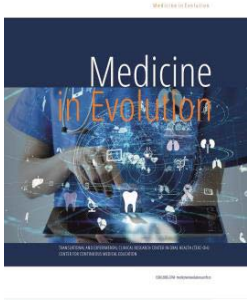
Repair of fractured lithium disilicate restorations with partial feldspathic ceramic veneers



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Abstract

The purpose of this case report is to describe the use of partial feldspathic ceramic veneers to restore a fractured lithium disilicate ceramic restoration. Feldspathic ceramics have almost the aesthetic property of enamel, and they have good light transmission property, but its mechanical properties particularly when used over reduced dentin has been the subject of controversy. This case report presents the restoration of a distal fracture on the incisal margin of a layered lithium disilicate restoration, where only the feldspathic ceramic layer was damaged, and was repaired using a partial feldspathic veneer. Although the veneer was successfully adapted to incisal plane, there is a remarkable discrepancy in terms of esthetic finish in that there is a clear line of separation between the newly placed veneer and the existing restoration. The failure of lithium disilicate restoration under three months of service shows that the choice of materials and an evaluation before repair is critical. This case shows direction of feldspathic ceramics to the multifaceted restorative tasks, focusing on the necessity of the complex bonding and material science approaches for improved both performance and esthetic characteristics. The study indicates that feldspathic veneers may be useful to rehabilitate feldspathic ceramic restorations however; it is not easy always to completely achieve an aesthetic success.

Keywords: feldspathic ceramic materials, repair of restoration, partial veneer

INTRODUCTION

The use of the feldspathic ceramic veneers in restorative dentistry has become popular because of its esthetic characteristics such as susceptibility to mimic the optical properties of the hydroxyapatite of the dental enamel. Of feldspathic ceramics most are cherished for their capacity to match color and transparency which is especially important where aesthetics are paramount such as in the anterior zone (1,2). Still, these benefits cannot be overlooked as the disadvantages of feldspathic ceramics relate to its mechanical characteristics, its inferior flexural strength compared to several other ceramics for instance lithium disilicate or zirconia and these make their usage a challenge in conditions that involve high stresses (3,4).

Typical flexural strength values of feldspathic ceramics are between 100-140 MPa, and the material ''feels'' quite brittle; this puts mechanical constraints on their use, especially in restorative procedures (5,6). Feldspathic veneers offer several advantages, especially in cases where existing restorations are damaged and only partial repair is needed rather than a complete replacement (7). This case demonstrates the successful use of a partial feldspathic veneer to repair a broken lithium disilicate restoration.

A confined crack at the distal incisal aspect of the lithium disilicate restoration was treated by means of placing a partial feldspathic veneer over about 50% of the respective tooth area (8). Other authors stated that this approach the feldspathic veneers can also be used for selective repair, despite the general rules for full coverage restoration (9). This can be interlinked to the type of fracture that was observed; it was a mid-facial fracture which only affected the lower part of the incisal edge; therefore, there was no reason to go for full coverage treatment (10).

Research also exists for feldspathic veneers in repair situations where the mechanical load is not carried over a complete restoration; and is referred to as the load bearing kind (11,12). Healing of the existing restoration in this case made it evident that feldspathic ceramics can help in enhancing the durability and integral value of threatened restorations through selective use (13). Superior attachment systems and correct application of feldspathic veneer for management of compromised restorations enable improvement in the utilitarian value of these materials in restorative dentistry (14,15).

Therefore, although feldspathic ceramics are relatively weak in mechanical strength, the esthetic benefits and the treatment of the local crack have clinical uses. This case study confirms that feldspathic veneers are an option in the restoration of small defects that are present in existing restorations, this is in its larger use in restorative dentistry (16,17). The results highlight use advanced adhesive processes and materials' characteristics to provide satisfactory results even under worst scenarios.

Aim and objectives

The aim of this study was to restore the functional and aesthetic integrity of a fractured lithium disilicate restoration on tooth 2.1 using a partial feldspathic veneer. The objectives included assessing the feasibility of a partial veneer based on the extent of unsupported enamel, ensuring a secure bond and long-term durability of the restoration, and achieving a satisfactory aesthetic outcome despite the challenges in shade matching.

MATERIAL AND METHODS

The patient was a female who presented with a fractured lithium disilicate restoration on tooth number 2.1, which required repair with a partial feldspathic veneer. The aim was to treat the affected zone and bring it to adjust the appearance of the continued restoration. The

crown fracture was at the distal incisal edge of the lithium disilicate restoration, adjacent to the palatal stripe, reducing the incisal enamel surface of the restoration by approximately 50%. This localized fracture showed that a partial feldspathic veneer was ideal in this case (18).

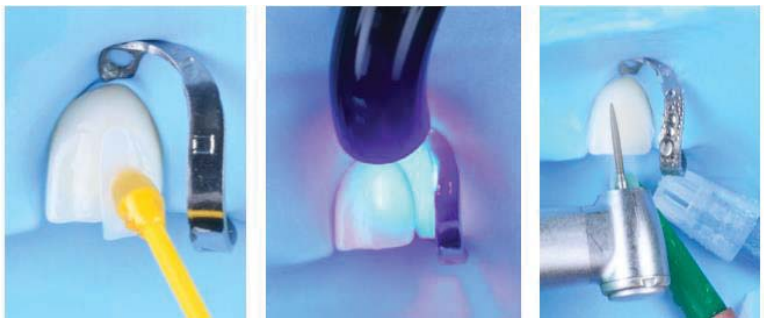
Since an enamel projection under the veneer would be unsupported, dimensions of unsupported enamel around the fractured site were taken to evaluate the feasibility of a partial feldspathic veneer. A periodontal probe and the Alberta gum and bone chart were used in order to measure unsupported enamel (19). The additional measurements showed that the unsupported enamel did not apply more than 2mm: this meant that feldspathic ceramics were still a possibility (20).

Preparation and restoration curing of the damaged restoration was done by cutting off any crumbled material to create a clean surface using diamond bur (Red Band, Komet Dental, Germany) (21). It was then abraded aiming at getting better bond strength. On the tooth 2.1 a partial feldspathic veneer was placed to veiled only the distal half of the incisal edge.

The feldspathic veneer was cemented with Variolink Aesthetic Light Cure Neutral (Ivoclar Vivadent, Liechtenstein) (22). To avoid interference and contamination of the bonding surface a rubber dam was applied in order to achieve a dry work field (23). The veneer was laminated only onto enamel to ensure maximum interlocking and durability of the restoration. Finishing and polishing after bonding the restoration is finalized using diamond bur (Red Band, Komet Dental, Germany) to blend the new veneer and the remaining prosthetic work (24). This was done using rubber polishing discs (Enhance, Dentsply Sirona, USA) and a polishing brush (Shofu Super Snap, Shofu Dental, Japan) to smoothen the surface and give it a smoother finish (25,26). In spite of these measures, it was difficult trying to achieve ideal shade match with the new partial veneer and the existing lithium disilicate restoration. There was thus a slight visible gap leaving a result that was functionally acceptable but could be seen by more critical patients (Figure 4 a, b) (27).

a) b)

Figure 1. a). Regarding the appearance of the patient's smile after chipping on the dental unit 2.1, highlighting the incisal edge and the fracturing of this edge in the distal portion of the incisal margin. b). The intraoral appearance of the fracture at the level of tooth 2.1.



a) b) c)

Figure 2. a) The fixation of the restoration. b) Photopolymerization. c) Finishing with a red-coded diamond instrument

a) b)

Figure 3. Surface finishing with rubber polishers: a) Diamond Polisher, Shofu Dental, Japonia; b) (Diacomp Plus, EVE Ernst Vetter GmbH, Germania)

a) b)

Figure 4. a) The appearance of the restoration after fixation and finishing, viewed extraorally. b) The appearance of the restoration after fixation and finishing, viewed intraorally

RESULTS

When the partial feldspathic veneer had been placed, the restoration was acceptable regarding incisal adaptation. The veneers blended seamlessly with the incisal relationships, without appreciable interference to the same. Follow up assessments after the restoration also provided affirmed the incisal stability and supported the theory stating that there were no changes in bite or function (28). The frustration of this repair is evident when we are looking at the aesthetic result that came out of the repair. Even if the borders between the partial veneer and the existing lithium disilicate restoration are carefully finished and polished, one can observe its contrast. This separation, although it did not compromise the functionality of the restoration to a great extent, was observable on visual scrutiny and contributed to the overall compatibility of the restoration with the neighbouring tissues (29,30). The difficulty of achieving a match with the surrounding tissue without having a smooth gradient was that the ceramic feldspathic veneer and the lithium disilicate restoration were of different colors and textures and were different in the ceramic materials that could be used to interpose between them (31). Three months after the placement, the lithium disilicate restoration on tooth 2.1 fractured. This was a significant complication, though the feldspathic veneer proved effective in masking the fractured surface. Analysts suggest that the properties of the lithium disilicate and the type of damage present before the restoration may have contributed to the fracture (32). The partial veneer itself remained clinically strong and well-fitted, which contrasted with the failure of the underlying restoration; the veneer functioned perfectly (33). The patient was informed of the possibility of further biomechanical work on the fractured lithium disilicate restoration and the aesthetic issues that were apparent. While the new partial veneer bonded well with the remaining tooth structure, the overall restoration highlighted the challenges often encountered in achieving both acceptable function and aesthetics in such repairs (34, 35).

DISCUSSIONS

In light of this case, the attempt to use feldspathic ceramic veneers for the rehabilitation of fractured lithium disilicate restorations underscores some presumptions commonly held with regard to the use of the feldspathic ceramics in less-than-optimal situation. That is why it is possible to consider two millimetres as a critical zone where the enamel is unsupported and needs a strengthening cement with more than 2 mm of unsupported enamel for some areas, the partial feldspathic veneer easily adapted to incisal contact areas and offered a functional answer to the fractured restoration (36).

This is especially true for clinical situation like the present case where the feldspathic veneer's incisal adaptation was even more difficult due to the presence of deep undercuts it is, for this reason that, bonding techniques contributes significantly to the final outcome of such restoration. The micole bond between feldspathic ceramics and enamel is therefore essential for the mechanical retention of these restorations, since they are normally brittle. (37) In this case, the strong bonding offered by Variolink Aesthetic Light Cure Neutral helped in holding the partial veneer in place and exercising its function (38).

However, there is little exploitation of the ideal aesthetic return on investment. The clear boundary between the feldspathic overlay and the residual lithium disilicate crown indicates the problem which arises when dealing with different ceramic systems. The problem of combining feldspathic ceramics with lithium disilicate materials persists, despite technological refinements of finishing and polishing (39). It is seen clearly why it is challenging to obtain excellent esthetic outcomes in restorative procedures done through the use of a number of ceramic materials. The fact that a fracture of the lithium disilicate restoration was noted three months after the repair underlines further some of the study limitations. In the present case, although the partial veneer was still remained, the failure of lithium disilicate restoration points that factors like material selection and the severity of the initial dentinal involvement might have affected its durability (40). The decision to initially use lithium disilicate with its high flexural strength most probably was not suitable for the compromised restoration, underlining the necessity of appropriate material selection and proper examination of the restoration before undertaking any reconstructions (41).

This case is in accordance with other studies that have indicated that feldspathic ceramics can work effectively when other conventional preparation protocols are violated, provided that these guidelines are appropriately followed in terms of case selection and bonding parameters (42). The study also highlights the conclusion that best possible care must be taken in terms of preparation, handling the material, and application of adhesive that is essential to have satisfactory results with particular stressing on the successful accomplishment of complicated types of restorations. Therefore, it can be concluded that feldspathic veneers can be rather effective in coping with the defects of ceramic restorations, however, to provide an ideal esthetic and functional performance it is necessary to consider material characteristics, preparations and adhesive technics. This case demonstrates the importance of the assessment of the restorative techniques and procedures used for modifying and enhancing the long-term stability and esthetics of ceramic restorations.

CONCLUSIONS

This paper discusses the use of a single feldspathic ceramic veneer to restore a fractured lithium disilicate restoration, highlighting both its functional and aesthetic aspects. Despite traditional guidelines suggesting that feldspathic ceramics are unsuitable for areas with unsupported enamel greater than 2 mm, the partial veneer successfully met the incisal demands in this case. However, the aesthetic result was slightly compromised, with a noticeable distinction between the new veneer and the existing lithium disilicate restoration.

This emphasizes the difficulty of achieving a perfect integration of different ceramic materials. The fracture of the underlying lithium disilicate restoration underscores the need for careful material selection and thorough evaluation of existing restorations before undertaking repairs. While a feldspathic veneer can be a practical solution for specific restorative conditions, its application must be carefully considered in light of material properties, adhesive techniques, and aesthetic goals. Further research and refinement in restorative practices are needed to improve the longevity and aesthetics of ceramic restorations and to optimize the use of feldspathic ceramics in complex restorative treatments.

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