

Restorative Management of Mutilated Molar Teeth with Pulpal Floor Perforation Using Endocrowns: A Clinical Case with One Year Follow-Up

Ghaida Teffeha^{1*}, Lylia Khamessi¹, Hanen Boukhris¹, Adel Amor², Nabih Douki²

¹DDM, Department of Fixed Prosthodontics, Faculty of dental medicine, University of Monastir, Tunisia

²Professor, Department of Fixed Prosthodontics, Faculty of dental medicine, University of Monastir, Tunisia

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*Corresponding author: Teffeha Ghaida

Abstract

Case Report

The restoration process of damaged posterior teeth which had suffered from a perforation of the pulp chamber floor can be a puzzling and frustrating treatment. It requires an extensive knowledge about the restorative materials and techniques. Several options are currently available to address the challenges of restoring posterior teeth. Besides restoring function, dental practitioners need also to consider esthetics and morphology for a successful treatment. Considering the new esthetic approach, we had to resort to the use of endocrowns. The present case report is describing a step by step protocol of the preparation process and the bonding of an endocrown, which is an esthetic and conservative option to restore a compromised first upper molar with a pulpal floor perforation. A one year follow up of the case has shown a successful outcome. However, the success of a clinical procedure involves establishing the entire treatment protocol appropriately, ensuring that each step is done adequately with respect to the recommendations.

Keywords: Posterior teeth; pulp chamber perforations; Endodontically treated teeth; Endocrown; ceramics.

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INTRODUCTION

The restoration of endodontically treated teeth has been, for long, a challenging procedure for dentists. In fact, these teeth are often severely damaged and the retention and the resistance of full coverage crowns can be compromised [1].

The use of an intracanal retainer may be in this case inevitable, whether we use a metal post or a fiber post retained crown. Fortunately, the evolution of dental ceramics, CAD/CAM systems, and bonding materials have made it possible to spare root canals and perform esthetic restorations with an optimal biocompatibility and high mechanical properties allowing a safe use of endocrowns for posterior teeth [2].

The endocrown, a monolithic adhesive restoration, is proposed as an alternative to the full post-and-core supported crowns, of non-vital posterior teeth, especially those with minimal crown height but sufficient tissue available for stable and durable adhesive cementation [3].

It has the advantage of preserving root tissue, keeping internal preparation of the pulp chamber to its anatomic shape and reduces the number of interfaces in the restorative system [4]. Therefore, this bonded reconstruction is minimally invasive for root canals [5].

In order to ensure the success and longevity of the endocrown, we have to respect the indications of such restorations, it also requires knowledge of the clinical procedures and adhesive protocol [3].

In the present paper, we present an original case describing an aesthetic and conservative posterior endocrown restoration of a compromised first upper molar with a pulpal floor perforation.

CASE PRESENTATION

Diagnosis

A 32-year-old systemically healthy, non-smoker female patient presented herself at the Department of Dentistry, in "Sahloul" Hospital, Sousse, Tunisia with complaints regarding pain related to the left-side maxillary first upper molar (#26) and food impaction between the (#26) and the (#25) (Figure-1).

Clinical examinations were performed, and a previous provisional restoration was identified. The tooth was tender to percussion.

Initially, we suspected an interdental septum syndrome related to the #26 and the #25

However, radiographic examination revealed a radiolucency in the inter-radicular furcation area, despite the fact that the tooth was endodontically treated and it seemed to be a satisfying treatment.

After carefully removing the provisional restoration, a close examination of the tooth under operating dental microscope revealed an iatrogenic pulpal floor perforation.

Based on this finding, the severely damaged tooth was considered compromised, both conservative and radical treatment options were discussed with the patient from extraction to saving the remaining tooth structure. Patient refused the extraction and was interested in a more conservative approach.

The patient's case was promising, since she presented a favorable occlusion and a good oral hygiene.

Finally, after the patient's consent, we decided to address the challenge of managing the iatrogenic pulpal floor perforation and restoring the 26 with a minimally invasive restoration for root canals.

Clinical Procedure

First Visit

After removing the provisional restoration and realizing that the pulpal floor presented an iatrogenic perforation, we faced a compromised and weakened tooth structure.

After performing the endodontic retreatment, the pulp chamber was covered with Biodentine® to maintain the integrity of the pulpal floor under rubber dam isolation (Figure-2).

An endocrown restoration was recommended due to the amount of remaining tooth structure. In order to realize this endocrown, we had to make sure that the perforation management procedure is a success and wait until no clinical symptomatology is observed.

Second Visit

After 3 months, a clinical and a radiographic control was performed. We decided, then, to proceed with the preparation. We had to keep the pulpal floor and the canal entrances sealed with Biodentine® to maintain the integrity of the pulpal floor during preparation (Figure-3).

The preparation consisted of an occlusal preparation, achieving an overall occlusal reduction of at least 2 mm. The cervical margin was in the form of a butt joint using a wheel bur that was held parallel to the occlusal plane. For the axial preparation, we used a cylindro-conical drill to make the coronal pulp chamber continuous with the access cavity.

We managed to have a central retention cavity into the pulp chamber constructing the crown and the core as a single unit.

We made a complete arch impression with an additional silicone impression material, which was transferred to the laboratory to be casted. A provisional endocrown was made by "isomoulage" technique using autopolymerized resin (Texton: SS White, Ce 0473, Prima Dental Group, England) and cemented with eugenol-free temporary cement (Temp Bond: Type I Class 1Ce 0086, Kerr, Italy).

Third Visit

We received the endocrown fabricated using CAD/CAM (all-ceramic material IPS Empress) (Figure-4).

A lithium-disilicate block was chosen because of its sufficient fracture resistance value and above all, its ability to be itched for a successful bonding procedure. The use of a rubber dam was necessary for a secure bonding (Figure-5).

We used "Variolink esthetic®" which is an esthetic light and dual curing luting composite. It was important to respect manufacturer's recommendations. The final restoration is shown in Figure-6.



Fig-1: Initial clinical and radiographic examination



Fig-2: The pulp chamber was covered with Biodentine to maintain the integrity of the pulpal floor

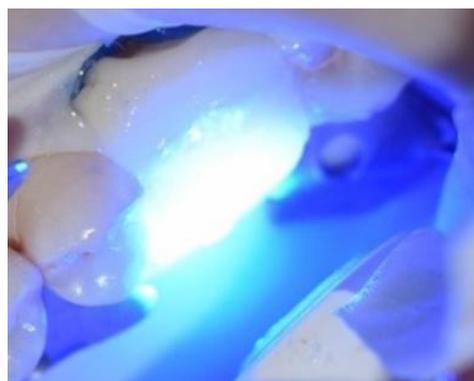


Fig-5: Bonding procedure



Fig-3: Axial and occlusal preparation



Fig-6: Final aspect after bonding

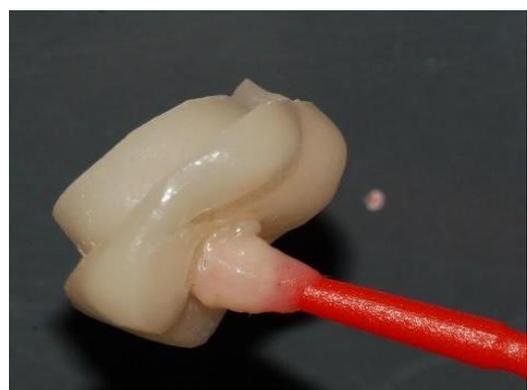


Fig-4: Endocrowns made of lithium disilicate ceramic

DISCUSSION

Perforation Repair

Root perforations can occur pathologically as a result of resorption and caries or due to iatrogenic reasons during root canal treatment [6].

Accidental root or pulp chamber perforations are a common complication that may occur during endodontic treatment while realizing access cavities or during post-space preparation [7, 8].

The perforation compromises the integrity of the root and creates the potential for an inflammatory reaction in the periodontium [9, 10].

Classification

Table-1: Classification of root perforations, proposed by Fuss & Trope [11]

	Level of perforation	Prognosis
Coronal perforation	Coronal to the level of crestal bone and epithelial attachment with minimal damage to the supporting tissues and easy access	Good Prognosis.
Crestal perforation	At the level of the epithelial attachment into the crestal bone	Questionable Prognosis.
Apical perforation	Apical to the crestal bone and the epithelial attachment	Good Prognosis.

In multi-rooted teeth where the furcation is perforated, the prognosis differs according to the factors described for single-rooted teeth. Accidental root perforations do occur in approximately 2–12% of endodontically treated teeth that might have serious implications [12, 13].

There are other factors determining the prognosis including the size and the location of the perforation, and the duration of exposure. The only factor that is under control of the operator is the choice of the material used to repair the perforation (Table-1) [14].

In order to repair such defects, several surgical and non-surgical approaches may be considered. Different materials may be used such as: Zinc oxide eugenol, IRM (Intermediate Restorative Material), Glass Ionomer Cement, Calcium Phosphate Cement, MTA, Biodentine[®], Endosequence, Bioaggregate, and New Endodontic Cement [14].

In this case, we chose to use Biodentine which is a calcium silicate-based bioactive material. It is a powder/-liquid system. The powder is composed of Tri-calcium silicate, Di- calcium silicate, Calcium carbonate, oxide, Iron oxide, and Zirconium oxide. The liquid consists of Calcium chloride and Hydro soluble polymer. It is easy to handle owing to its ease of manipulation and a short setting time of approximately 12 minutes. It has high alkaline pH and it is a biocompatible material which makes it a favorable for perforation repairs [15, 16].

Guneser *et al.*, showed in a study that Biodentine has considerable performance as a perforation repair material even after being exposed to various endodontic irrigation methods compared to MTA [17].

Prosthetic Reconstruction

A successful treatment of a decayed and compromised teeth with pulpal disease is ensured, not only by a good endodontic treatment, but also by a proper post-endodontic, prosthetic reconstruction of the tooth [18].

Proper restoration of endodontically treated teeth requires a strong knowledge of the endodontic, periodontal, restorative, and occlusal principles [19].

Oftentimes, we come across teeth that have lost their coronal structure extensively, as it is the case above, due to caries or previous restoration or the endodontic treatment itself. This loss of tooth structure may compromise the integrity and the retention of the restoration increasing the likelihood of fracture during function. In order to restore these teeth, crown lengthening can be done either surgically or by orthodontic extrusion to get the ferrule effect [18].

It is possible then to make cast metal restorations with the aid of posts for retention.

Although metallic posts have been used over the years, they resulted in unacceptable coloration, extreme rigidity and corrosion. That's the reason fiber posts were introduced offering better flexibility, as they have modulus of elasticity comparable with dentin and were aesthetically pleasing [20].

However, several studies have shown that whether we use a metal or a fiber post to retain the

crown, stress development in root canal is inevitable, leading eventually to fractures [10].

Fortunately, nowadays there is a shift from classical approach to a minimally invasive approach. The introduction of bonded dentistry is further revolutionized by the evolution of esthetic dental ceramics, which are increasingly advancing, and made it possible to preserve existing tooth structure while restoring esthetics and function [21].

Ceramic endocrowns properly cemented in molars have a low risk of being fractured or loosen during normal masticatory load [22].

Therefore, the endocrown presents as an excellent option rather than full crown followed by post and core, especially in the case discussed above, where the tooth with the pulpal floor perforation was severely damaged. The endocrown make it possible to offer both excellent esthetics, and mechanical strength with no invasion of the root canal [23].

The Preparation Design

The preparation design of the endocrown is more conservative than the traditional crown, it maintains the biologic width and is less damaging to periodontium [24].

Our purpose is to achieve minimally invasive preparations with maximal tissue conservation for restoring endodontically treated teeth. This will help to mechanically stabilize the tooth-restoration complex and increase the surfaces available for adhesion.

The cervical margin can be either in the form of a butt joint as an occlusal reduction with no peripheral preparation or a peripheral preparation with a shoulder finish line. Commonly, the clinical situation dictates the choice of one of the two options.

Either way, a preparation of a central retention cavity in the pulp chamber is mandatory with no extension to root canals. Given the exceptional circumstances in this case, where we faced a compromised and weakened tooth structure after realizing the iatrogenic perforation, we had to keep the pulpal floor and the canal entrances sealed with Biodentine[®].

Nevertheless, the preparation of the pulp chamber was performed, the cavity design guidelines by Pissis were used. The preparations were done to allow for an intracoronal extension of 2 mm.

The intracoronal preparation of pulp chamber offers a bonding surface which is often equal or even superior to that obtained from the bonding of a radicular post of 8 mm depth. It also makes the application and

polymerization of luting resin cement better controlled [24].

Longevity and Effectiveness

The Monoblock concept offers reduced number of interfaces in the restorative system, and so less stress concentration [24].

Endocrowns represent a very promising treatment alternative for endodontically treated molars. In 2012, Biacchi and Basting compared the fracture strength of 2 types of full ceramic crowns: indirect conventional crowns retained by glass fiber posts and endocrowns. They concluded that endocrowns were more resistant to compressive forces than conventional crowns [25].

Nevertheless, this conservative approach can be subject to failure, tooth fracture is one of the main complications we can face, due to the occlusal stresses that occur during function and are transmitted to the walls of the pulp chamber [9].

The fracture resistance of three different endocrowns made of lithium disilicate ceramic and two different indirect resin composites (Solidex® composite and Gradia® composite) was compared by Altier *et al.*, They came to conclude that lithium disilicate ceramic endocrowns exhibited higher fracture strength than the indirect composite groups [26].

Indications and Contraindications

The endocrown is suitable for all molars, particularly those with clinically low crowns, calcified root canals or very slender roots. The endocrown is contraindicated if adhesion cannot be assured if the pulpal chamber is less than 3 mm deep or if the cervical margin is less than 2 mm wide for most of its circumference [25].

CONCLUSION

When a posterior tooth is compromised, because of iatrogenic pulp chamber perforation, ceramic endocrowns offer advantages over metal post or a fiber post retained crown. They offer an aesthetic long-lasting alternative with a predictable degree of clinical success. However, long-term follow up and longitudinal clinical studies are needed to ensure their overall success.

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Conflict of Interest: The authors declare that there is no conflict of interest regarding the publication of this paper.

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