ISSN Print: 2394-7489
ISSN Online: 2394-7497
IJADS 2021; 7(3): 477-481

www.oraljournal.com
Received: 05-05-2021
Accepted: 16-06-2021

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Preservation of extensively damaged tooth with an alternative approach: A case report

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DOI: https://doi.org/10.22271/oral.2021.v7.i3g.1340

Abstract
Preservation of healthy dental structure is essential to help mechanical stabilization of tooth restoration integrity in the management of endodontically treated teeth. Biomechanical principles indicate that the structural strength of a tooth depends on the quantity and intrinsic strength of hard tissues and the integrity of the anatomic form. Also, the availability of suitable surfaces for adhesion positively influences the long-term success of the endodontically treated teeth. This case report illustrates prosthodontic restoration of grossly destructed endodontically treated mandibular molars using 2 different treatment approaches namely an endocrown restoration and a prefabricated fibre post cemented with a crown.

Keywords: Endocrown, endodontically treated teeth, post and core, fibre post

Introduction
Endodontically treated teeth often present themselves with extensive damage and gross destruction and to restore them has been a challenge for over the years [1]. As these teeth lose a significant part of tooth structure due to caries, prior restorative procedures, endodontic access cavity preparation or due to loss of moisture supplied by dentin, it leads to substantial structural weakening [2]. The endodontically treated teeth must be restored to form, function, and aesthetics. The quality of the coronal restoration which has a good seal will directly impact the survival and success of the endodontically treated teeth [3]. Many studies reported that endodontic access preparation with decreased structural integrity leads to a higher occurrence of fractures and leads to increased cuspal deflection during the function in endodontically treated teeth compared with vital teeth. Therefore, cuspal coverage of endodontically treated teeth is recommended [1]. The present case report reflects on the different types of treatment modalities for severely destructed endodontically treated teeth. The case report includes metal ceramic crown retained by post and core technique i.e. glass fibre post and newer minimally invasive full ceramic endocrown with an anchorage in the pulp chamber.

Case history
Case report 1
A 55 years old female patient reported to the Department of Prosthodontics and crown & bridge, with a chief complaint of root canal treated tooth in the lower left back region of the jaw. On clinical evaluation, it was observed that left mandibular first molar had a fixed restoration over it which was dislodged a month ago (Figure 1). Also, the crown height was approximately 4-5 mm from the cement-enamel junction. On radiographic evaluation, the obturation was noted to be satisfactory, with 3 root canals (Figure 2). Due to inadequate coronal height available, a crown lengthening procedure was included in the treatment planning. Because of limited interocclusal space with severe attrition, a lithium disilicate ceramic endocrown restoration (IPS-EMAX) was planned as the fixed prosthesis, as it would offer better aesthetics and high mechanical performance. The complete procedure was explained to the patient along with her consent. This monobloc, ceramic adhesive restoration requires specific preparation techniques to be suitable for biomechanical needs.

The preparation steps are as follows

1. An overall occlusal reduction of 2mm with a diamond wheel bur, holding it parallel to the occlusal surface was carried out.
2. The internal aspect of the tooth was prepared using a diamond tapered bur with removal of any undercuts and occlusal divergence of 6˚ was given (Figure 3).
3. The gutta percha from the four canal orifices was removed up to 2-3mm using Gates Glidden drills (no.1, 2) and widening it with Pesso reamers (no. 1) to complete the post space extension (Figure 4).
4. A deep chamfer finish line was prepared with minimal taper to create a butt joint.
5. After the tooth preparation, impression was made with polyvinyl siloxane impression material (3M ESPE) of light and putty consistency using a double mix single stage technique, recording the post space projections without any air entrapment (Figure 5, 6).
6. The impression was disinfected and endocrown was fabricated using heat pressed lithium disilicate ceramic (IPS e. Max Press/Ivoclar Vivadent).
7. The finished and polished endocrown was checked intraorally before cementation for any premature contacts. (Figure 7, 8)
8. Cementation:
   - The internal surface of the endocrown was treated in accordance with the technique recommended for lithium disilicate-based ceramics (Figure 9)
   - Application of 10% hydrofluoric acid (Angelus) on the internal surface for 20 seconds, washing with water/air for 30 seconds (Figure 10, 11)
   - Application of the silane agent (Silano- Angelus) for 1 minute (Figure 12)
   - The tooth surface was treated with an adhesive system (Single bond universal adhesive, 3M ESPE) for 15 seconds.
   - A self- etch / self- adhesive resin cement (Maxem Elite, Kerr**)** was used to cement the endocrown (figure 13, 14, 15). The cement was dispensed inside the crown and the crown was pressed onto the preparation, excess cement was removed and light cured for 60 seconds on the lingual, vestibular and occlusal surfaces.

Fig 1: pre-operative photograph

Fig 2: pre-operative radiograph

Fig 3: Radiograph after removal of the restoration

Fig 4: Radiograph after removal of 2-3 mm of gutta percha from all the canals

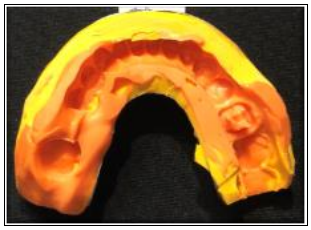

Fig 5: Polyvinyl Siloxane mandibular impression

Fig 6: Polyvinyl siloxane mandibular impression

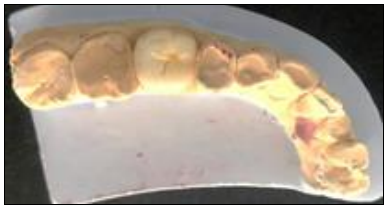

Fig 7: Lithium disilicate endocrown with 36

Fig 8: Lithium disilicate endocrown with 36

Fig 9: Cementation procedure

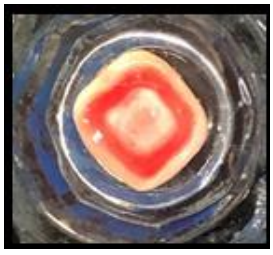

Fig 10: etching of the internal surface of the crown with 10% hydrofluoric acid

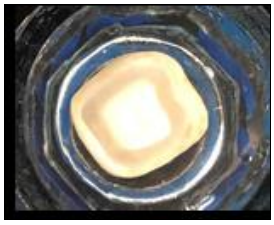

Fig 11: drying of the crown giving a frosty appearance

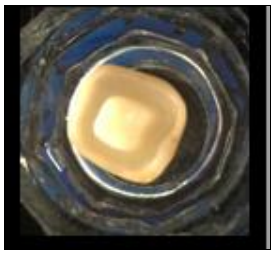

Fig 12: application of the Silane coupling agent

Fig 13: Radiograph after cementation of the endocrown with 36

Fig 14: bite in centric relation

Fig 15: Cementation of endocrown with 36

Case report 2

A male patient of 20 years old reported to the Department of Prosthodontics, with a complaint of endodontically treated tooth in the lower left back region and wanted to get it restored. On intraoral examination, gross destruction of the left mandibular first molar tooth, was noted with missing of lingual wall (Figure 16). On radiographic examination, it revealed that 4 root canals were obturated satisfactorily (Figure 17). The patient was asymptomatic and hence a treatment of Post & core was implemented. A Glass Fibre post was decided to be placed in the mesiobuccal and distobuccal root canals. The preparation of post space was done in both the root canals by leaving around 4-5 mm of gutta percha in the apical region with the use of Gates Glidden No.1, 2, Pesso Reamers No. 1, 2, 3 and a Fiber Post final drill for the corresponding Pesso Reamers No. 3 (Figure 18). After the post space preparation, the Fibre Post was checked for the fit (Figure 19, 20). The Fibre post was luted using Rely X U200 Self Adhesive Resin Cement (3M ESPE, Germany) (Figure 21) followed by core build up with Filtek Z350 XT composite resin (3M ESPE). After the core build up, tooth preparation for metal ceramic crown was done and definite shoulder finish line of 1mm width was established all around extending 0.05 mm into the gingival sulcus. Retraction procedure was carried out and a polyvinyl siloxane (3M ESPE Express XT Putty and Light body) impression was made. This was followed by temporization with Protemp™ Crown Temporization Material (3M ESPE). The shade was determined with a shade guide (VITA CLASSICAL Shade Guide). The final PFM crown was cemented with RelyX U200 Self Adhesive Resin Cement (3M ESPE, Germany) (Figure 22, 23, 24).

Fig 16: Pre-operative photograph

Fig 17: Pre-operative radiograph

Fig 18: Mesial and distal root canal post space preparation

Fig 19: Try-in of fibre post in mesial root canal

Fig 20: Try in of fibre post distal root canal

Fig 21: Cementation of fibre post

Fig 22: Post cementation

Fig 23: Intraoral photograph after cementation

Fig 24: Final cementation

Discussion

Minimally invasive preparations with maximal tissue conservation, are now considered the gold standard for restoring extensively damaged endodontically treated teeth and different treatment modalities like inlay, onlay, overlay, post and core and Richmond crown are used for restorations to achieve long term success of treatment. Fibre posts are a contemporary alternative of cast posts and pre-fabricated metal posts.

Endodontic posts have been classified into various ways such as the preformed and custom cast, metallic and non-metallic, stiff and flexible, esthetic and nonesthetic posts. They are usually required for supporting a core foundation, when there is insufficient clinical tooth structure remaining. The choice of post design must be in accordance with the biomechanical requirements of the remaining tooth structure. One of the major functions of a post and core systems are to improve the resistance to laterally directed forces by distributing them over as large area as possible [5].

Depending on developments in adhesive dentistry resin-based fiber reinforced posts have been used in the restoration of maxillary anterior teeth. Fibre resin posts show similar hardness to dentin and exhibits greater durability than the metal posts. Having an elastic modulus similar to dentin, the fibre posts strengthen the remaining tooth structure and increase the resistance to tooth fracture. Because of these advantages, fibre post was used along with composite resin in this case to restore the fractured teeth [6].

One of the main clinical advantages of the fibre reinforced post is the ability to remove them easily, without trauma. Fibre posts are not retrieved in one piece like a cast or prefabricated post, but are removed from the canal by drilling down directly through them. Quartz glass fibre posts have a lower allergenic potential, and are generally considered to be more biocompatible [5].

The use of these glass fibre posts have advantages such as better biocompatibility, more rapid treatment, aesthetics, and corrosion resistance. Moreover, it has been reported that when compared with the traditional metallic cast posts, glass fibre posts decrease the likelihood of irreparable root fractures [7].

Endocrown appears to be a valuable option for endodontically treated posterior teeth with extensive loss of coronal structure [8].

The choice of post endodontic dental restoration is based on several factors. These factors include the healthy tissue structure of the remaining teeth, the teeth location in the

mouth, and the esthetics that are important as a selection guide of adequate restorations. Endocrown is a partial crown made from ceramic material or composite resin which is cemented with resin cement to the post-endodontic teeth. This restoration is full occlusal coverage and takes advantage of the pulp chamber to increase the adhesive surface area [9].

In endocrown, the internal portion of the cavity provides macro-mechanical retention while micromechanical retention is achieved by adhesive cementation [10].

Endocrown has the advantage that, its procedures are easy and have better mechanical performance than conventional crowns, lower costs due to fewer procedure stages, less time, and good esthetics [9].

By dispensing with the use of an intra-radicular post and maintaining the seal provided by the endodontic filling material, an endocrown allows minimal tooth preparation, and thus strengthens the tooth, since it helps preserve sound dental tissue and root canal structures. The limitation for performing this procedure may be restricted to the ceramic material, which must be an acid etchable ceramic in order to obtain the bond to tooth preparation by means of an adhesive cementation system, and, consequently, ensure stability of the crown in the preparation. Pressed or machined ceramics, especially those reinforced with lithium disilicate, appear to be the best option. The lithium disilicate ceramic used to make the restorations have high mechanical strength and provides restorations with an aesthetic appearance very similar to that of tooth enamel [11].

In the present case report, post and core restored mandibular molar and a lithium disilicate ceramic endocrown were prepared on endodontically treated mandibular molar. This was aesthetically competent. The assessment for post and core restoration included, two to three remaining walls showing gross destruction and for that of endocrown, it included, the remaining wall tissue structure that must be healthy with no crack lines, a minimum thickness of 1 mm. Also, involvement of the biological width must be minimal.

In comparison to the post and core restorations, bonding surface offered by the pulpal chamber of the endocrown was equal or even superior to that obtained from the bonding of a radicular post of 8 mm depth [12]. Therefore, from the clinical results obtained, it may be concluded that restorations of the endocrown type are restorative options for endodontically treated molar teeth with extensive loss of coronal structure. They are able to replace conventional crowns supported on posts and composite resin cores and provide advantages in terms of mechanical performance, cost, and clinical time [1].

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