RSBO

ISSN:
Electronic version: 1984-5685
RSBO. 2024 Jan-Jun;21(1):152-7

Case Report Article

Ceramic veneers failure: a repair and reintervention clinical report

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Received for publication: June 13, 2022. Accepted for publication: March 17, 2023.

Keywords:
dental veneers; dental restoration failure; dental restoration, permanent; esthetic dentistry.

Abstract

Introduction and Objective: Although the use of ceramic veneers is widespread, their failures are seldom reported. When fractures do occur, they are often related to treatment planning. This case report describes a 6.5-year follow-up of a restorative treatment involving ceramic laminate veneers on a patient with a nail-biting habit. **Case report:** After two restorations failed, repair with composite resin was chosen as an intermediary treatment, and the clinical steps until the ultimate replacement of the ceramics are described. **Results and Conclusion:** The repair resulted in postponing the restorations replacement for almost five years. It highlights that replacement does not need to be the first treatment option in cases of failures of feldspar ceramic laminate veneers. These failures may be managed conservatively with a composite resin repair, with the advantage of postponing the need for replacement.

Introduction

Ceramic laminate veneers (CLVs) allow optimal, long-lasting esthetic restorative results by reproducing the optical properties of natural teeth with minimally invasive procedures [9, 15]. CLVs present high clinical survival rates but often may fail due to ceramic fracture or chipping [11, 20]. Factors such as laboratory processing technique and marginal adaptation may affect the clinical longevity and success of CLVs [10, 11]. However, failures can also be related to the treatment planning, especially concerning the decision on the ceramic type and thickness, and individual factors of the patient, such as parafunctional habits, also increase the risk for clinical fractures [7].

Additive restorative procedures such as direct composite restorations should always be considered

the first treatment option because they are more conservative while presenting excellent esthetic results [7]. Besides, composite resin restorations are repairable [8]. However, as direct composite restorations present color instability and suffer more wear than ceramic restorations, the latter can still be preferred to meet the patient's needs and expectations.

The possibility of bonding CLVs to teeth using resin-based adhesives and luting agents constitutes an advantage of the treatment by allowing effective stress transfer from the ceramic to the supporting dental structure. However, this strong link may be a challenge when replacing the ceramic is needed, particularly when bonded to enamel [13, 20]. The procedure for removal may be time-consuming and pose a risk of damaging the underlying dental tissues. Clinicians should be able to handle failures by considering how to intervene and identify the most probable reason for failure. In some cases, the CLV can be repaired to postpone or avoid ceramic replacement and, ultimately, extend the longevity of the existing restorations. This study aims to report a 6.5-year follow-up of a restorative treatment involving the placement of CLVs, repair as an intermediary treatment after two restorations failed, and the clinical steps until the ultimate replacement of the veneers.

Case report

The CARE guidelines were used for this report [6]. Figure 1 presents a timeline of the patient's history with main interventions, clinical approaches, and their outcomes. A 19-year-old Caucasian man had a complaint of unsatisfactory composite resin restorations and diastemas in his anterior maxillary teeth. The patient past medical history did not reveal significant findings or current use of medication. The occlusal evaluation revealed incisal wear signs on both maxillary canines and the dental history revealed only a nail-biting habit. In the clinical evaluation, the maxillary lateral incisor exhibited fractured composite restoration (figure 2). After discussing the benefits and limitations of the treatment with the patient, a restorative approach using CLVs was chosen. A feldspar ceramic was selected since it allows to best mimic the optical properties of natural teeth. The patient received orientation on the importance to quit the parafunctional habit.

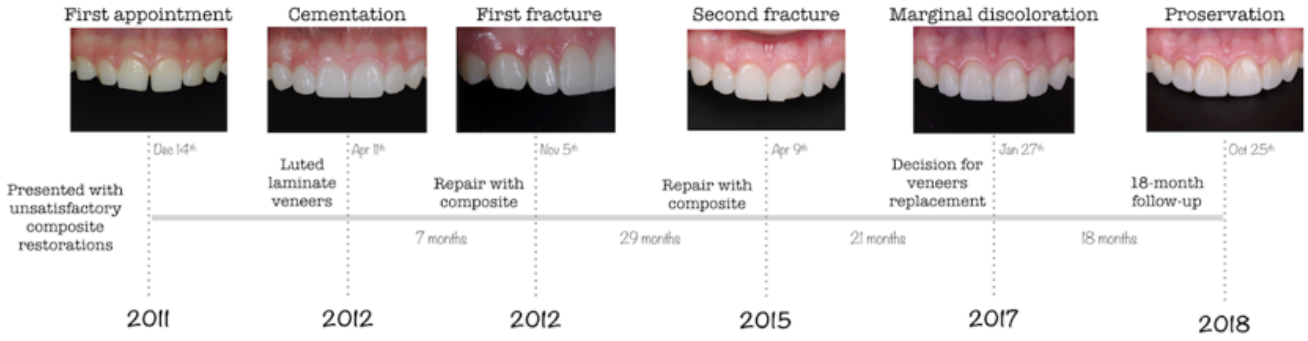

Figure 1 – Patient's clinical history timeline

Figure 2 – Initial clinical situation

An impression using polyvinylsiloxane (Virtual; Ivoclar Vivadent, Schaan, Liechtenstein) was made for obtaining stone cast models, from which a diagnostic waxing was created and a polyvinylsiloxane mold obtained to be used as a guide for tooth preparation. The cervical margin was exposed using #00 retraction cord (Ultrapack; Utradent Products Inc., South Jordan, UT, USA), and the gingival margins of the preparation were set at the cervical gingival level to create a definitive

margin and facilitate positioning of the veneer during the cementation. All existing restorative material was removed using 12-fluted carbide burs (H375R; Cosmedent, Chicago, IL, USA). Tooth preparation was carried out using diamond burs (#2135F; KG Sorensen, Cotia, SP, Brazil) with the aid of the polyvinylsiloxane mold to keep the preparation minimally invasive (figure 3). The preparation was finished using #14 and #16 12-fluted burs (H375R; Cosmedent). Shade matching was performed using a value-oriented shade guide (Vita Bleachedguide 3D-MASTER, Vita Zahnfabrik, Bad Säckingen, Germany) and determined as 1M1. A single-step, double impression technique was performed using polyvinylsiloxane. The provisional veneers were made with the aid of a silicone mold obtained from the previously waxed cast. The mold was filled with bisacryl resin (Protemp 4; 3M ESPE, St. Paul, MN, USA) and inserted into the mouth until polymerization was complete.

Figure 3 – Front view after preparation

After isolating the operative field with cotton rolls and a suction device, the enamel was treated 37% phosphoric acid gel (Ultra Etch; Ultradent Products Inc.,) for 30 seconds, rinsed and air-dried. A two-step adhesive system (ExciTE F DSC; Ivoclar Vivadent) was applied and gently air-dried for 5 seconds. The intaglio surface of the feldspar CLVs (VITA VM7; Vita Zahnfabrik,) was etched with 10% hydrofluoric acid for 120 seconds (Condac Porcelana; FGM, Joinville, SC, Brazil), ultrasonically cleaned with distilled water and air-dried. A silane coupling agent (Monobond N; Ivoclar Vivadent) was applied for 60 seconds and air-dried. The CLVs were luted to the prepared teeth using a light-polymerized resin-based luting agent, shade 0 (Variolink Veneer; Ivoclar Vivadent). Figure 4 shows the clinical aspect immediately after luting.

Figure 4 – Aspect after luting

Seven months after luting the veneers, the patient complained about a fractured incisal edge on the maxillary right canine (figure 5). The decision was to repair it with composite resin. The operative field was isolated with cotton rolls and suction device, the fractured area of the ceramic was sandblasted with 50 μm alumina particles (Bio-Art, São Carlos, SP, Brazil), followed by thorough washing and drying. The veneer was etched with 10% hydrofluoric acid for 120 seconds, the surface was rinsed and dried. Silane coupling agent was applied for 60 seconds and air-dried. The two-step adhesive system Adper Single Bond 2 (3M ESPE) was applied and the repair was carried out using a nanofilled composite resin (Filtek Z350; 3M ESPE) shade A1.

Figure 5 – Maxillary right canine with fractured veneer

The patient returned 2.5 years after the repair on the maxillary right canine with the maxillary left incisor veneer fractured (figure 6A). A repair with composite resin (figure 6B) was performed following the same procedures described for the maxillary right canine. After 21 months since the second repair, the patient returned presenting pigmentation of the composite used to repair the maxillary left central incisor, chipping in the maxillary right lateral incisor, and stained cracks

in the maxillary left central and lateral incisors (figure 7). At this moment, considering that almost 5 years had passed since the first fracture and the compromised esthetics, the choice was to replace the veneers. The new veneers were thicker, and the material chosen was a lithium disilicate-reinforced glass ceramic (e.max Press; Ivoclar Vivadent) in order to improve the mechanical strength. An impression was made, a cast was obtained, and a new diagnostic waxing was developed. The feldspar CLVs were removed using diamond burs (#2135F; KG Sorensen) and the preparation was polished with #14 and #16 12-fluted burs. A single-step, double impression technique was performed using polyvinylsiloxane. Provisional veneers were made with bisacryl resin.

Figure 6 – Maxillary left central incisor with fractured veneer (A). Repair with composite resin (B)

Figure 7 – Aspect 21 months after repair of maxillary left central incisor: marginal discoloration of composite and chipping in maxillary right lateral incisor

The enamel was treated 35% phosphoric acid gel (Scotchbond Etchant; 3M ESPE) for 30 seconds, rinsed and air-dried. The three-step adhesive system (Scotchbond Multipurpose; 3M ESPE) was applied and gently air-dried for 5 seconds. The intaglio surface of the CLVs was conditioned with 10% hydrofluoric acid for 20 seconds, ultrasonically cleaned with distilled water and air-dried. A silane coupling agent was applied for 60 seconds and air-dried. The CLVs were luted to the prepared teeth using a light-polymerized resin-based luting agent, shade Clear (NX3; Kerr Dental, Pomona, CA, USA). The final esthetic and occlusal evaluation were performed after 7 days (figure 8A). A follow-up visit occurred after 18 months (figure 8B and 8C), the patient was satisfied with the treatment.

Figure 8 – Aspect after luting new veneers (A). Approximate view (B). Eighteen-month follow-up evaluation (C)

Discussion

The treatment with feldspar CLVs initially proposed had an excellent esthetic result and the patient was satisfied. As the patient presented a nail-biting habit, he was informed about the consequent risk of failure and received orientation to stop it. Parafunctional loading is one predisposing factor for the occurrence of fractures in CLVs [7]. The extra loading associated with the low thickness of the veneer may explain the chippings and fractures observed during the clinical service [10, 11].

The treatment planning is an essential step towards clinical success [19]. Direct resin composite veneers would have been a more conservative alternative treatment for this case [4]. It is an additive technique repairable in case of failures [18]. In case of failures, CLVs even if with minimal preparation of the teeth, will involve further loss of dental tissue to replace the failed restorations. In the present case, the professional and the patient agreed to decide on ceramic restorations, meeting the patient's needs and expectations. In retrospect, it is likely that an initial decision for composite veneers would have avoided failures or facilitate its management.

Although the use of ceramic veneers is widespread, their failures are seldom reported. Clinical reports usually concentrate in showing clinical success and, when failures are present, how to replace the restorations. The repair of CLVs with composite resin is a faster, less invasive, and more cost-effective alternative compared with replacement. The high content of vitreous phase in feldspar ceramics allow effective surface conditioning and high bond strengths of the repair composite [12]. The combination of sandblasting and acid etching is generally not indicated for intaglio ceramic surfaces, but it was used in the repair to improve the ceramic-resin bond strength as reported in previous studies [2, 16].

The depth of the preparation is an essential aspect of the treatment. An intra-enamel preparation was performed in the present case, resulting in more conservative treatment and optimized bond strength by avoiding dentin exposure. Other factors, such as a previous restoration or discolored substrate, can influence the reduction needed [1]. However, keeping the preparation limited to enamel enables maintaining an optimal bonding [13]. The same concern was present at the moment of replacement of the veneers. Removing bonded ceramic veneers is challenging once the material mimics the natural dental structure, requiring caution not to cause additional damages to the underlying tissue.

The repeat restoration cycle addressed by Elderton in the 1990's [3] may be experiencing its climax in restorative dentistry. In social media, posts showing restorations placed or replaced by reasons other than the presence of disease is commonplace, with increased involvement of patients in the repetitive cycle. One of the main important aspects of this study is to reinforce that replacement does not need to be the first decision. The option to repair may postpone the need to replace the restoration and improve its clinical longevity [5]. In the presented situation, the repair resulted in postponing the replacement for almost 5 years. After the repair restorations failed, the new CLVs were made with a stronger ceramic material in order to improve fracture and chipping resistance [8]. The new veneers also were thicker to achieve higher fracture strength, which is confirmed by the results of a recent study [17].

Conclusion

Failures of feldspar ceramic laminate veneers may be managed conservatively with a composite resin repair, postponing the need for reintervention or replacement. This case presented a repair approach that postponed replacing the failure of ceramic laminate veneers, thus extending the longevity of the existing restorations.

Acknowledgements

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brasil (Capes) – Finance Code 001.

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