Case Report: Managing a Ceramic Chipping in a Zirconium Oxide-Based Crown with a Feldspathic Veneer

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Abstract

This case report describes the clinical approach in managing a chipping of the feldspathic ceramic layer in a zirconium oxide - supported restoration with a new feldspathic veneer; minimal intervention. The case involved chipping of ceramics at tooth 1.1, in which the damaged part was removed and replaced, sparing the tooth from further intensive preparations or changes to the zirconium oxide framework. The technique involved in the procedure included hydrofluoric acid etching, silanization, and resin cementation to foster a high bond strength. The outcomes of the study revealed an excellent aesthetic result with the replanted veneer blending properly with adjacent teeth. This case raises evidence for using feldspathic ceramics in zirconium oxide -based restorations and demonstrates that such complications can be resolved with stability of function and esthetics. The less invasive

treatment modality and the short time taken to restore the teeth suggest feldspathic veneers as a potential solution for similar long-term dentition restoration.

Keywords: feldspathic ceramics, restoration on zirconium oxide, minimal invasive

INTRODUCTION

In the contemporary dentistry the conservation of hard dental tissues during restorative procedures remains one of the most important problems, especially in regards to aesthetics. Conventional retributive procedures sometimes require a lot of tooth structure to be removed that may be deleterious to the stability of the tooth in question. This situation has shifted most clinicians towards techniques that afford the least amount of dental tissue removal while delivering the best functional and esthetic results [1]. In this regard, minimal invasive procedures have been adopted, alongside the consideration of tissuebooth while thinking of the structural stability of the restorations [2]. Recent developments in dental materials include zirconium oxide -based restorations with layered feldspathic ceramics in that they provide durable as well as aesthetic solutions. Zirconium oxide has excellent mechanical properties while feldspathic ceramics have an aesthetic of natural enamel more closely than any other material [3]. However, there are common problems with the ceramic chipping or fracture and the feldspathic layer and therefore the long-term stability of these restorations remains questionable [4]. Investigations have shown that the material properties resulting from feldspathic ceramic are prone to catastrophic failure in functional loads, especially in anterior cosmetic prosthetics where esthetics and occlusal forces are contest [5]. The treatment of such complication therefore necessitates knowledge of the stuff properties as well as the clinical procedures that can help to minimize these risks. Preventing the propensity of ceramic chipping has been approached in another method and that is the control of the mechanical properties of the restorative materials through the design and layering of the different materials used [6]. Further, minimally invasive preparation should be employed in as many cases as possible to allow the dentist to retain more of the tooth substrate for better support to the restoration and thereby minimizing mechanical failure [7].

That is why, despite these advances, the number of publications concerning zirconium oxide - supported restorations with feldspathic ceramic layering remains still small, especially case reports that describe individual complications and their handling. The current paper is a case report describing feldspathic ceramic layer chipping in the zirconium oxide supported restoration and adds to the list of complications and possible solutions in the context of utilizing these materials for anterior restorations. It is the hope of the author of this report that by drawing attention to the mechanical and clinical factors involved, the reader gains better appreciation with regard to the hazards linked to such restorations and develop pragmatic recommendations for handling similar cases in clinical practice [8].

Aim and objectives

The purpose of this article is to assess the clinical application and effectiveness of feldspathic ceramic veneer as a technique for restoring zirconium oxide - supported crowns with chipped feldspathic layers, focusing on aesthetic outcomes and conservative intervention. The aim is to evaluate the bonding performance of protocols such as hydrofluoric acid etching, silanization, and resin cementation in achieving long-term adhesion to feldspathic ceramics. This study demonstrates that restorative ceramics can effectively retain both function and aesthetics after restoration. Additionally, this report discusses the role of feldspathic ceramics in zirconium oxide - based restorations, emphasizing their potential for managing complications in contemporary restorative dentistry.

MATERIALS AND METHODS

A 35-year-old male patient presented with chipping of the feldspathic ceramic layer of a zirconia oxide - supported restoration (Zirkonzahn, Germany) at tooth 1.1.

The restoration was a zirconia oxide framework (Zirkonzahn, Germany) veneered with feldspathic ceramic (Vita VM9, Germany). The goal of the treatment was to restore the chipped area of the feldspathic veneer with minimal intervention, preserving the existing zirconia oxide framework.

The restoration process began by carefully finishing the chipped feldspathic ceramic. The damaged portion of the veneer was smoothed, and any sharp edges were removed, with no more than 1 mm of material being reduced to create a suitable bonding surface. This step was done to ensure the best possible adhesion for the new feldspathic veneer.

The feldspathic ceramic of the existing restoration was then conditioned with 5% hydrofluoric acid (Hydrofluoric Acid, Bisco, USA) for 60 seconds to prepare the surface for the bond.

Next, the new feldspathic ceramic veneer (Vita VM9, Germany) was conditioned in three stages. First, the veneer surface was etched with 5% hydrofluoric acid (Hydrofluoric Acid, Bisco, USA) for 60 seconds to ensure proper adhesion. Following the etching, 37% orthophosphoric acid (Ivoclar Vivadent, Liechtenstein) was applied to the veneer surface for 30 seconds to enhance the bond strength. After rinsing and drying, a silane coupling agent (Monobond Plus, Ivoclar Vivadent, Liechtenstein) was applied for 1 minute to optimize the bond to the feldspathic ceramic. The silane was then air-dried.

An adhesive bonding agent (Adhese Universal VivaPen, Ivoclar Vivadent, Liechtenstein) was applied to both the prepared tooth surface and the back of the new veneer. The adhesive was light-cured for 20 seconds.

The feldspathic ceramic veneer was then bonded to the zirconia oxide framework using light-cured resin cement (Variolink Esthetic LC, Ivoclar Vivadent, Liechtenstein). The cement was light-cured on both the buccal and palatal surfaces for 40 seconds each at a light intensity of 1,200 mW/cm² to ensure a strong and stable bond.

After cementation, any excess cement was carefully removed, and the restoration was polished with a polishing system (OptraFine Diamond Polishing System, Ivoclar Vivadent, Liechtenstein) to ensure a smooth, natural-looking finish that blended seamlessly with the adjacent teeth.

Figure 1. a) The fracturing of the veneering ceramic on the zirconia oxide crown at tooth 1.1 from the frontal view, b) The fracturing of the veneering ceramic on the zirconia oxide crown at tooth 1.1 from the lateral view

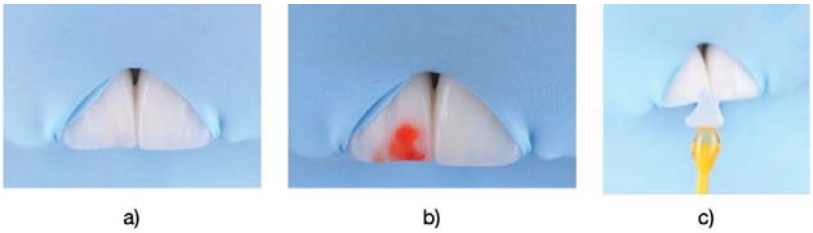

Figure 2. a) The aesthetic appearance of the gingival margin at tooth 1.1, b) Conditioning with hydrochloric acid (HCl), c) The appearance of the veneer after its creation (BASF).

RESULTS

In this case, the fractured feldspathic ceramic on tooth 1.1 was effectively and smoothly restored. The entire procedure, from the removal of the fractured ceramic to the cementation of the new feldspathic veneer, was completed without any complications, adhering strictly to a minimally invasive approach. The zirconia oxide substructure remained intact, and the feldspathic ceramic component of the restoration was carefully finished using diamond burs (Brasseler USA, Savannah, GA, USA), with only minimal adjustments made to ensure proper seating and fit. The integration of the new veneer with the adjacent dental tissues was optimal.

Aesthetically, the new feldspathic veneer closely matched the shade and opacity of the neighboring natural teeth, resulting in a seamless and natural appearance.

The restoration blended well with the surrounding dentition without altering the patient's smile. The bonding process was stable, with no mechanical interference during the placement of the new veneer. The occlusal surface was minimally adjusted to ensure functional stability, allowing the patient to resume normal function without issues.

Moreover, the procedure was completed efficiently, and despite the potential complications, the restoration process was relatively quick. These findings suggest that such complications, specifically feldspathic ceramic fractures in zirconia oxide-supported restorations, can be successfully managed, achieving both functional and aesthetic success. The minimal intervention approach not only resolved the issue effectively but also optimized treatment time. Immediately after treatment, the patient expressed satisfaction with both the aesthetic outcome and the tactile feel of the restoration.

Follow-up appointments confirmed the stability of the veneer, as well as its strong adhesion to the adjacent teeth and periodontal structures.

Additionally, at the 6-month follow-up, the restoration remained stable, with no signs of failure or detachment. The veneer maintained its excellent aesthetic properties, and the patient continued to report satisfactory function and comfort.

DISCUSSIONS

The current case report shows that complications associated with the fracture of feldspathic ceramic in zirconia oxide -supported restorations can be treated efficiently without significant invasions on the restoration. The swift and uneventful rewounding of this fractured laminate strongly suggests that when zirconia oxide - based restorations are veneered with feldspathic ceramics, they offer an esthetic and feasible option, chip or not. This procedure enabled the conservation of the zirconia oxide structure, and the structure of the feldspathic veneer was replaceable without much tooth preparation to maintain the integrity of natural dental tissues [9]. From the culmination of Aesthetic result acquired in this case, it heralds more recognition of feldspathic ceramic in anterior restorations. One of the key behaviors of this material is its appropriateness in recreating the reflectance properties of enamel in the most aesthetic, demanding regions of the mouth: the maxillary anterior teeth. Although feldspathic ceramics are found to possess good aesthetic properties, inherent brittleness makes them susceptible to fracture when used under functional loads. However, considering the above-mentioned possible disadvantage, if it is encountered it is treatable based on clinical guidelines and materials [10]. In the case of the damaged restoration therefore, the use of a feldspathic veneer was time efficient and produced good results. Hydrofluoric acid etching and silanization methods used during preparation of veneer were critical to allow bonding of ceramic material to the tooth substrate. These steps prevented short span and long-term adhesion, which is key importance to the restoration. It was important to achieve sustainable bond and these procedures were creating long-term

adhesion. It also evident that the incorporation of a light-cured resin cement was a major factor to the high predictability and stability of the veneer that favored the aesthetic and functional results [11]. One of the advantages identified in this study was the intact zirconia oxide substructure observed before the feldspathic ceramic layer cracked. This was possible because the zirconia oxide did not have to be replaced or significantly modified due to the new system that was designed. This has the merit of preserving the original substructure which, in addition to saving time and money for such restorations, has the potential for decreasing the likelihood of further problems that might follow from more destructive interventions. Furthermore, it preserves the perovskite structure of the zirconia oxide framework and offers more stability when the newly feldspathic veneer is applied so as to increase the strength of the crowns [12]. Based on this case, it can be concluded that, the use of optimum materials and technique for chipping in a feldspathic ceramic can be brought to a satisfactory conclusion with regard to aesthetic and functional consideration. The bonding protocol adopted in this case involved hydrofluoric acid etching, silanization, and the use of a dual-cure resin cement, and was a major factor in predictable and long-term restoration. The patient reported a high level of satisfaction with esthetics, and the postoperative assessments provided evidence of the temporal stability of the restoration [13]. While this case was successful more research is needed to assess the long-term prognosis of similar restorations with fractured feldspathic ceramics. Research on zirconia oxide - based restorations with feldspathic layering has offered great prospects for the restorative application, but ceramic chipping remains an area of contention especially with cases involving high occlusal load. Considering the fact that long-term follow-up data are missing from different clinical studies, it is evident that undertaking other long-term clinical trials would be useful in refining technique in order to have better outcomes and give clinicians valuable understanding of how to avoid ceramic fractures in future restorations [14]. However, this case report adds to the prior literature that shows that zirconia oxide and feldspathic ceramics can be used in aesthetic dentistry and complications, especially if handled in the right way, do not have to compromise the success of the restoration. Hence, based on this case report, it can be more fully understood that feldspathic ceramic fractures arising in zirconia oxide - supported restorations can be well handled and provide good functionality and esthetics, whilst eliciting minimal invasions. Such materials, with the technique of clinical accuracy and low invasiveness of the treatment plan, complications achieve efficient and stable treatment outcomes that provide satisfaction for the patient [15]. More future studies are needed to determine the effectiveness of such restorations in a more diverse patient population and after many years.

CONCLUSIONS

This case describes a modification in technique and the successful management of a feldspathic ceramic fracture in a zirconia oxide supported restoration. The procedure showed that such complications can be dealt with effectively and this was enhanced by the particularly good aesthetic and functional results. Favourable substructure preservation through zirconia oxide, and facilitating appropriate bonding of the veneer feldspar prevented extensive failure and intervention on natural dentition tissues. The absence of ceramic failures and minimal need for resin cement during the clinical stages led to a predictable and satisfactory result. This case provides further evidence for the predictability of zirconia oxide - supported restorations, with a layering technique of feldspathic ceramic in aesthetic dentistry, including in the event of complications. More research work and follow-up analysis are recommended to confirm these observations and enhance protocols for comparable situations.

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Conflicts of Interest

The authors declare no conflict of interest.

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