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Case Report

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Esthetic rehabilitation of smile with minimally invasive preparations and thin laminate ceramic veneers using chairside cad/cam system

Abstract

Thin ceramic laminates or veneers are a suitable option to correct shape, symmetry, contour, and size of anterior teeth, and can also be used for diastema closuring or clinical crown lengthening using conservative preparations. This case report describes the esthetic rehabilitation of maxillary anterior teeth using thin ceramic veneers produced using a chairside CAD/CAM system (CEREC 4.2.5, Sirona). The patient had diastemas between the maxillary incisors besides short teeth. After obtaining the diagnostic models, waxing, and mock-up, intra-oral scanning was performed to show the areas of retention and guide the conservative preparations. The laminate veneers were milled adjusted and luted using light-cure resin cement. The use of thin ceramic laminates with minimally invasive preparations is a conservative and esthetically approach for successful esthetic rehabilitation of anterior teeth.

Keywords: ceramics, esthetic, CAD/CAM

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Leandro Maruki Pereira,[1] Caio Cesar Dias Resende,[1] Lucas do Nascimento Tavares,[1] Alexandre Yukio Maruki,[2] Marcel Santana Prudente,[1] Luis Henrique Raposo[1]

[1]Department of Occlusion, Fixed Prostheses and Dental Materials, Federal University of Uberlandia, Uberlandia, Brazil
[2]Dental technician in private laboratory, Maruki's lab, Brazil

Correspondence: Luis Henrique Raposo, Department of Occlusion, Fixed Prosthodontics and Dental Materials, School of Dentistry, Federal University of Uberlândia, Av. Pará, 1720, Bloco 4LA sala 4LA-42, Campus Umuarama, Zip Code: 38405-320, Uberlândia, Minas Gerais, Brazil, Tel 55343225-8105, Email lucasnascimentotavares@hotmail.com

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Abbreviations: CAD, computer-aided design; CAM, computer-aided manufacturing

Introduction

Teeth presenting diastema and misalignment are a common finding in the anterior maxillary dentition, and this fact can strongly affect the appearance of a smile, besides being displeasing for the patients.[1] The current literature suggests several approaches for the correction of diastemas and misaligned teeth, such as orthodontic intervention, direct and indirect restorative treatments, or their combination.[1–3] The restorative treatment is dependent on the size of the diastemas and teeth misalignment,[4,5] and the success of these procedures is based on the correct diagnosis, planning, technique and restorative material used.[6] Among the several techniques available for these cases, the most commonly employed are those using direct composite resin or indirect ceramic restorations. Direct restoration with composite resin has advantages such as conservation of tooth tissue, low cost, reversibility, besides being a relatively simple technique.[5] However, indirect techniques could have a conservative preparations to receive laminated ceramic veneers that present excellent optical properties, compressive strength, surface smoothness, abrasion resistance, gloss and color stability.[7] The use of indirect restorations can be facilitated with the chairside CAD/CAM technologies, which reduce chair-time and laboratory steps.[8] The evolution of CAD/CAM systems has stimulated the development of new ceramic materials, guiding the choice based on the translucency, brightness value, available space in the buccal area and the degree of tooth discoloration to optimize the aesthetic results.[6–9] Another important factor to consider when using indirect techniques for closing diastemas or correcting misaligned teeth is the clinical long term success provided by enamel bonding in minimally invasive preparations.[7] Additionally, chairside CAD/CAM technologies are helpful on determining the exact areas for removing teeth retention during preparation. Therefore, this article describes the clinical and laboratory steps of a diastema esthetic rehabilitation using chairside CAD/CAM system and emphasizes the possibilities of this technology to guide conservative preparations in retentive areas of teeth in order to create an insertion direction to thin laminate veneers and preserve enamel to achieve optimal ceramic-tooth bonding.

Case presentation

A 22-year old female patient seek treatment on a private practice service complaining about the shape, color and existing spaces between her anterior teeth. Clinical, x-ray and photography exams of the patient revealed good oral hygiene, teeth without caries, periodontal diseases and occlusal prematurities and/or interferences (Figures 1A&1B). The treatment plan was discussed with the patient and we decided to rehabilitate the anterior esthetics associating dental bleaching and thin ceramic veneers with minimally invasive preparations (Figures 2A&2B). The ceramic resistance and colour stability was a decisive factor on the patient's choice over composite resin restorations. To initiate the treatment photography planning based on digital smile design (DSD) was performed in order to allow precise diagnostic wax up (Figure 3). The jaw impressions for the wax up were made with vynilpolisiloxane (VPS) material (Express XT, 3M-ESPE) to allow suitable detailing of hard and soft tissues. The cast models were poured in Type IV stone (Durone IV, Dentsply) and the waxing-up was then performed according to the DSD planning using organic wax (Formaden). After, a VPS mock-up guide barrier was obtained from the wax-up and the excess of VPS material was removed from the proximal niches with a scalpel blade. The sculpture obtained in the wax-up was reproduced in the mouth using the VPS guide filled

with self-curing bis-acryl composite material (Protemp4, 3M Espe). The excess bis-acryl material was removed from the accesses at the proximal niches of the VPS guide and the patient analyzed and approved the new anterior esthetics obtained with the mock-up provisional restoration (Figure 4). Minimal invasive preparations were carried out with regular grit diamond burs (#3145FF KG Sorensen), using the mock-up as a guide for directing enamel removal only in the regions were more thickness were required for the ceramic laminates (Figure 5). The next step performed, was scanning the preparations with a digital chairside camera (Cerec Ominicam, CEREC, Sirona), which received a thin layer of TiO2 powder to facilitate the detection of retention areas (Optispray, CEREC, Sirona). The software of the CAD/CAM equipment (4.2.5, CEREC, Sirona) identified the areas of retention in the virtual model, which were posteriorly removed from the preparations (Figure 6) to provide adequate insertion direction for the restorations. After the preparations, the mock-up was redone in the left hemi-arch only and the scanning of the right hemi-arch was performed. According to the reference provided by the mock-up of the left hemi-arch, the thin laminate venners of the right hemi-arch were planned in the CAD software and then, polychromatic feldspathic ceramic blocks (Reallife, 0M1 shade, Vita Zahnfabrik, Bad Säckingen, Germany) were milled in the CAM unit (MC XL, CEREC, Sirona). Once the milling process was finished, the shape and fit of the laminate veneers was optimized with fine-grit diamond burs (Zzag, Switerland). The laminate veneers were placed into position in the right side and the same steps were performed in the preparations of the left side, as described. The marginal fit of the restorations was checked and after, esthetic and texture adjustments were carried out before the glazing step was performed using the firing schedules indicated by the manufacturer (Programat CS2, Ivoclar Vivadent) (Figure 7). The luting procedures were initially performed using a try-in test paste (Variolink Veneer, Ivoclar Vivadent) to select the best shade option for the resin cement according to the consent of the patient (Figure 8). A silicone barrier was used to protect the external surface of the laminate veneer before the surface treatment protocol (Figure 9A). After, the internal surface of the ceramic restoration was etched with 10% hydrofluoric acid (Vita Ceramics Etch, Vita Zahnfabrik) for 120 s, followed by cleaning with 35% phosphoric acid (Total Etch, Ivoclar Vivadent) for 30 s, copious water rising and air-drying (Figure 9B & 9C). Then a silane coupling agent (Monobond S, Ivoclar Vivadent) was actively applied with disposable brushes for 20 s and left to react for 1 min (Figure 9D). The enamel surfaces were etched with 37% phosphoric acid(Total Etch, Ivoclar Vivadent) for 30 s, followed by water rinsing and air-drying (Figure 10A). Dry retraction cords were positioned subgingivally, and a total-etch two-component adhesive system (Excite ®F, Ivoclar Vivadent) was applied, but not photoactivated (Figure 10B). Then, photo-cured resin cement (Variolink Venner, shade +1, Ivoclar Vivadent) was used to place the thin laminate veneers in position (Figure 10C). Photoactivation was initially performed for 5 s with a LED curing unit (BluePhase G2, Ivoclar Vivadent) and the excess of resin cement was removed with a scalpel blade, followed by 40 s of light activation per face in each veneer. After removing the retraction cords, the remaining excess of resin cement was removed with extra-fine grit diamond burs (#2135FF, KG Sorensen) and diamond rubber polishers (Optimize, TDV). Occlusion and anterior guidance were checked and adjusted to ensure no premature contacts or interferences in the restorations. The patient (Figure 11A) approved the final aspects of the thin laminate veneers and the new anterior esthetics obtained with the ceramic restorations.

Figure 1A Initial clinical situation

Figure 1B Frontal smile view.

Figure 2 Intraoral evaluation. A: Initial situation; B: After chairside bleaching.

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Figure 3 Digital smile design planning.

Figure 4 Frontal view of mock-up provisionalization.

Figure 5 Minimally preparations guided by mock-up.

Figure 6 Retention areas analyses in the right central incisor by CAD.

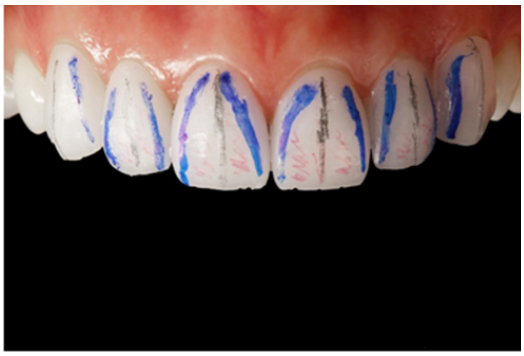

Figure 7 Esthetic adjustments and texture characterization of the thin laminate veneers.

Figure 8 Selection of the resin cement color using try-in paste.

Figure 9A VPS matrix for veneer protection.

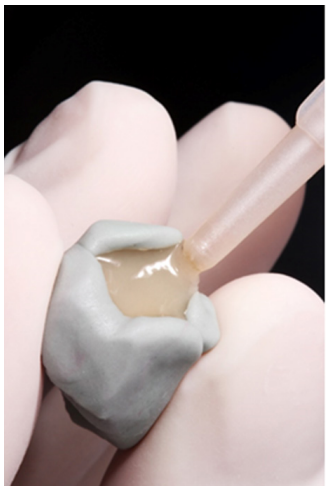

Figure 9B Surface treatment: 5% Hydrofluoric acid etching.

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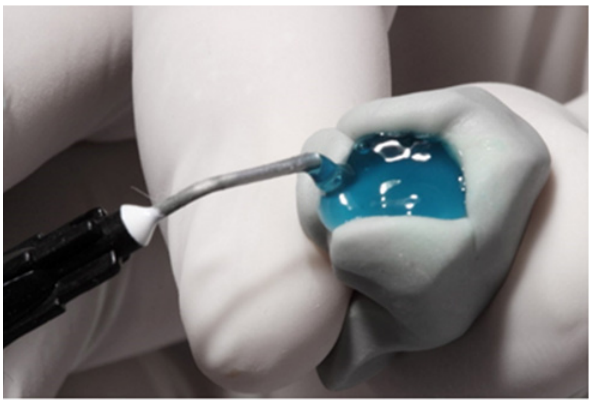

Figure 9C Surface treatment: Cleaning with 35% phosphoric acid.

Figure 9D Surface treatment: Silane application.

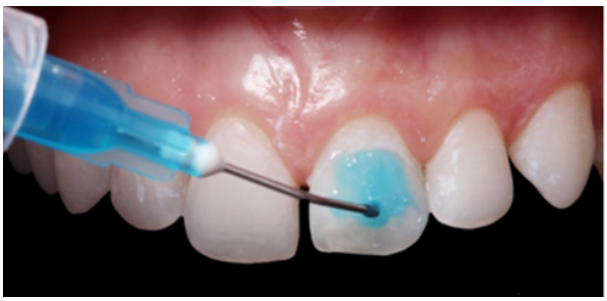

Figure 10A Enamel etching with 35% phosphoric acid application.

Figure 10B Adhesive system application.

Figure 10C Final luting of veneers and removal of excess resin cement.

Figure 11 Smile after final restorations.

Discussion

The approach using indirect restorations for diastema closure was selected for the treatment of the case presented considering that the patient had no intention to undergo an orthodontic treatment. The use of direct composite restorations was rejected by the patient due to the possible color variation, increased abrasion and lower resistance as compared to ceramics. The treatment with minimally preparations and thin ceramic laminates was indicated for closing diastemas besides enhancing natural tooth dimensions and proportions. However, prior to selecting this restorative approach, it is important to consider the limiting aspects and essential care that should be taken by the patient.[7] The mock-up is useful tool that allows showing the rehabilitation planning for patients with high aesthetical expectations before proceeding with the preparation step. Thus, the mock-up is a predictive instrument and helps to create final restorations with the same characteristics from the initial wax-up. This fact is especially important when using the CAD/CAM technology, in order to provide precise mock-up scanning, allowing adequate design and milling of the ceramic restorations. Furthermore, the chairside CAD/CAM system eliminates some laboratory steps, saving clinical time with excellent fit, besides meeting the esthetic demands of patients.[10,11] The choice of which technique and veneering material to use depends on the position, shape, number of teeth involved and degree of enamel discoloration, besides the physical properties of the restorative materials and their bond capability, and no less important, the expertise of the operator**.** The polychromatic feldspathic ceramic blocks selected were 0M1 shade (Reallife, Vita) and presented a more translucent superior area equivalent to the incisal region, and a less translucent inferior area corresponding to the cervical region to optimize the esthetic results. However, despite the lower resistance of feldspathic ceramics, it use was justified in the reported case

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because the patient had good occlusal stability without presenting any parafunction habits. The restoration of tooth volume through the use of bonded porcelain veneers not only reestablishes the original and youthful appearance of the smile, but also allows biomimetic recovery of the crown. Minimally preparations guided by mock-up were performed to guide the conservative preparations and avoid excessive preparations, which could diminish adhesion areas.[12] In this case report, mock-up was used. However, it cannot full guide all precises' parameters and difficult found areas of retention and guide the conservative preparations. It depends on ability technique. In the present case report, a different approach was used by associating the DSD/wax-up, mock-up provisionalization and CAD/CAM system to assist in the planning of the minimally invasive preparations and thin laminate ceramic veneers, since the CAD software highlights the retention areas to be removed in the tooth, simplifying the insertion path of the laminate veneers without interferences as well optimizing enamel conservation. Besides these advantages, a chairside CAD/CAM system allows the sequence of clinical procedures such as mock-up, preparations, restoration adjustments/characterization and final luting to be carried out in a single session, what is particularly interesting for cases in which patients have limited time or urgency to complete an esthetic rehabilitation of teeth.

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Conflicts of interest

Declare if any financial interest or any conflict of interest exists.

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