Chang *et al*. found that end crowns were more fracture-resistant than crowns with posts.[17]

Regarding the finish line, the majority of the former studies have described endocrowns without a ferrule. Despite varying opinions, placing a ferrule has proved to give a greater fracture resistance.[18,19] However, it should be not at the expense of enamel, which would compromise adequate bonding.[20] A similar protocol was followed in the present study.

The current case report describes a case, where the endocrown was fabricated using lithium disilicate-based ceramic material and was bonded to the prepared tooth structure using resin cement. In a recent clinical trial by El-Ma'aita *et al*., they reported that endocrowns made of lithium disilicate exhibited higher retention, higher survival rate, and better patient acceptability than the ones made with zirconia.[21] A probable reason can be attributed to the elastic modulus of lithium disilicate material being comparable to human dentin which enables better occlusal load distribution and thereby reduces the chances of fracture. Another reason is that prostheses fabricated from this material can be etched which enhances microretention and thus bonds reliably.[22]

Conclusion

Preparation designs for endodontically treated teeth to receive a coronal restoration have become more conservative over the years due to improvements in adhesive dentistry. An endocrown is one such minimally-invasive prosthesis with a promising and acceptable long-time survival rate, which aims to redeem the *bio-dome* of the broken castle. However, further well-designed clinical studies with long-term assessments are required to authenticate this claim.

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