ORTHODONTIC ESTHETIC FINALIZATION AND FUNCTIONAL WITH CERAMIC LAMINATES: CLINICAL CASE REPORT

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ABSTRACT

In the present moment, continuous progress is being made in dentistry with regard to the development of techniques and materials that aim to meet the demands of professionals and patients in esthetic dental procedures. The success of the procedure lies in an interdisciplinary approach to diagnosis and management. Given this demand in contemporary dentistry, ceramic laminates can be utilized to restore health, esthetics, and function. The present study describes the outcome of orthodontic treatment using ceramic laminates in an unsatisfied patient with thickness, size, dental shape, even so the presence of diastema in the maxillary anterior teeth. At the final stage of orthodontic treatment, the patient expressed esthetic dissatisfaction while smiling and requested correction of the same. On evaluation, small size and thickness of teeth, presence of small diastemata and interincisal gaps in the anterosuperior segment were observed along with disproportion in dimensions of the teeth in relation to the face. Rehabilitation with ceramic laminates were proposed in the superiors incisors and canines bilaterally. Preparation for the ceramic laminates consisted of removal of retentive areas, following which molding was performed and the restorations were made using the IPS e.max system. After color matching and adaptation, the ceramic laminates were cemented with light-curing resin. At the end of the treatment, a harmonious smile proportional to the face was obtained, meeting the expectations of the patient and the professionals involved.

Key words: Oral rehabilitation. Periodontics. Orthodontics. Dental esthetics. Ceramic laminates.

INTRODUCTION

The maintenance and restoration of health, esthetics, and function are the main objectives of the dentistry. In recent years, there was an expressive growth in the interest for esthetic procedures, demanding for professional's part knowledge and expertise to apply references and principles for solving different problems arising restorative Dentistry. The concept of esthetics is subjective, being influenced by cultural, social conditions and individual values, the way that self-perception of the patient's image is extremely important to determinate the treatment plan. That's why transforming the image of the smile demands not even restorations with morphologies predetermined by concepts and numerical proportions[1, 2, 3].

A growing number of individuals are seeking orthodontic treatments, predominantly to achieve a harmonious smile. Orthodontic therapy plays an important role in the rehabilitation of

esthetics and function; however, challenging cases may require an interdisciplinary approach to meet the requirements of the patient[4].

Continuous progress is being observed in adhesive dentistry and the development of materials that mimic the naturals characteristics of dentals structures. Among the various commercially available materials, dental ceramics are most popular due to optimal optical properties and esthetics, chemical durability, and hardness. Moreover, dental ceramics acquire minimal or no intrinsic or extrinsic pigmentation[5,6,7].

Dentists must employ minimally invasive procedures, which are conservative techniques that ensure maximum preservation of healthy dental tissues.5, 8 In addition to the inherent characteristics of dental ceramics, preparation of these laminates can be limited to the level of the enamel, with removal of acute angles and retentive areas, thus allowing adequate bonding resistance to the adhesive materials.9 Ceramic laminates are indicated, among other cases, in patients with healthy teeth who desire ultraconservative esthetic modifications to achieve a harmonious smile[10].

Currently, minimally invasive restorations with ceramic laminates are consolidated procedures. However, creation of an esthetic smile and ensuring clinical longevity of the restorations depend upon thorough clinical examination, accurate diagnosis, appropriate case-selection based on scientific evidence and careful execution of the procedure[11,12].

The aim of the present study was to describe a case of minimally invasive rehabilitation with the use of dental ceramic laminates. The procedure was performed on a patient who was dissatisfied with the appearance of the thickness, size, and shape of the dentition and presence of diastemata in the maxillary anterior teeth, after orthodontic treatment and periodontal surgery.

This case report followed the requirements of the Resolution 466/2012 of the National Health Council / Brazilian Ministry of Health and was approved by the Ethics Committee of the UFBA School of Dentistry, opinion number 2.226.021.

CASE REPORT

A 26-year-old female patient visited the Dental Service of the Federal University of Bahia (FOUFBA) during the final phase of orthodontic treatment (Figures 1 A-C and 2 A, C) with chief complaints of dissatisfaction with her smile due to short teeth and presence of spaces between the upper front teeth. The patient had previously undergone periodontal plastic surgery (gingivoplasty) (Figure 2 B), for correction of asymmetrical gingival contour. Clinical evaluation and analysis of the study model revealed teeth with small size and thickness, presence of small diastemata and interincisal gaps along with disproportion in dimensions of the teeth in relation to the face. To solve the case, the rehabilitation of the dental units with ceramic laminates was indicated in the maxillary incisors and canines bilaterally. Extraoral and intraoral photographs were obtained to facilitate communication with the laboratory (Figure 3 A-B).

Figure 1. Aspect of the smile before orthodontic treatment; A) Right lateral view, B) Frontal

view, C) Left lateral view. Presence of diastemata and gingival asymmetry.

Figure 2. A) Patient during orthodontic treatment with fixed appliance; B) Appearance of smile after periodontal plastic surgery; C) Patient using removable retainer device.

Figure 3. A) Initial clinical aspect of the smile; B) Zoomed image of the teeth.

After dental prophylaxis with extra-fine SS White pumice stone (SS White, Brazil), B1 color for the ceramic laminates was selected in ambient light, using the Vita Classical scale (Wilcos do Brasil Indústria e Comércio, Brazil).

Following discussion of the treatment plan and consent of the patient, teeth preparation was performed. Selective tooth reduction was done at the supragingival region and the level of the enamel, convexities of the mesial and distal marginal ridges, retentive areas, and line angles. For better seating of the laminates and in order to avoid over-configuration, minimal reduction was performed near the gingival margins (Figure 4 A). Fine diamond tips 2214 F and 3216 F by KG Sorensen (Cotia, São Paulo, Brazil) were used for taking preparations and for final polishing, Sof-Lex discs (3M ESPE, Brazil). Following this, molding of the upper arch was performed with Express XT addition silicone (3M ESPE, Brazil). The molding was done by the single step technique, which required four minutes for vulcanization to be achieved (Figure 4 B). Owing to the supragingival location of the final margin, insertion of retraction wire into the gingival sulcus was not indicated. For the lower arch, alginate Hydrogum 5 (Zhermack Labordental, Brazil) was molded, as per instructions by the manufacturer. Occlusal registration was performed using Occlufast Rock addition silicone (Zhermack Labordental, Brazil).

Figure 4. A) After teeth preparation for ceramic laminate restoration; B) Mold made with addition silicone impression material, single step technique.

Despite presence of minimal scuffing on the newly prepared teeth surfaces, neutral topical fluoride gel (New DFL) was applied for 4 minutes in order to reduce occurrence of tooth sensitivity, so it wasn't necessary temporary restorations. The patient was referred to the orthodontist for fabrication of a new removable orthodontic appliance, to avoid possible movement and alteration of the position of the teeth.

The molds were perforated with special Durone type IV gypsum (Dentsply Maillefer, Switzerland) and sent to the denture-manufacturing laboratory together with the Occlufast (Rock - Zhermack Labordental, Brazil) bite record and the chosen color guide for fabrication of the ceramic laminates. IPS e.max Press (Ivoclar Vivadent, Liechtenstein) stratified and IPS e.max ceram veneering ceramics (Ivoclar Vivadent, Liechtenstein) were used (Figure 5).

Figure 5. Ceramic laminates fabricated using the IPS e.max Press System.

After fabrication of the prosthetic components, marginal adaptation was evaluated in the gypsum model and was verified in the oral cavity using an exploratory probe Nº. 5 (S.S. White, Brazil). The interproximal contacts and texture, shape and color of the prosthesis were also verified. The dry and hydrated ceramics were evaluated on the prepared units and after making the necessary adjustments, the prosthetic components were sent to the laboratory for application of glaze.

After re-evaluation of the adaptation, surface smoothness, and brightness of the prosthetic components, the process of cementation was initiated. Prophylaxis of the preparations was accomplished using extra-fine white pumice (SS White, Brazil). Color selection for the photoactivated resin cement RelyX Veneer (3M ESPE, Brazil) was done using RelyX Try-in (3M ESPE, Brazil), which is a color test paste that simulates the chromatic effect of the cement after photopolymerization along with the prosthetic component and dental substrate. A translucent color test paste was selected and was applied onto the internal surface of the prosthetic component. After removal of the excess material, esthetic harmony was evaluated. Following the assessment, the prosthesis was washed with water and dried. Clinical procedures for treatment of the internal surface of the prosthetic components and prepared units were then initiated.

Before the conditioning of the ceramic part was initially performed the protection of the glaze area with utility wax (Clássico, Brazil). The inner surface was etched with 10% hydrofluoric acid gel (Condac Porcelana, FGM, Brazil) for 20 seconds according to the manufacturer's instructions, followed by abundant washing and application of 37% phosphoric acid (Condac, FGM, Brazil) for 30 seconds in order to promote final cleaning. The components were then washed thoroughly with water and air-dried. A layer of silica RelyX Ceramic Primer (3M ESPE, Brazil) was applied with a disposable applicator (microbrush, Kgbrush) for 15 seconds and dried using hot air for 1 minute (Hair dryer, Taiff Tourmaline, Brazil), following which

Adper Single Bond 2 adhesive (3M ESPE, Brazil) was applied without photoactivation.

After preparation of the prosthetic components, isolation of the operative field was achieved with the aid of the lip and cheek Arcflex retractor (FGM, Brazil), followed by prophylaxis of the preparations using water and pumice (SS White, Brazil). For conditioning of dental structures, 37% phosphoric acid (Condac, FGM, Brazil) was applied for 30 seconds, followed by abundant washing and drying with air jets until the surface was opaque. Then a layer of Adper Single Bond Universal Adhesive (3M ESPE, Brazil) was applied using the disposable applicator (microbrush, Kgbrush). Smearing movements were performed over the whole preparation, a second layer of adhesive was applied after 20 seconds. After a further waiting period of 20 seconds, Airon polyester strips were inserted in the interproximal areas (Maquira Indústria de Produtos Odontológicos SA, Maringá, Paraná, Brazil) to prevent union preparations after photopolymerization, as well as to remove excess adhesive material. Thereafter, photoactivation was performed for 20 seconds with the Optilight Max unit (Gnatus, Brazil).

Dental threads were inserted in the interproximal areas to facilitate removal of excess material during cementation of the prosthesis. The translucent RelyX Veneer resin cement (3M ESPE, Brazil) was applied homogeneously on the inner surface of the laminates. Fixation of the components was initiated by pressing the prosthetic upper central incisors onto the tooth in the inciso-cervical and vestibular-palatine directions until extravasation of excess cement and perfect adaptation to the dental preparations was accomplished. Excess cement was removed using a brush, following which a Liquid Strip of the Variolink II system (Ivoclar Vivadent, Liechtenstein) was applied throughout the gingival margin. Photopolymerization was then performed with the Optilight Max unit (Gnatus, Brazil) for 40 seconds on each face of the laminate. The sequence was repeated in the other units (Figure 6).

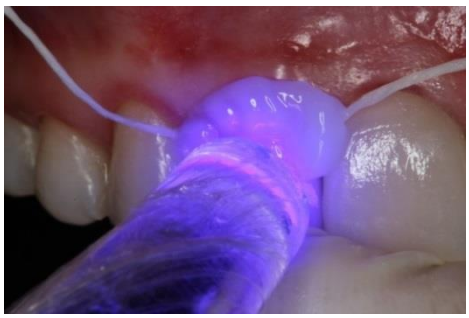

Figure 6. Use of Liquid Strip paste and photoactivation of the laminates.

Subsequently, final adjustments were made and occlusion was evaluated in maximal habitual intercuspation (MIH), protrusion, and lateral movements, in order to eliminate occlusal interferences and premature contacts. Polishing was performed with the OptraFine system (Ivoclar Vivadent AG, FL-9494 Schaan / Liechtenstein). Post treatment photograph was taken for the purpose of comparison, record keeping, and follow-up of the case (Figure 7 A-C).

Figure 7. A) Aspect of the smile after the cementation right lateral view; B) Frontal view; C) Left lateral view.

The final outcome of treatment was a harmonious and jovial smile, to the satisfaction of the patient, which was also compatible with the esthetic parameters described in the literature (Figure 8 A-D).

Figure 8. A) Convex incisal line bypassing the lower lip; B) Texture analysis in lateral view; C) Analysis of the translucency of the incisal edge in the corono-axial view; D) Exposure of the upper incisors, imparting joviality to the smile.

After the final cementation, the maxillary anterior teeth were found to be symmetrical, harmonious, and in alignment, with adequate thickness and dimension. Curvature of the convex smile touching the lower lip was observed (Figure 9 A-B). After completion of the restorative treatment with ceramic laminates, the patient returned to the orthodontist to make a new orthodontic retainer device.

Figure 9. A) Pre treatment appearance of the patient's smile; B) Post treatment appearance of the patient's smile.

DISCUSSION

Beauty is related to a sense of pleasure in the visualization of an object, sound, or person. The concept of beauty differs for each individual, being modulated by aspects related to gender, age, sociodemographic factors, educational status and advertisements. These values affect self-assessments and satisfaction with image itself[13]. Esthetic dental procedures, besides restoring the form and function of oral structures, aim to create a harmonious smile and enhance the self-perception of the individual[14].

Success of modern dentistry could be attributed to the interdisciplinary approach to diagnosis and therapy.13 In the present case, the multidisciplinary treatment approach ensured creation of a balanced, jovial, and harmonious smile, meeting the expectations of the patient and the goals of the dentist. Esthetic smile designing requires an understanding of the

characteristics and expectations of the patient, rather than strict adherence to the principles of esthetic dental procedures, thus we attend to the patient's complaints and limitations, respecting the individuality and longings, not imposing an aesthetic standard.

Several direct and indirect restorative techniques, combined with or without orthodontic treatment, have been described in esthetic dentistry for the closure of diastemata and alteration of the dental form. The choice of clinical procedure depends on the esthetic needs, occlusion and socioeconomic conditions of the patient, as well as the technical knowledge of the professional. In the present case, the indirect restorative technique with dental ceramics was selected, considering the need for conservative dental preparation, prosthetic components with reduced thickness and extra oral, which enhancing esthetics results and the stages of finishing and polishing; in addition to the inherent properties of this material[5,15]. A study by Gomes et al.6 (2008) reported that in the quest to satisfy the growing esthetic requirement advocated by the modern society, rapid development of dental ceramics has been facilitated owing to the optical and chemical durability that is similar to that of natural teeth, among other properties.

Owing to their widespread use in dentistry, several commercial ceramic systems are available. Each ceramic system is associated with specific procedural indications and contraindications. Martins et al. (2010)[16] stated that the choice of the ceramic system depends on the decision of the dentist. The system used in the present case, IPS e.max (Ivoclar, Vivadent) presents in its vitreous structure lithium disilicate crystals, known for high flexural resistance, esthetics and translucency, and is indicated for anterior and posterior unit crowns, inlays, onlays and laminates[17,18].

The technique of ceramic laminates is used when the tooth to be restored requires selective reduction, with minor modifications of edges, acute angles, and retentive areas[19]. In the present case report, the involved teeth were small in size and thickness, with presence of small diastemata, and interincisal gaps. In addition, the dimensions of the teeth were disproportionate in relation to the face. Farias-Neto et al. (2015)[20] stated that the ceramic laminate technique is an excellent option for esthetic rehabilitation of teeth requiring synthetic restorative material. Similarly, the present clinical case required esthetic redesigning of the smile of the patient by use of synthetic restorative material; therefore, the choice of the proposed treatment with ceramic laminates was justified. Selective reduction of the enamel was performed at the retentive areas and line angles to diminish stress by masticatory forces, in order to avoid possible fracture of the restoration.

For the preparation of ceramic laminates, the surface texture of the components is an important parameter to be considered. The faces of the natural teeth show macro and micromorphological irregularities, with light being reflected from these uneven surfaces. The resultant dispersion of light influences the perception and interpretation of the color and appearance of the esthetic dental material.21 Thus, in the present case, several smooth and discrete irregularities were created on the surface of the laminates, resulting in a restoration with diffuse and natural light effects.

One of the important factors for clinical success of a restoration is cementation of the prosthetic components. For adhesive cementation, the inner surface of the prosthetic component should also be coated to strengthen the micromechanical bonding between the ceramic and the resin material[22]. Therefore, during the preparatory phase of the prosthetic components, conditioning was performed with 10% hydrofluoric acid for 20 seconds, following the recommendations of the manufacturer. Butze et al. (2011)[22], reported a reasearch evaluating the surface topography of the IPS e.max ceramic after surface treatment with 10% hydrofluoric acid for 20 seconds. The study verified the removal of the vitreous matrix and exposure of the lithium disilicate crystals, resulting in an irregular surface and, consequently, more favorable micromechanical union, thereby justifying the treatment performed on the internal surface of the ceramic laminates.

The silane bonding agent used in the preparatory phase of the internal surface of the laminates, aimed to form a unique structure between the ceramic, resin cement and the teeth through chemical adhesion of the inorganic components of the ceramics to the organic portion of the cement, in addition to increasing the physical adhesion by wetting the surface[23,24]. After application, a minimum of one-minute waiting period must be ensured to allow vaporization of the solvent in order to prevent interferences in the adhesive process. Another important factor to be considered is thermal treatment of the monomer, which enables better organization and distribution of the silane film, enhancing stability and chemically reactivity with the resin material[23,24].

Currently, several varieties of dental cements are commercially available. Different shades of resin cements are available that facilitate selection of the most suitable tone for cementation of the prosthetic component. Aiqahtani et al. (2012)[25], quantitatively evaluated the color difference (ΔE) between different shades of resin cements used under three ceramic materials with two different thickness. The study concluded that the type of ceramic material, thickness of the prosthetic component, and hue of the cement influenced the ΔE values of the ceramic systems. The lowest mean values of ΔE were obtained for lithium disilicate glass ceramic (IPS Empress e.max Press). For the authors, the high translucency of the IPS Empress e.max Press ceramic laminates provided effective polymerization of the underlying resin cement, since absorption of the photoactivating light is higher in translucent materials when compared to opaque ceramics[25].

Mazioli et al. (2017)[26] investigated the bond strength of a conventional resin cement (RelyX ARC, 3M ESPE, St. Paul, MN, USA) and a self-adhesive cement (RelyX U200, 3M ESPE, St. Paul, MN, USA) on a lithium disilicate ceramic, using the micro-shear mechanical test. The study reported that the conventional resin cement demonstrated better results when compared to the self-adhesive resin cement; therefore, may be considered a more suitable material for cementation of lithium disilicate ceramics.

Thus, considering the translucency of the vitreous lithium disilicate ceramic system chosen for the preparation of the prosthetic component, the minimum thickness of the

ceramic laminate and the importance of the bonding of the complex (tooth, resin cement and internal surface of the laminate); use of the conventional resin cement may be justified in the present case. The characteristics and properties of the lithium disilicate ceramic and the conventional cement resulted in alteration of the final esthetics of the ceramic laminate.

CONCLUSION

Instituting a multidisciplinary approach, involving orthodontics, periodontics, and restorative dentistry, rehabilitation with ceramic laminates on the maxillary anterior teeth based on the principles of minimally invasive dentistry, facilitated restoration of function and esthetics, providing balance and harmony to the smile. The technique and restorative materials used in the present case ensured reproduction of the teeth, integration with periodontal tissues and facial profile of the patient, thereby providing a satisfactory outcome acceptable to both the patient and the professionals involved.

ACKNOWLEDGEMENTS

We thank the technique in dental prosthesis Liane Maria de Almeida Gallas for the execution in the laboratory phase of the ceramic pieces.

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