# Endocrown for an Endodontically Treated First Molar in a Child with Malocclusion: A Case Report

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**Abstract**

Providing endodontically treated young permanent first molars in children with esthetic full coverage crowns may be a challenge especially if these crowns will be used later for bonding of orthodontic tubes or brackets. Yes, there is ready made zirconia crowns but still the bonding with zirconia may be an issue of controversy. This case reported using lithium disilicate endocrown as an esthetic full coverage permanent crown in an endodontically treated young permanent molar in child with posterior cross bite that need orthodontic correction. With this type of crowns the patient is provided with an esthetic crown without reducing the axial tooth surfaces and in the same time leaving the buccal surface free for bonding of orthodontic tubes. More ever the lithium disilicate material itself is an etchable material to which the tubes can be bonded too.

**Case report (J Int Dent Med Res 2020; 13(4): 1573-1577)**

**Keywords:** Endocrown, endodontically treated molar, lithium disilicate, malocclusion.

**Received date:** 11 September 2020 **Accept date:** 12 October 2020

## Introduction

Nowadays, the gold standard for restoring endodontically treated teeth (ETT) is minimally invasive restorations[1]. Endocrown as an example of these; is a one piece core and crown restoration that is adhesively luted to endodontically treated molars[2,3]. Pissis[4] was the forerunner of the endocrown technique, however; In 1999, the term “endocrown” was described for the first time by Bindle and Mörmann[5].

Indications of endocrowns includes; Interocclusal space not enough for post core and crown[6], to avoid surgical crown lengthening where ferrule cannot be established as the endocrown margins are mainly equigingival[3,7], calcified, curved or short root canals where post application is difficult[2], and for young permanent endodontically treated molars[8,9].

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When compared with conventional crowns, endocrowns have many advantages which are; short clinical time and low cost[10], preservation of sound enamel and dentin that is removed during conventional axial surface and ferrule preparation as endocrowns are usually prepared without ferrule[11,12], higher fracture resistance due to more thick occlusal portion and better stress distribution[13,14].

Two preparation designs of endocrowns described in the literature, a standard one (non-ferrule containing, flat or classic) consists of a circumferential 1.0-1.2 butt margin and a central retention cavity inside the pulp chamber[3,4]. Another design with 90-degree shoulder (ferrule containing) was also described[15].

The endocrown material have an influence on its performance. It should be fabricated from a material with modulus of elasticity close to that of the tooth structure to distribute occlusal forces along the bonded surface[16]. It should have enough bond strength to the underlying tooth structure[16]. Resin ceramic and lithium disilicate are the most used[17-19]

A heated debate still occurring on the ideal technique for restoration of ETT since they are considered to have a higher risk of fracture than vital teeth[20-23].

The posterior unilateral crossbite in children is usually associated with a shift of the mandible during mouth closure due to premature contacts[24-26]. This leads to irregular masticatory cycle and significant increase in bite fore even after being orthodontically corrected[26-31]. Therefore; endodontically treated posterior teeth in such cases may be more prone to fracture.

Cuspal coverage with indirect restoration have been reported to improve the outcome of the endodontically treated teeth[32-34]. An improved survival of ETT with satisfactory coronal cuspal coverage has been attributed to a reduction in microleakages and the protection of the remaining tooth structure[34,35]. On the contrary, when restored with composite resin without indirect cuspal coverage, endodontically treated teeth have a lower success rate, with a 5-year survival rate of 63%[36].

The purpose of this report is to discuss the use of an endocrown as a minimally invasive method of cuspal coverage used for the restoration of an endodontically treated lower first molar in a child with a unilateral posterior cross bite.

## Case Report

A 12 years old male child came with severe pain related to lower left side of the mouth. He had no past medical problems. On clinical examination (fig.1) and radiograph (fig.2) failed composite restoration in tooth# 36 was found. As per endodontic principles a decision of endodontic treatment of #36 was taken. After completion of endodontic treatment; a flowable composite base was used to seal permanently the root canal orifices and block out the undercuts. Lithium disilicate (IPS E-max press) endocrown was selected as a post endodontic restoration in this case. The shade of the restoration was selected before tooth preparation. The tooth preparation was carried out by making 2mm occlusal reduction creating the circumferential butt margin (fig.3 A& B). Vinyl poly siloxane definitive impression was then made (fig.4) and sent to the dental lab for fabrication of the restoration.

**Figure 1.** Preoperative clinical photograph.

**Figure 2.** Preoperative radiograph.

**Figure3A.** Endocrown preparation.

**Figure 3B.** Endocrown preparation showing occlusal clearance and cross bite.

**Figure 4.** Definitive impression.

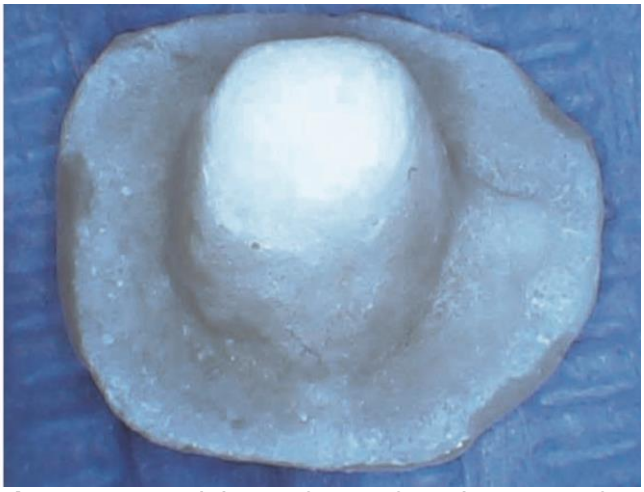

**Figure 5.** Intalgio surface of endocrown after hydrofluoric acid etching.

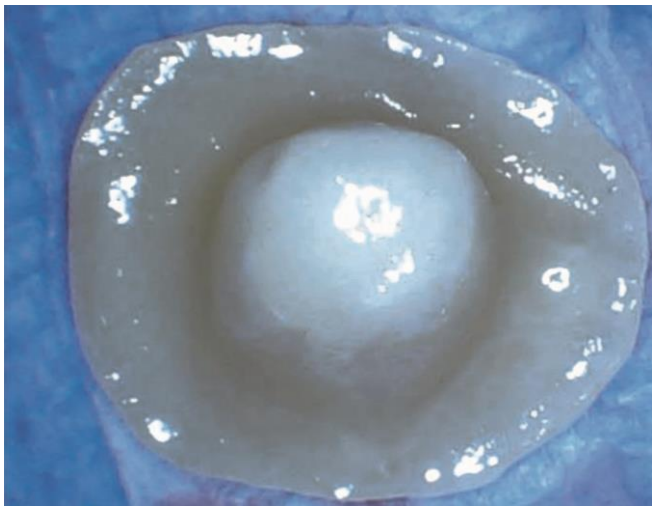

**Figure 6.** Intalgio surface of endocrown after silane application.

During cementation, rubber dam was applied, and provisional restoration removed, then marginal fit, selected restoration shade and occlusion were checked before cementation.

The intaglio surface of the ceramic endocrown was etched with 9.5 % hydrofluoric acid for 60 seconds (fig.5), rinsed thoroughly with water and ultrasonically cleaned to remove any impurities that may interfere with the adhesion process, and then dried with air. Silane coupling agent (ESPE Sil) was applied to the etched intaglio surface of endocrown (fig.6) then allowed to air dry for five minutes.

The prepared tooth surface was etched with 37% phosphoric acid etching gel for five seconds then rinsed with water and dried. A total-etch single bottle adhesive system (Single Bond) was applied and light cured for 20 seconds (LED-F Light Curing Machine).

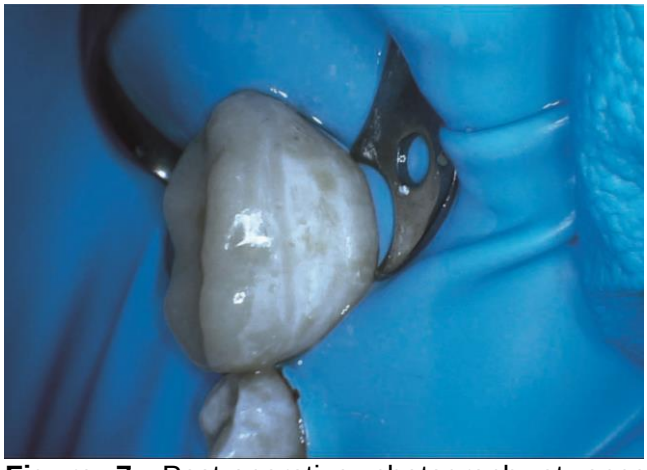

**Figure 7.** Post-operative photograph at once after cementation.

**Figure 8.** Post-operative radiograph.

A suitable amount of a dual cured resin cement (RelyX ARC) was squeezed out the dispenser syringe then mixed and applied to the intaglio surface of endocrown which is seated under finger pressure until excess cement came out of the buccal and lingual surfaces. To remove excess cement an initial light curing of five seconds was done. A final curing of 60 seconds was then done on the buccal and lingual surfaces. Finishing of the margins was done with finishing burs and then polished with Astropol polishing system from Ivoclar Vivadent. Dental floss passed with light friction between tooth #35 and #36, figure 7 shows the result immediately after cementation. Figure 8 shows the post-operative radiograph.

## Discussion

Management of carious permanent molars is important for the quality of life and jaw growth[37]. They are the first posterior teeth to erupt and the most affected by dental caries[38]. They exert the highest force during chewing[39].

Cavity depth has been quantified as one of the highly critical factors in determining the reduction in tooth stiffness and risk of fracture[1]. Due to larger pulp chamber size; the cavity depth in permanent teeth of younger patients may be more than it in elder people so it may be more prone to fracture.

The original focus on strength of ETT shifted towards failure modes, postless approaches like endocrowns have been proposed to improve the chances of repair[40].

In a recent systematic review, Failure modes of endocrowns and traditional crowns were observed in the different studies. The main cause of endocrown failure was loss of retention (53% of failures), which simply can be repaired by recementation. For the traditional crowns, crown fracture was the main reason for failure (53%)[41].

Clinicians should continue to base decisions about how to restore root-filled teeth on their own clinical experience. the presented case if restored with composite without crown, the failure may be catastrophic splitting of the crown which accelerates tooth loss.

Endocrown has been selected because it is minimally invasive, covers and protects all the cusps like conventional crowns, however; it has no direct effect on the periodontal tissues as the margins are completely far supragingival.

This report gives an idea to the general dental practitioner; who are playing a key role in managing the development of dentition; about new treatment options of endodontically treated molar teeth in young age.

## Conclusions

The presented case illustrates how an endodontically treated molar tooth in a child with posterior cross bite can be protected against fracture due to abnormal masticatory cycles, expected occlusal changes during orthodontic treatment in the future.

**Clinical significance**: Endodontically treated permanent first molar teeth in child with posterior cross bite are more prone to fracture due to abnormal masticatory cycles. Restoring such teeth with minimally invasive restoration with favorable failure mode like endocrown may be a choice.

## Declaration of Interest

The authors report no conflict of interest.

## References

1. Dietschi D, Duc O, Krejci I, Sadan A. Biomechanical considerations for the restoration of endodontically treated teeth: a systematic review of the literature-Part 1. Composition and micro-and macrostructure alterations. Quintessence Int 2007;38(9):733-43.
2. Biacchi G, Basting R. Comparison of fracture strength of endocrowns and glass fiber post-retained conventional crowns. Oper Dent 2012;37(2):130-6.
3. Bindl A, Richter B, Mörmann W. Survival of ceramic computer-aided design/manufacturing crowns bonded to preparations with reduced macroretention geometry. Int J Prosthodont 2005;18(3):219-24.

4. Pissis P. Fabrication of a metal-free ceramic restoration utilizing the monobloc technique. PPAD 1995;7(5):83-94.
5. Bindl A, Mormann W. Clinical evaluation of adhesively placed Cerec endo-crowns after 2 years-preliminary results. J Adhes Dent 1999;1:255-66.
6. Chang C, Kuo J, Lin Y, Chang Y. Fracture resistance and failure modes of CEREC endo-crowns and conventional post and core-supported CEREC crowns. J Dent Sci 2009;4(3):110-7.
7. Abdel-Aziz M, Abo-Elmagd A. Effect of endocrowns and glass fiber post-retained crowns on the fracture resistance of endodontically treated premolars. Egypt Dent J 2015;61(3203):3210-6.
8. Jeong H, Kim S, Kim J, Choi N. Post-endodontic restoration on erupting permanent first molars using endocrown with a polyglass composite resin: report of two cases. J Korean Acad Pediatr Dent 2019;46(1):111-6.
9. Davidovich E, Shay B, Nuni E, Mijiritsky E. An Innovative Treatment Approach Using Digital Workflow and CAD-CAM Part 1: The Restoration of Endodontically Treated Molars in Children. Int J Environ Res Public Health 2020;17(4):1364-9.
10. Dietschi D, Duc O, Krejci I, Sadan A. Biomechanical considerations for the restoration of endodontically treated teeth: a systematic review of the literature, Part II (Evaluation of fatigue behavior, interfaces, and in vivo studies). Quintessence Int 2008;39(2):733-43.
11. Jotkowitz A, Samet N. Rethinking ferrule–a new approach to an old dilemma. Br Dent J 2010;209(1):25-31.
12. Skupien J, Luz M, Pereira-Cenci T. Ferrule effect: a meta-analysis. JDR Clin Trans Res 2016;1(1):31-9.
13. Motta A, Pereira L, Duda F, Anusavice K. Influence of substructure design and occlusal reduction on the stress distribution in metal ceramic complete crowns: 3D finite element analysis. J Prosthodont 2014;23(5):381-9.
14. Tay F, Pashley D. Monoblocks in root canals: a hypothetical or a tangible goal. J Endod 2007;33(4):391-8.
15. Sun J, Ruan W, He J, Lin X, Ci B, Yin S, et al. Clinical efficacy of different marginal forms of endocrowns: study protocol for a randomized controlled trial. Trials 2019;20(1):454-9.
16. Ramírez-Sebastià A, Bortolotto T, Cattani-Lorente M, Giner L, Roig M, Krejci I. Adhesive restoration of anterior endodontically treated teeth: influence of post length on fracture strength. Clin Oral Investig 2014;18(2):545-54.
17. Garibello-Perilla A, Delgado-Mejía E, Wahjuningrum DA, Arwinda RE, Arciniegas-González N-A, Cruz-González A-C. Influence of the Type of Silane Prior to the Use of a Universal Adhesive on Lithium Disilicate. J Int Dent Medical Res 2020;13(3): 939-44.
18. Rocca GT, Daher R, Saratti CM, Sedlacek R, Suchy T, Feilzer A, et al. Restoration of severely damaged endodontically treated premolars: The influence of the endo-core length on marginal integrity and fatigue resistance of lithium disilicate CAD-CAM ceramic endocrowns. J Dent 2018;68:41-50.
19. Tanapon Tarateeraseth NT, Ploypim Kraisintu, Settapak Somyhokwilas, Awiruth Klaisiri,tool Sriamporn. Effect of Different Types of Silane Coupling Agents on the Shear Bond Strength between Lithium Disilicate Glass Ceramic and Resin Cement. J Int Dent Medical Res 2020;13(3):836-42.
20. Pantvisai P, Messer HH. Cuspal deflection in molars in relation to endodontic and restorative procedures. J Endod 1995;21(2):57-61.
21. Taha NA, Palamara JE, Messer HH. Cuspal deflection, strain and microleakage of endodontically treated premolar teeth restored with direct resin composites. J Dent 2009;37(9):724-30.
22. Reeh E, Douglas W, Messer H. Stiffness of endodontically-treated teeth related to restoration technique. J Dent Res 1989;68(11):1540-4.
23. Magne P, Carvalho A, Bruzi G, Anderson R, Maia H, Giannini M. Influence of no-ferrule and no-post buildup design on the fatigue resistance of endodontically treated molars restored with resin nanoceramic CAD/CAM crowns. Oper Dent 2014;39(6):595-602.
24. Kennedy DB, Osepchook M. Unilateral posterior crossbite with mandibular shift: a review. J Can Dent Assoc 2005;71(8):569-74.
25. Saint Fabia Chantic NI, Anggani HS, Purwanegara MK. Identification of Dental Factors Associated With Crowding Malocclusion in Primary School Children in Jakarta. J Int Dent Medical Res 2020;13(3):1147-50.
26. Sonnesen L, Bakke M. Bite force in children with unilateral crossbite before and after orthodontic treatment. A prospective longitudinal study. Eur J Orthod 2007;29(3):310-3.
27. Kurol J. Longitudinal study and cost-benefit analysis of the effect of early treatment of posterior cross-bites in the primary dentition. Eur J Orthod 1992;14(3):173-9.
28. Ingervall T, Birgit B. Activity of temporal and masseter muscles in children with a lateral forced bite. Angle Orthod 1975;45(4):249-58.
29. Ardani I, Anandamaya D. The Relationship Between Skeletal and Dental Characteristics in Patients with Class II Malocclusion. J Int Dent Medical Res 2019;12(4):1421-5.
30. Nugroho MJ, Ismah N, Purbiati M. Orthodontic Treatment Need Assessed by Malocclusion Severity using the Dental Health Component of IOTN. J Int Dent Medical Res 2019;12(3):1042-6.
31. Reshitaj A, Bujupi R, Reshitaj K, Bytyqi B. Oral Health Related Quality of Life and Dental Anxiety in Children with Malocclusion between 11-14 years Old. J Int Dent Medical Res 2019;12(3):1047-9.
32. Suksaphar W, Banomyong D, Jirathanyanatt T, Ngoenwiwatkul Y. Survival rates against fracture of endodontically treated posterior teeth restored with full-coverage crowns or resin composite restorations: a systematic review. Restor Dent Endod 2017;42(3):157-67.
33. Tang W, Wu Y, Smales RJ. Identifying and reducing risks for potential fractures in endodontically treated teeth. J Endod 2010;36(4):609-17.
34. Mannocci F, Cowie J. Restoration of endodontically treated teeth. Br Dent J 2014;216(6):341-7.
35. Saunders W, Saunders E. Coronal leakage as a cause of failure in root-canal therapy: a review. Dent Traumatol 1994;10(3):105-8.
36. Stavropoulou A, Koidis P. A systematic review of single crowns on endodontically treated teeth. J Dent 2007;35(10):761-7.
37. Souza J, Souza S, Noronha M, Ferreira E, Martins A. Impact of untreated dental caries on the daily activities of children. J Public Health Dent 2018;78(3):197-202.
38. Linjawi A. First molar health status in different craniofacial relationships. Clin Cosmet Investig Dent 2016;8:89-95.
39. Dejak B, Młotkowski A, Romanowicz M. Finite element analysis of stresses in molars during clenching and mastication. J Prosthet Dent 2003;90(6):591-7.
40. Carvalho M, Lazari P, Gresnigt M, Del Bel Cury A, Magne P. Current options concerning the endodontically-treated teeth restoration with the adhesive approach. Brazilian Oral Res 2018;32(suppl 1):e74-9.
41. Govare N, Contrepois M. Endocrowns: A systematic review. J Prosthet Dent 2020;123(3):411-8.