Scholars Journal of Medical Case Reports
Abbreviated Key Title: Sch J Med Case Rep
ISSN 2347-9507 (Print) | ISSN 2347-6559 (Online)
Journal homepage: https://saspublishers.com

OPEN ACCESS

Prosthodontics

Conservative Management of Extensively Damaged Endodontically Treated Tooth using Ceramic Endocrown and Deep Margin Elevation: A Clinical Report

Bouthaina Mahjoubi[1*], Sarra Nasri[2, 4], Zohra Nouira[3, 4], Belhassen Harzallah[3, 4], Mounir Chérif[3, 4]

[1]Prosthodontist
[2]Assistant Professor, Department of Fixed Prosthodontics, Faculty of Dental Medicine, University of Monastir, Tunisia
[3]Professor, Department of Fixed Prosthodontics, Dental Faculty of Monastir, University of Monastir, Tunisia
[4]Research Laboratory of Occlusodontics and Ceramic Prosthesis LR16ES15

DOI: 10.36347/sjmcr.2023.v11i05.040 | **Received:** 07.04.2023 | **Accepted:** 10.05.2023 | **Published:** 13.05.2023

***Corresponding author:** Bouthaina Mahjoubi
Prosthodontist

Abstract **Case Report**

***Introduction*:** The restoration of endodontically treated molar continued to be a challenging issue. After endodontic treatment, generally the tooth is exposed to a higher risk of fracture. Endocrown as a minimal invasive restoration could be a wise alternative for restoring molars with large coronal destruction and limited interocclusal space. ***Observation*:** Through this work, we present a clinical case report of an endocrown-type restoration, fabricated from lithium disilicate ceramic (IPS e.Max CAD) in a maxillary first molar with extensive coronal destruction associated to cervical margin relocation. ***Discussion*:** We discuss the indication and use of endocrown to replace single crowns with intraradicular retention. The supragingival margins of the endocrown preparation simplify rubber dam isolation, and the adhesive procedure that's why deep marginal elevation in this case was performed.

Keywords: Molar, endocrown, deep margin elevation, all ceramic.

INTRODUCTION

The restoration of endodontically treated tooth (ETT) still remains a controversial topic because it's more susceptible to fracture as a result of a modification in the mechanical properties and the loss of tooth structure during endodontic treatment such as the loss of marginal ridge integrity which is considered among the factors contributing to the weakness of tooth [1]. Tooth pulp extirpation is associated to the dehydration of the tooth, the increase in modulus of elasticity and diminishing of fracture resistance [2]. Therefore, the prosthetic treatment aims to protect the amount of residual tissue from fracture to ensure the longevity of both the restoration and the devitalized teeth.

The restorative approach regarding ETT has changed in recent years with the development of adhesive dentistry reducing the need to posts and cores to restore the coronal tissue loss. These restorative procedures couldn't be possible without the evolution of reinforced ceramics (such as leucite and lithium disilicate-based ceramics), and dental adhesive systems [3].

Pissis, in 1995, described for the first time the ceramic monoblock technique for teeth with extensive loss of coronal structure, in which the retention of the restoration lies on the use of adhesive cementation and macro mechanical retention in canal entrance [4]. Then, Bindl and Mormann introduced the term "Endocrown" to describe a mono-block ceramic crown bonded to a depulped posterior tooth [5].

Endocrown can be used as a better alternative to post-retained restorations in molars in situations of excessive loss of coronal dental tissue and limited interocclusal space, in which it is not possible to attain adequate thickness of the ceramic covering on the metal or ceramic substructures. It reduces failures related to post placement which cause weakening of the roots, in addition to the perforation risk during the preparation of the post space [6, 7]. Endocrown machined using computer-aided design and computer-aided manufacture to ensure a precise marginal adaptation in less time.

However, in some cases, the infra-gingival situation of the limits of preparation, at the level of the

sulcus or of the supra-crestal attachment (biological space) is a frequent difficulty met. This complicates isolation by means of rubber dam and the bonding of indirect restorations with subgingival margins [8]. One of the most conservative approach to relocate the margin coronally is to apply a material such as composite resin over the pre-existing cervical margin, the so- called "deep margin elevation" (DME) technique.

The goal of this paper is to present a clinical case, in which an aesthetic and conservative posterior endocrown was used to restore an endodontically treated maxillary molar that presented extensive coronal destruction. We will discuss through this work the indication and the use of endocrown in combination with a deep marginal elevation method.

CASE DESCRIPTION

A 25-year-old female was referred to the department of fixed prosthodontics at the Faculty of dental medicine of Monastir for treatment of tooth #26 which suffered from major coronal destruction and needed to be restored.

The medical history was non-contributory. At the first clinical examination, an extensive glass ionomer cement restoration of a non-vital tooth (26) was identified (fig 1). The tooth was treated endodontically. After removing the coronal restoration (fig 2), we noticed an important loss of tooth structure. The pulp chamber was wide and deep enough. Gingival tissue was inflamed in the distal region, but there was preserved biologic space. Besides, we observed a reduced interocclusal space. The prosthetic decision was to restore tooth (26) with an endocrown fabricated from lithium disilicate ceramic (IPS e.Max CAD).

Fig. 1: Clinical condition of tooth #46 with extensive glass ionomer cement restoration

Fig. 2: The molar after removal of the restoration

The preparation for the endocrown is different from the conventional full coverage crown: A minimum of 2 mm occlusal height reduction should be achieved. Then, the Preparation of the cervical margin or

"cervical sidewalk" using a wheel bur held parallel to the occlusal plane. Differences in levels between the various parts of the cervical margin should be linked by a slope 60° to escape a staircase effect. The cervical margin should be supragingival; in this case, it was necessary to perform a deep margin elevation (DME) in the distal region of the tooth to relocate the cervical margin in a supragingival position to make easier the adhesive procedure. It consists in applying an increment of composite resin over the pre-existing cervical margin to relocate it coronally. It was shown that this technique increases tensile strength and therefore the adhesion of the prosthetic part, since a good interaction exists between the composite and the adhesive restoration [9].

DME should be applied with caution respecting three criteria: capability of field isolation (fig 3), the perfect seal of the cervical margin provided by the matrix (fig 4, 5), and no invasion of the connective compartment of biological width.

Fig. 3: rubber dam isolation to perform deep marginal elevation

Fig. 4: Application of acid etching

Fig. 5: Application of flowable composite or Nano hybrid composite resin after the application of extended sectional matrix

After DME, we used a cylindrical-conical diamond bur with a total occlusal convergence of 7° to create continuity between the coronal pulp chamber and endodontic access cavity, without touching the pulpal floor. Removing too much tissue from the pulp chamber walls will reduce their thickness and the width strip of enamel. The depth of the cavity must be at least 3mm (fig. 6).

Fig. 6: Preparation for endocrown was made

Conventional impression was made using a 2-stage putty and washes addition-reaction silicone (Elite HD+ (putty and light body), Zhermack) (fig 7). Preparation was provisionalized using Acrylic Resin Block Technique (fig 8 a, b).

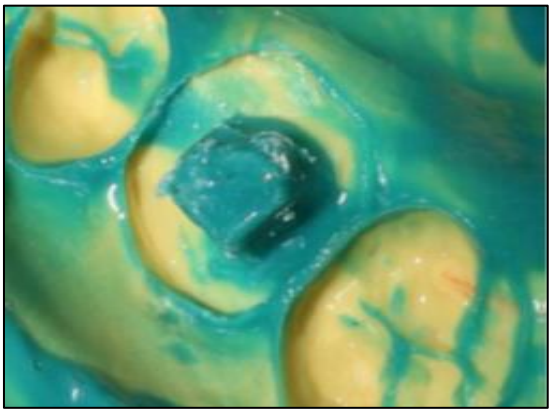

Fig. 7: Impression

a b

Fig. 8: Provisional restoration using acrylic resin block technique

On insertion day, the restoration (fig. 9) was tried-in to check marginal and interproximal fit, shade and occlusion.

After trying in the restoration, its surface should be treated following this protocol:

- Etched with 9.0% hydrofluoric acid (Ultradent) for 20 sec, rinsed with water (Fig 10.a),
- Etched with phosphoric acid (Ultra-Etch, Ultradent) for one minute as an additional surface cleaning procedure, rinsed with water.

- Cleaned, dried with an air spray and coated with a silane-coupling agent (Monobond S, Ivoclar) (Fig 10.b).

Fig. 9: Endocrown frabicated from IPS emax Cad

a b

Fig. 10: Endocrown Surface treatment, a) Etched with 9.0% hydrofluoric acid, b) Coated with a silane-coupling agent

Then, tooth-surface treatment was done under rubber dam isolation. Selective enamel etching was performed using 37.5%phosphoric acid (Meta etchant, META Biomed) for 20 s then rinsed. A layer of universal adhesive (Tetric N Bond universel, Ivoclar Vivadent) was then applied to the whole fitting surface of the tooth, actively rubbed on the surface for 20 s, gently air-thinned to avoid excess of adhesive, then light cured for 20 s.

Dual-cured resin cement (Variolink, Ivoclar Vivadent) was then applied to the intaglio surface of the restoration. The endocrown was then inserted and the excess cement removed following an initial light curing for 1– 2 s. Light curing for 40 s was then carried out for each surface. The margins were then covered with a layer of glycerine gel (Liquid strip, Ivoclar Vivadent) and light curing was performed for 10 s to minimize the oxygen inhibition layer (Fig. 11).

Fig. 11: Final aspect after cementation

DISCUSSION

The rehabilitation of the endodontically treated tooth (ETT) has been always a debate topic, no restoration consensus is admitted and the choice of restorations is most often a dependent practitioner.

Full crowns and partial coverage onlays have been always the gold standard to restore aesthetically and functionally the damaged endodontically treated posterior teeth. The endocrown is another form of adhesive indirect restoration that incorporates the core and cuspal coverage as one unit, which is bonded to the remaining tooth structure to avoid the use of posts and cores build up [10, 11]. This minimally invasive treatment strategy presents several advantages in comparison with the classical post and core approach:

(1) Tooth tissue preservation;
(2) Reduced risk of catastrophic failures such as root fractures, root perforation and contamination of the endodontic system and failures related to the amount of adhesive interfaces to create;
(3) No need of sufficient interocclusal space and several appointments, and decreased cost [12].

Since the retention of the endocrown is ensured essentially by the bonding, it is crucial to use prosthetic materials, which can be resin bonded to tooth tissues. Clinical studies about endocrowns usually refer to glass-ceramic materials, particularly feldspathic ceramic, fabricated with a computer-aided design and manufacturing (CAD/CAM) process [13].

In Fact, Lithium disilicate ceramic have favourable physical properties, good aesthetics, and they are etchable ceramics, which can be effectively bonded to resin cement and tooth structure. However, when milled from ingots, it requires an additional step of crystallization which could increase marginal gaps. This additional step is also time consuming and could be considered a disadvantage to the material [14, 15].

Hybrid ceramics are a new category of ceramics with a dual ceramic-polymer network that incorporates the benefits of ceramic and composite materials offering strength, flexibility, crack prevention properties and a superior abrasion behaviour. They can be bonded to the tooth immediately after their milling which is an advantage over other materials [16].

Currently, indirect ceramic restorations are a satisfactory clinical alternative to restore damaged posterior teeth. Unfortunately, bonding of indirect restorations needs to be well executed under a dry working field which is a key point for the clinical outcome of these restorations, which makes it difficult to insert them directly to the dentin in deep proximal boxes with a tissue loss that could extend beyond the cemento-enamel junction (CEJ) [17]. This complicates isolation by means of rubberdam and the luting of extensive indirect restorations with subgingival margins [8].

To solve this problem, many approaches can be indicated: in fact, the surgical crown lengthening procedure is the most invasive one and it can lead to the destruction of the biological width, if it's not well planned and conducted [18]. However, this treatment is not always desired by the patient that's why forced orthodontic eruption may be an aesthetic and minimal invasive alternative, but it's a time consuming when he patient is pressed to restore his tooth [19].

A less invasive, practical alternative approach is to perform a deep margin elevation (DME), a concept proposed already over 25 years ago. DME relocates the cervical margin of a subgingival preparation supragingivally, using a resin composite material. Subsequently, indirect ceramic or composite restorations could be luted in an isolated workfield using rubberdam [20].

In some cases of subgingival margin, we can place rubber dam to isolate the operative field with no need to perform DME, but it will be difficult to the laboratory technician to achieve the proximal emergence profile easily. The aim of performing DME is to facilitate impression; the fabrication of the restoration with supragingival margin, the bonding procedure and even the elimination of excess of luting composite is much easier [21].

Bresser and al through a-vitro study, demonstrated that there's no significant difference was found between the fracture strength of groups restored with and without DME, independently of the used material [22].

The choice of the material for DME is still a debate issue. A study by Roggendorf, M. J. *et al.*, showed that a meticulous application of hybrid composite layers is the best way to prevent the formation of gaps. On the other hand, Dietschi *et al.*, noted that flowable composites, which are materials with an intermediate modulus of elasticity, having more favorable marginal adaptation compared to packaging composites. Due to the low viscosity, the flowables are easily applied to deep proximal areas, resulting in fewer voids, and perfectly wet the bonding surface, which makes them favorable for use in DME. On the contrary, there are studies showing that high-filled composites have an advantage due to their lower contraction stress during polymerization and higher resistance to deformation under load [8, 23].

Rocca *et al.*, found that that the type of composite did not have a significant influence on the marginal adaption. A study by Frankenberger *et al.*, reported that the marginal quality to dentine was

influenced to a greater extent by a meticulous layering technique, but not the type of material [24].

Other materials used for DME include resin modified glass ionomer cement (RMGIC). However, RMGIC lacks sufficient strength to withstand masticatory forces and have inferior mechanical properties as compared to contemporary composite resin materials [25].

Deep margin elevation is an innovative technique, reduces tissue impact related to surgical crown lengthening, making it a worthy alternative of interest. Further clinical studies to determine the long term performance of this treatment approach should be encouraged.

CONCLUSION

The endocrown appears more and more as a restoration of choice for damaged endodontically treated molars by preserving as much of the remaining tooth as possible. Its indication is linked to the evolution of properties of ceramic materials, hybrids and polymers but also bonding materials. The association of indirect restorations with DME have a good survival rate, however longer follow-up is needed as degradation of the restorations is seen over time.

DECLARATION OF CONFLICTING INTERESTS

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

FUNDING

The author(s) received no financial support for the research, authorship, and/or publication of this article.

REFERENCES

1. Reeh, E. S., Messer, H. H., & Douglas, W. H. (1989). Reduction in tooth stiffness as a result of endodontic and restorative procedures. *Journal of endodontics*, *15*(11), 512-516.
2. Linn, J., & Messer, H. H. (1994). Effect of restorative procedures on the strength of endodontically treated molars. *J Endod*, *20*, 479-485.
3. Biacchi, G. R., Mello, B., & Basting, R. T. (2013). The endocrown: an alternative approach for restoring extensively damaged molars. *J Esthet Restor Dent.*, *25*(6), 383-90.
4. Pissis, P. (1995). Fabrication of a metal-free ceramic restoration utilizing the monobloc technique. *Pract Periodontics Aesthet Dent*, *7*, 83–94. In 1999.
5. Bindl, A., & Mörmann, W. H. (1999). Clinical evaluation of adhesively placed Cerec endocrowns after 2 years—preliminary results. *J Adhes Dent*, *1*, 255–65.
6. Ferrari, M., Vichi, A., & Grandini, S. (2001). Efficacy of different adhesive techniques on bonding to root canal walls: an SEM investigation. *Dent Mater*, *17*, 422-429.
7. Veselinović, V., Todorović, A., Lisjak, D., & Lazić, V. (2008). Restoring endodontically treated teeth with all-ceramic endo-crowns: case report. *Stomatološki glasnik Srbije*, *55*(1), 54-64.
8. Dietschi, D., Olsburgh, S., Krejci, I., & Davidson, C. (2003). In vitro evaluation of marginal and internal adaptation after occlusal stressing of indirect class II composite restorations with different resinous bases. *Eur. J. Oral Sci. 111*, 73-80.
9. Panadan, J. J., Sharma, R., & Negi, Y. (2022). Deep Margin Elevation Technique: A Substitute to Surgical Crown Lengthening: A Case Report. *Ozone Dental Journal*, *4*(3), 33-7.
10. Gupta, R., Thakur, S., Pandey, N. K., Roopa, B., & Fares, K. T. (2021). Endocrown - A Paradigm Shift in Rehabilitation: A Report of Two Cases. *Contemp Clin Dent*, *12*(2), 195-198.
11. Al-Dabbagh, R. A. (2021). Survival and success of endocrowns: A systematic review and meta-analysis. *J Prosthet Dent*, *125*, 415.e411-415.e419.
12. Belleflamme, M. M., Geerts, S. O., Louwette, M. M., Grenade, C. F., Vanheusden, A. J., & Mainjot, A. K. (2017). No post-no core approach to restore severely damaged posterior teeth: An up to 10-year retrospective study of documented endocrown cases. *Journal of Dentistry*, *63*, 1-7.
13. Otto, T., & Mormann, W. H. (2015). Clinical performance of chairside CAD/CAM feldspathic ceramic posterior shoulder crowns and endocrowns up to 12 years. *International journal of computerized dentistry*, *18*(2), 147-61.
14. Pieger, S., Salman, A., & Bidra, A. S. (2014). Clinical outcomes of lithium disilicate single crowns and partial fixed dental prostheses: a systematic review. *J Prosthet Dent*, *112*, 22-30.
15. Gold, S. A., Ferracane, J. L., & da Costa, J. (2018). Effect of Crystallization Firing on Marginal Gap of CAD/CAM Fabricated Lithium Disilicate Crowns. *J Prosthodont*, *27*, 63-66.
16. Swain, M. V., Coldea, A., Bilkhair, A., & Guess, P. C. (2016). Interpenetrating network ceramic-resin composite dental restorative materials. *Dental Materials*, *32*(1), 34-42.
17. Da Silva Gonçalves, D., Cura, M., Ceballos, L., & Fuentes, M. V. (2017). Influence of proximal box elevation on bond strength of composite inlays. *Clinical oral investigations*, *21*, 247-254.
18. Magne, P., & Spreafico, R. C. (2012). Deep margin elevation: a paradigm shift. *Am J Esthet Dent*, *2*(2), 86-96.
19. Antônio Felippe, L., Monteiro Jr, S., Cardoso Vieira, L. C., & Araujo, E. (2003). Reestablishing

biologic width with forced eruption. *Quintessence international*, *34*(10), 733-738.

20. Ferrari, M., Koken, S., Grandini, S., Cagidiaco, E. F., Joda, T., & Discepoli, N. (2018). Influence of cervical margin relocation (CMR) on periodontal health: 12-month results of a controlled trial. *Journal of dentistry*, *69*, 70-76.
21. Bresser, R. A., Gerdolle, D., Van den Heijkant, I. A., Sluiter-Pouwels, L. M. A., Cune, M. S., & Gresnigt, M. M. M. (2019). Up to 12 years clinical evaluation of 197 partial indirect restorations with deep margin elevation in the posterior region. *Journal of dentistry*, *91*, 103227.
22. Bresser, R. A., van de Geer, L., Gerdolle, D., Schepke, U., Cune, M. S., & Gresnigt, M. M. M. (2020). Influence of Deep Margin Elevation and preparation design on the fracture strength of indirectly restored molars. *Journal of the mechanical behavior of biomedical materials*, *110*, 103950.
23. Khabadze, Z. S., Bagdasarova, I. V., Shilyaeva, E. S., Kotelnikova, A. P., Nazarova, D. A., Bakayev, Y. A., & Abdulkerimova, S. M. (2021). Deep margin elevation: a systematic review. *Эндодонтия Today*, *19*(3), 175-183.
24. Rocca, G. T., Gregor, L., Sandoval, M. J., Krejci, I., & Dietschi, D. (2012). In vitro evaluation of marginal and internal adaptation after occlusal stressing of indirect class II composite restorations with different resinous bases and interface treatments.“Post-fatigue adaptation of indirect composite restorations”. *Clinical oral investigations*, *16*, 1385-1393.
25. Furtado, S., Hegde, V., & Fanibunda, U. (2021). Deep margin elevation: Raising the bar in adhesive restorations-A case series. *International Journal of Applied Dental Sciences*, *7*(3), 387-392.