ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 2, Issue – 6, November - December - 2019, Page No. : 211 - 216

Endocrown in molars: an Overview

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Type of Publication: Review Paper

Conflicts of Interest: Nil

Abstract

The restoration of extensively damaged endodontically treated teeth remains a challenge. Their biomechanical deterioration impacts the tooth's long-term prognosis. Endocrown is an adhesive restoration with minimally invasive preparation.[1,2] This monolithic, ceramic adhesive restoration requires specific preparation techniques to satisfy criteria that are primarily biomechanical in nature: a cervical margin in the form of a butt joint and a preparation of the pulp chamber that does not extend into the root canals. The remaining tooth substance is thus more robust, resulting in increased longevity. The present review emphasizes on this simple and efficient concept which is compatible with the philosophy of biointegrated prostheses. This type of reconstruction, which is still uncommon, should be more widely known and used..[3]

Keywords: endocrown, pulp chamber, monolithic, butt joint, endodontically treated teeth

Introduction

Restoration of endodontically treated teeth with large coronal destruction is still a clinical challenge, especially due to the loss of strength characteristics associated to the removal of pulp and surrounding dentin tissues.[3] Coronal retention of the restoration is usually compromised, thus intraradicular posts combined or not with core materials may be required. [4,5]

The true breakthrough in the restoration of endodontically treated teeth was the introduction of adhesion, propelled by the development of effective dentin adhesives.[7] The chief advantage of adhesive restorations is that macroretentive elements are no longer mandatary as long as enough surface is available. With this approach, the insertion of radicular posts has become the exception rather than the rule when applying conventional restorative techniques. In fact, minimally invasive preparations, with maximal tissue conservation, are now considered 'the gold standard' for restoring ETT.[4] Pissis was the forerunner of the endocrown technique and has described it as the 'mono-block porcelain technique'.[8] In 1999, the endocrown was described for the first time by Bindle and Mörmann as adhesive endodontic crowns and characterized as total porcelain crowns fixed to endodontically treated posterior teeth.[9] These crowns would be anchored to the internal portion of the pulp chamber and on the cavity margins, so macromechanical retention is provided by the pulpal walls, and micromechanical retention is obtained by the use of adhesive cementation.[6]

Discussion

Preparation designs for Endocrown

The main purpose for the use of Endocrowns is to attain an all-ceramic bonded restoration that is minimally invasive of root canals. Therefore, the Endocrown preparation is different from the conventional full coverage crowns. Several studies described the endocrown preparation following Bindl and Mormann technique. While few studies described some modifications to the original preparation.

Occlusal reduction

An overall reduction in the height of the occlusal surface of at least 2 mm in the axial direction is required. This reduction can be achieved by drilling 2-mm-deep grooves as guides, then using a green diamond wheel bur to reduce the occlusal surface.

The bur is oriented along the major axis of the tooth and held parallel to the occlusal plane (Fig. 1). Its shape allows control of the orientation of the reduction and ensures a flat surface, which determines the position of the cervical margin or “cervical sidewalk.” The cervical margin should be supragingival; however, if clinical factors or esthetics require, the margin can follow the gingival margin. Differences in level between the various parts of the cervical margin must be linked by a slope of no more than 60° to avoid a staircase effect. Enamel walls less than 2 mm thick should be removed.

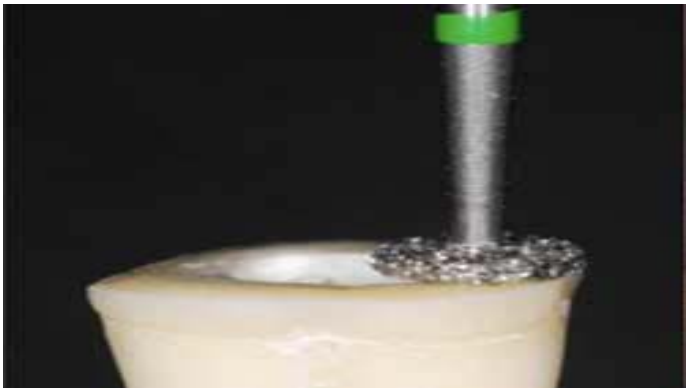

Figure 1: Preparation of the cervical margin or “cervical sidewalk” using a wheel bur held parallel to the occlusal plane.[3]

Axial reduction

This step primarily involves eliminating undercuts in the access cavity. A cylindrical-conical green diamond bur with a total occlusal convergence of 7° is used to make the coronal pulp chamber and endodontic access cavity continuous (Fig. 2). With the bur orientated along the long axis of the tooth, the preparation is carried out without excessive pressure and 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 should be at least 3 mm.

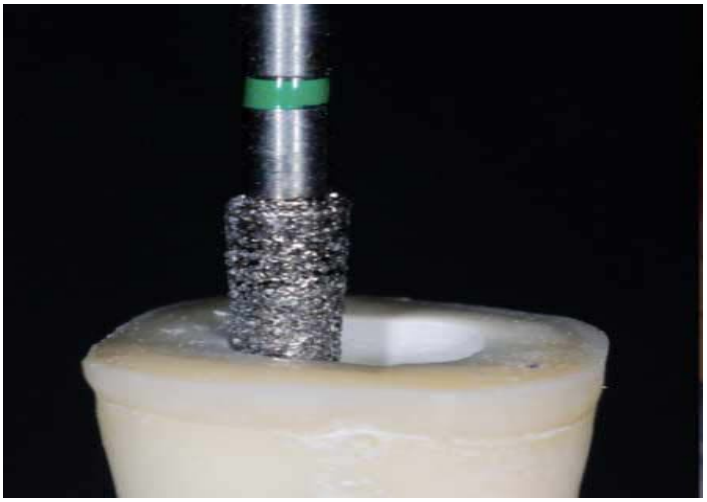

Figure 2 : Axial preparation using a cylindro-conical drill to make the coronal pulp chamber continuous with the access cavity.[3,10,11]

Finishing and Polishing of Cervical Band

The bur used in this step has the same taper as the one used in axial preparation, but a larger diameter and a finer particle size. It should be guided around the entire surface of the cervical band to remove micro-irregularities and produce a flat, polished surface (Fig. 3)

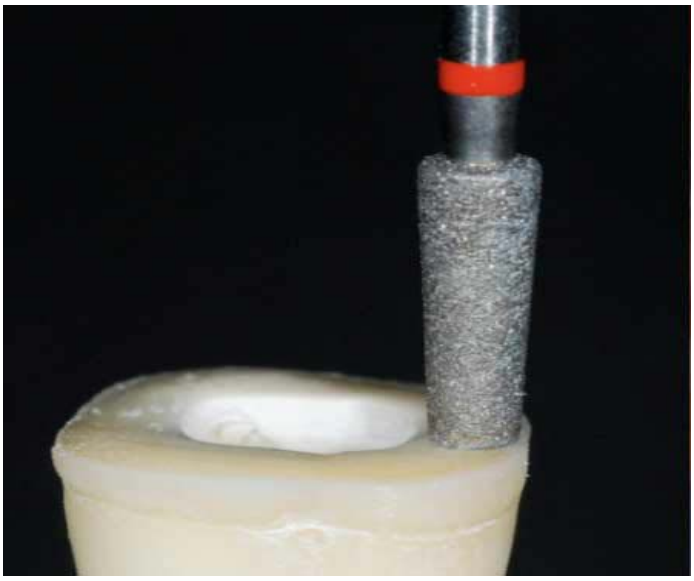

Figure 3: Polishing the cervical band[3]

Removal of Gutta Percha and Pulpal floor Preparation

The entrance to the pulpal canal is opened. Gutta percha is removed to a depth not exceeding 2 mm to take advantage of the saddle-like anatomy of the cavity floor. This should be done with a nonabrasive instrument to maintain the integrity of the canals entrance. [3,13,15]

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. [3,12]

Material Selection

Glass-ceramics: Glass-ceramic has the advantages of biocompatibility and biomimicry,[15,] and its wear coefficient is close to that of the natural tooth.[16] In addition, the single interface of this 1-piece restoration enhances cohesion.

Bonding Agent: The bonding material constitutes the critical interface between the restoration and the prepared tooth.[21] In addition to its adhesive properties, its modulus of elasticity is important as it must be able to absorb pressure, just as the dentin enamel junction (DEJ) does.[22] The interface includes all prepared surfaces. Products that must be photopolymerized require the use of a high-power lamp that must be able to reach light-triggered initiators on the pulpal floor, under layers of ceramic that sometimes exceed 7 mm.

Moreover, the appearence of ceramics that had high mechanical strength and were capable of being acid etched (such as those reinforced with leucite or lithium disilicate), allied with the adhesive systems and resinous cements, made it possible to restore posterior teeth, especially molars, without cores and intraradicular posts.[31]

Conventional vs Endocrown

Conventional restorations are usually prepared using materials with different elastic moduli, i.e. metals or glass-reinforced fibers for the post portion and resin composites or ceramics for the core/crown portion. Considering that the stiffness mismatch between dentin, luting cement, and the restorative system may influence stress distribution, with the higher the number of interfaces between distinct materials the lower the stress distribution, the monoblock nature of endocrowns would support more stress loading than the multi-interfacial nature of conventional restorations.[1,2]

Cementation

Eugenol-containing root canal sealers are believed to inhibit the polymerization of resin cements. This problem may be overcome by cleaning of the root canal walls and acid etching. Cleaning all of the gutta percha and eugenol-containing root canal sealer in the canal is necessary. Debris on the rough surfaces of the root canal prevents the adequate roughen of dentin and polymerization of resin cement.

Both light- and dual-polymerizable luting resins can be adequately polymerized when they are used for luting thick indirect endocrown restorations.[6,7]

Longevity and Effectiveness

In a systematic review by Govare et al[1], it was concluded that endocrowns appear to be a promising alternative for restoring molars treated endodontically and with extensive loss of tooth structure. As observed in the clinical studies, a successful endocrown restoration requires a good preparation design and good mastery of bonding techniques to limit failures due to displacement. The new nanocomposite resins and lithium disilicate seem to have advantages in the fabrication of endocrowns.

In a systematic review and meta-analysis by Augusto et al[2], it was concluded that endocrowns may perform similarly or better than the conventional treatments using intraradicular posts, direct composite resin or inlay/onlay restorations.

Preparation and Stress Distribution

The butt joint, or cervical sidewalk, is the base of the restoration — with a band of peripheral enamel that optimizes bonding.[27] The goal is to achieve a wide, even, stable surface that resists the compressive stresses that are most common on molars.[8] The prepared surface is parallel to the occlusal plane to ensure stress resistance along the major axis of the tooth.

The pulpal chamber cavity ensures retention and stability. Its shape — trapezoidal in mandibular molars and triangular in maxillary molars — enhances the restoration's stability.[3]

There is no need for additional preparation. The saddle form of the pulpal floor enhances stability. This anatomy, along with the adhesive qualities of the bonding material, makes it unnecessary to attempt further use of post involving root canals.[2,5,7]The compressive stresses are reduced, being distributed over the cervical butt joint and the walls of the pulp chamber.[3]

Conclusion

The preparation for endocrowns is rational and can be performed quickly. The supragingival position of the cervical margin preserves the marginal periodontium, and facilitates impression making. The all-ceramic monolithic-type construction, made by pressure molding or machining, endows the endocrown with mechanical strength. These forces are distributed over the cervical butt joint and axial walls, thus moderating the load on the pulpal floor. The endocrown fits perfectly with the concept of biointegration and belongs among the restorative options for posterior endodontically treated and badly damaged molars.

References

1. Govare N, Contrepois M. Endocrowns: A systematic review. J Prosthet Dent. 2019
2. Sedrez-Porto JA, Rosa WL, da Silva AF, Münchow EA, Pereira-Cenci T. Endocrown restorations: A systematic review and meta-analysis. J Dent. 2016 Sep;52:8-14.
3. Fages M, Bennasar B. The endocrown: a different type of all-ceramic reconstruction for molars. J Can Dent Assoc. 2013;79:d140.
4. Robbins JW. Restoration of the endodontically treated tooth. Dent Clin North Am 2002;46(2):367-384.
5. Morgano SM, Hashem AF, Fotoohi K, Rose L. A nationwide survey of contemporary philosophies and techniques of restoring endodontically treated teeth. J Prosthet Dent 1994;72(3):259-267.
6. Sevimli G, Cengiz S, Oruc MS. Endocrowns: review. J Istanb Univ Fac Dent. 2015 Apr 29;49(2):57-63.
7. Van Meerbeek B, Perdigao J, Lambrechts P, Vanherle G. The clinical performance of adhesives. J Dent 1998;26(1):1-20.

8. Pissis P. Fabrication of a metal-free ceramic restoration utilizing the monobloc technique. Pract Periodontics Aesthet Dent 1995;7(5):83-94.
9. Bindl A, Mormann WH. Clinical evaluation of adhesively placed cerec endo-crowns after 2 years--preliminary results. J Adhes Dent1999;1(3):255-265.
10. Zogheib LV, Saavedra Gde S, Cardoso PE, Valera MC, Araújo MA. Resistance to compression of weakened roots subjected to different root reconstruction protocols. J Appl Oral Sci. 2011;19(6):648-54.
11. Fernandes AS, Dessai GS. Factors affecting the fracture resistance of post-core reconstructed teeth: a review. Int J Prosthodont. 2001;14(4):355-63.
12. Nagasiri R, Chitmongkolsuk S. Long-term survival of endodontically treated molars without crown coverage: a retrospective cohort study. J Prosthet Dent. 2005;93(2):164-70.
13. Fernandes AS, Dessai GS. Factors affecting the fracture resistance of post-core reconstructed teeth: a review. Int J Prosthodont. 2001; 14(4):355-63.
14. Goodacre CJ, Campagni WV, Aquilino SA. Tooth preparations for complete crowns: an art form based on scientific principles. J Prosthet Dent. 2001 Apr;85(4):363-76.
15. ander E, Dietschi D. Endocrowns: a clinical report Quintessence Int. 2008;39(2):99-106.
16. Magne P, Knezevic A. Simulated fatigue resistance of composite resin versus porcelain CAD/CAM overlay restorations on endodontically treated molars. Quintessence Int. 2009;40(2):125-33.
17. Zogheib LV, Saavedra Gde S, Cardoso PE, Valera MC, Araújo MA. Resistance to compression of weakened roots subjected to different root reconstruction protocols. J Appl Oral Sci. 2011;19(6):648-54.
18. Fernandes AS, Dessai GS. Factors affecting the fracture resistance of post-core reconstructed teeth: a review. Int J Prosthodont. 2001;14(4):355-63.
19. Nagasiri R, Chitmongkolsuk S. Long-term survival of endodontically treated molars without crown coverage: a retrospective cohort study. J Prosthet Dent. 2005;93(2):164-70.
20. Fernandes AS, Dessai GS. Factors affecting the fracture resistance of post-core reconstructed teeth: a review. Int J Prosthodont. 2001; 14(4):355-63.
21. Schillingburg HT, Hobo S, Whitsett LD, Jacobi R, Brackett SE. Fundamentals of fixed prosthodontics. Chicago: Quintessence; 1997.
22. Bernhart J, Bräuning A, Altenburger MJ, Wrbas KT. Cerec3D endocrowns — two-year clinical examination of CAD/CAM crowns for restoring endodontically treated molars. Int J Comput Dent. 2010;13(2):141-54.
23. Höland W, Schweiger M, Watzke R, Peschke A, Kappert H. Ceramics as biomaterials for dental restoration. Expert Rev Med Devices. 2008;5(6):729-45.
24. Qin F, Zheng S, Luo Z, Li Y, Guo L, Zhao Y, Fu Q. Evaluation of machinability and flexural strength of a novel dental machinable glass-ceramic. J Dent. 2009;37(10):776-80. Epub 2009 Jun 16.
25. Messer RL, Lockwood PE, Wataha JC, Lewis JB, Norris S, Bouillaguet S. In vitro cytotoxicity of traditional versus contemporary dental ceramics. J Prosthet Dent. 2003;90(5):452-8.
26. Donovan TE, Chee WW. Cervical margin design with contemporary esthetic restorations. Dent Clin North Am. 2004;48(2):vi, 417-31.
27. Mrazek WR. Laboratory procedures for fabricating pressable all-ceramic restorations. J Dent Technol. 1997;14(4):10-6.

28. Bindl A, Richter B, Mörmann WH. Survival of ceramic computer-aided design/manufacturing crowns bonded to preparations with reduced macroretention geometry. Int J Prosthodont. 2005;18:219-24.
29. Guarda GB, Gonçalves LS, Correr AB, Moraes RR, Sinhoreti MA, Correr-Sobrinho L. Luting glass ceramic restorations using a self-adhesive resin cement under different dentin conditions. J Appl Oral Sci. 2010;18(3):244-8.
30. Biacchi GR, Basting RT. Comparison of fracture strength of endocrowns and glass fiber post-retajned conventinal crowns. Oper Dent. 2012;37(2):130-6.