

Restoration of a Compromised Vital Posterior Tooth Using Ceramic Inlay-Onlay

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Abstract

This article describes a case of compromised posterior vital tooth with severely undermined cusp. It was treated by ceramic inlay onlay restoration. A 25 year old female patient presented to the department of Prosthodontics. She was suffering from sensitivity in the posterior region and complaining about a metallic taste. A comprehensive examination revealed a failing amalgam restoration in the first molar (tooth 16) which is responsible for the metallic taste. A recurrent decay was also noted. A treatment plan including a ceramic inlay onlay was suggested and accepted by the patient.

Introduction

Today's, the minimal invasiveness based on adhesion seems to be the major treatment goal regarding the restoration of compromised vital posterior teeth. Consequently, ceramic inlays and onlays have become scientifically recognized forms when restoring vital posterior teeth^[1]. In fact, these restorations constitute an elective alternative to metal class I or II amalgam. They have more desirable physical properties than direct composite restorations. In the same context, they conserve tooth structure and offer mechanical benefits due to modern adhesive technology^[2]. In addition, the bonding of inlays-onlays to teeth will increase the fracture resistance caused by large MOD preparations^[3]. Qualtrough and Wilson (1996) stressed the importance of the bonding procedure to the overall success of such restorations. They reported that, contrarily to traditional cast metal inlay, ceramic inlays and onlays have an excellent clinical longevity^[4]. Compared to gold and amalgam, the micro leakage with ceramic inlay onlay is also reduced; this minimizes post-operative sensitivities which are still to be reported between 3% and 5% in recent studies.

When it comes to titanium inlay-onlay, all clinicians are in general agreement that the material is characterized by thermal stability and specific strength but poses the problem of low ductility^[5]. Thus, Titanium ductility was noticeably improved by many procedures, but using titanium inlay remains a critical approach. In fact, more improvement solutions are not yet well accepted in the industrial domain because of high temperature or low efficiency^[6].

Moreover, using a ceramic inlay onlay allows also the clinician to achieve an excellent shade. In this situation translucent ceramic inlay will be indistinguishable from the tooth being

restored^[3,7]. The long term success of an indirect posterior restoration is strongly depending on many factors including the case selection, the preparation design, the ceramic material and the creation of uncompromised adhesive tooth /ceramic interface^[8,9]. The clinician should also determine the geometric configuration of the cavity preparation and if there will be a cusps coverage which remains a controversial point^[10]. Cavity design should be in correlation with principles of adaptation, resistance and retention^[10].

Regarding the selection of the ceramic material system, studies proved that glass fiber reinforced ceramics showed an acceptable success rate^[11,12].

Clinical Report

A 25 year old female patient presented to the department of Prosthodontics. She was suffering from a dental sensitivity in the posterior region and complaining about a metallic taste. After a comprehensive examination, failing amalgam restoration in the maxillary right first molar was evident and recurrent decay was noted. This molar presented an amalgam restoration with compromised buccal cusp [Figure 1, 2]. The margins of the cavity were supra gingivally located. The failed amalgam, the recurrent decay were removed, a temporary restoration was placed during the first Appointment and a bonded ceramic restoration was planned. The first step was to mark the patient's bite with an articulating paper. The preparation was, then, performed using diamond burs [Figure 3]. The depth of the cavity was 2 mm with rounded occlusal axial angles. Undercuts has to be avoided with a cervico axial wall convergence of 10° to 20°. Dentin

close to the pulp was covered with ionomer glass cement and the margins were finished. The temporization was performed using a silicon index and acrylic resin (Texton) and cemented with a temporary non eugenol cement [Figure 4]. Full arch impression was taken using a silicone material (high viscosity washed with a low viscosity) [Figure 5]. The restoration was manufactured from etch-able ceramic blocks (CEREC Vita Block1) via Cerec in Lab [Figure 6-9]. For a secure bonding, the use of rubber dam was necessary [Figure 10]. The thickness of the inlay onlay was recorded using a pair of tactile compasses and the thickness of the cuspal coverage was also measured [Figure 11].



Figure 1: Initial situation



Figure 2: Compromised Buccal Cusp

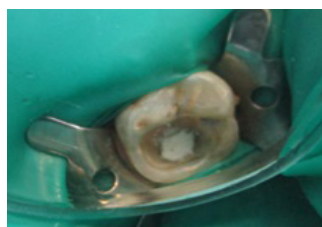


Figure 3: Preparation Cavity



Figure 4: Temporization

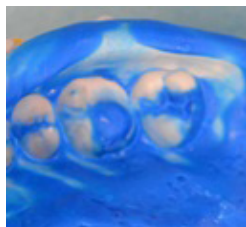


Figure 5: Full arch impression

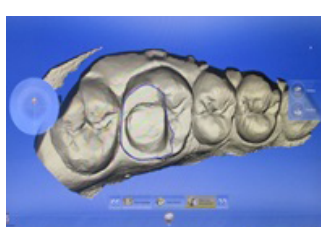


Figure 6: Restoration Outlining



Figure 7: Determination of the Restoration Axis

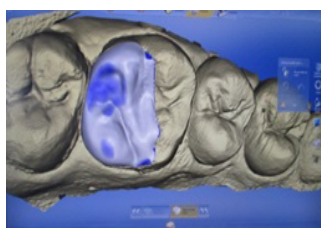


Figure 8: The Design of the Restoration



Figure 9: The Final Restoration after Manufacturing

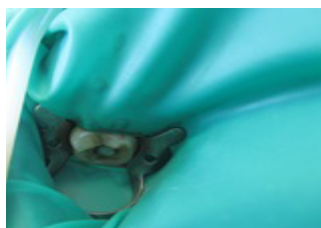


Figure 10: Rubber Dam Placement



Figure 11: Measurement of the Restoration Thickness at 2mm from the Groove

The intra oral fit was evaluated then under rubber dam [Figure 12]. Teeth surfaces were cleaned and etched for 15 sec using 37% phosphoric acid and then rinsed off. When the internal surface of the ceramic restoration was treated by hydro fluor-ic acid the external surface was waxed in order to protect it from etching [Figure 13-15]. A silane coupling agent was applied on the etched surfaces and allowed to air dry [Figure 16]. Resin luting agent is then applied to the restoration and the preparation. The inlay onlay was seated and excess luting material was removed. The restoration should be supported while the resin is cured. Gross excess resin can be removed after a spot cure. Light curing is then done in accordance with the resin manufacturer's recommendations. Occlusal adjustments were performed after bonding to avoid fracture risk [Figure 17]. Figure 18 showed the restoration, which is indistinguishable from the tooth being restored, after bonding.

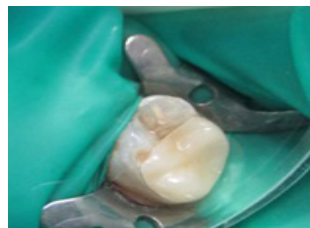


Figure 12: Evaluation of the fit under rubber dam

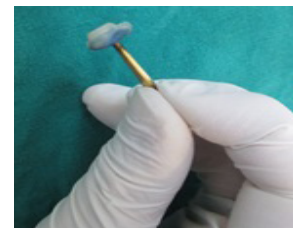


Figure 13: Waxed external surface of the restoration

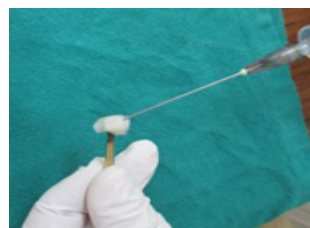


Figure 14: Etching

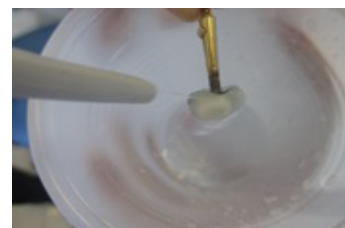


Figure 15: Rinsing off

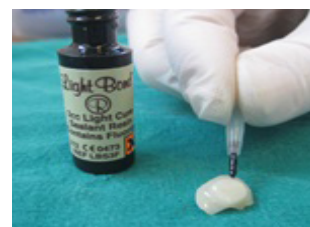


Figure 16: Application of the Silane Coupling Agent

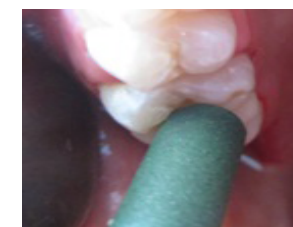


Figure 17: Occlusal adjustments after bonding



Figure 18: The final result

Discussion

The primary emphasis for dentistry now is the reinforcement and preservation of tooth structure^[3]. In fact, preserving sound tissue by using a minimally invasive bonded restoration resulted in less trauma and superior prognosis^[3]. For these reasons, ceramic inlays-onlays are considered as an attractive alternative for Class I and II amalgam. They become highly recommended for treating vital posterior teeth especially when excessive width cavities may preclude the use of direct posterior composite restorations. They are stronger than composite resins and offer superior physical properties. Their clinical effectiveness is strongly related to the development of durable dental ceramics as well as adapted bonding systems^[1].

Recent studies evaluating the clinical performance of ceramic inlays and onlays within a 40-months period showed a high success rate around 96.7%. This result was reported for most analyzed variables such as color, marginal adaptation, abrasion, secondary caries, fracture and postoperative pain. Their findings were in accordance with literature. They finally concluded, in the same context, that these restorations did not show alterations that could result in their replacement^[5]. Reiss (2000) evaluated 1011 CEREC inlays during a period of 12 year and reported a success rate around 85% with a fracture rate only of 8%. In the same context and according to S. Jorgen CEREC inlays have been reported to have 89% survival rate at 10 years^[2]. Another retrospective study evaluated 141 two surface inlays and 155 three surface inlays reported a 12-year inlay survival rate of 89.6% with decreased failure rate on non-vital teeth. On these bases, ceramic onlays and inlays are today scientifically recognized restorations for the posterior region^[1]. A successful minimally invasive approach using inlays and onlays require a case selection and assessment. The clinician should then evaluate the tooth being treated. The margins should be supra gingivally located for a secure bonding. The cavities should not be extended below the ECJ^[13]. The preparation design reduce the physical stress leading to a strength restoration^[1]. It was clearly shown that Guidelines for ceramic inlay preparation differ from those for cast gold. The preparation should have smooth flowing margins to facilitate the fabrication of the restoration. Bevels are strongly contraindicated because ceramics are brittle^[2]. Box walls should converge in an occlusion direction which facilitates optical capture. In order to achieve a balance between the preservation of tooth structure and strength of the material and as insufficient material thickness result in fracture, authors concluded that the idealized inlay preparation design requires a cavity depth of between 1.5 and 2 mm; cavity width of 1/3 the intercuspal distance; TOC (total occlusal convergence angle) about 20° and rounding of all internal line angles^[1,3].

A successful bonded inlay onlay is strongly related to the creation of an uncompromised adhesive tooth –ceramic interface. According to authors, Resin cement used in bonded restorations is elastic and it tends to deform under stress conducting to a higher resistance to fracture. In fact, the elastic modulus of the bonding material affect the fracture strength of the restoration^[10]. It has been, also, shown that conditioning of the enamel and dentin separately is preferable^[4].

Conclusion

Ceramic inlays and onlays offer mechanical advantages over direct resin, titanium, gold and amalgam restorations for treating vital posterior teeth. They also provide successful aesthetic restorations with a translucent aspect indistinguishable from the tooth being restored. However, their indication should consider many factors. They include supragingivally located margins, sufficient enamel thickness. The experience is also necessary before they can be generally recommended for clinical use.

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