Multidisciplinary approach for rehabilitation of smile aesthetics with minimally invasive ceramic veneers

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Abstract: Minimally invasive ceramic laminates are a treatment option for smile cosmetic rehabilitation, providing greater conservation of structure and mimicking dental structures. The association of periodontal surgical techniques and reverse planning enhances aesthetic result desired. The development of new ceramic systems reinforced by lithium disilicate and resin cements favored increasing longevity and clinical performance of indirect restorations. The present paper aims at presenting a case report of smile aesthetics rehabilitation, describing the planning, teeth whitening, periodontal surgery, minimally invasive preparation, molding and cementing of with ceramic veneers reinforced by lithium disilicate. These steps contributed for the success in the treatment and patient satisfaction. **Keywords:** Ceramics. Esthetics, dental. Tooth preparation. Periodontics.

How to cite: Soares PV, Faria NFB, Cardoso IO, Moura GF, Pereira AG. Multidisciplinary approach for rehabilitation of smile aesthetics with minimally invasive ceramic veneers. J Clin Dent Res. 2017 Jan-Mar;14(1):68-88.

Submitted: May 08, 2015 - **Revised and accepted**: November 16, 2016.

DOI: http://dx.doi.org/10.14436/2447-911x.14.1.068-088.oar

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» The authors report no commercial, proprietary or financial interest in the products or companies described in this article.

» Patients displayed in this article previously approved the use of their facial and intraoral photographs.

INTRODUCTION

Aesthetics is based on a subjective concept of beauty. This concept is daily influenced by cultural patterns and media. In dentistry, aesthetic procedures are directly related to analysis of the patient's facial pattern, taking into account series of characteristics to define contours of the face and related to the midline.[1,2]

These parameters also influence the analysis of an ideal aesthetic smile, described as whitened teeth and aligned. They are in harmony with the other structures present, respecting their due anatomical and functional proportions, without presenting alterations of color, shape, structural abnormalities and position of anterior teeth.[1,3]

With the improvement of dental materials and rehabilitation techniques, conservative procedures, called minimally invasive procedures, appears as solution. These procedures stand out due to the low amount of dental wear, limiting on the enamel structure which should allow an insertion profile and a thickness of 0.3 to 0.5 mm that allows minimum resistance for fabrication and cementation of the laminate.[4] The cervical preparation should be located at the same level of the gingival term or slightly inside the groove allowing a better adaptation of the pieces and a healthier term for the gingival tissue.[5] This allows the application of adhesive restorations on the buccal face of the teeth. In this way the professionals can achieve aesthetic results similar to the natural one with maximum preservation of the healthy dental structure.[6-8]

This technique can be performed with direct restorations, composite resins, or indirect, minimally invasive ceramic laminates (MICL), popularly known as "Dental Contact Lenses." For the success of the use of MICL's, one must respect and believe in the adhesive protocol, through the cementation and also the characteristics presented by the ceramics. The ceramics applied to MICL have satisfactory properties regarding biocompatibility, color stability, surface smoothness, longevity, biomechanics and appearance similar to the natural tooth. Some ceramics have been modified over time to increase fracture resistance and reduce crack propagation. Among the modified ceramics is the use of Lithium Disilicate crystal, allowing thinner ceramic laminates with aesthetic quality, optical pattern similar to enamel and high resistance to wear/fracture.[9,10]

Another factor that contributes to the success of the treatment related to aesthetic modification and patient satisfaction is the use of reverse planning. The reverse planning is represented by the virtual smile planning, Wax-Up (which signifies the diagnostic waxing based on the previous planning) and Mock -Up (which is the simulation with temporary restorative materials of the result obtained in the waxing). These methodologies facilitate the inter-professional communication, with the patient and ceramist allowing prior analysis of the final result.[3]

This paper aims to present a clinical case report addressing aesthetic smile rehabilitation, applicability, surgical periodontal indication and protocols for preparation, molding and cementing of MICL's.

CASE REPORT

Patient N.F.B.F., 22 years old, female, presented in Clinic of the Dentistry School of the Federal University of Uberlandia (FOUFU) unsatisfied with the aesthetic appearance of her smile, reporting dental morphological alteration and presence of diastemas in the maxillary incisors (Figs 1 and 2).

Figure 1: Frontal view of face.

Figure 2: Frontal view of smile.

During anamnesis and clinical examination, it was found healthy teeth, with anterior teeth presenting short clinical crowns, due to the excess of gingival tissue, indicating the need for clinical crown lengthening. The occlusion was evaluated and favorable intermaxillary relationship was verified as well as sufficient space for rehabilitation with restorations, besides good occlusal stability and absence of wear facets related to parafunctional habits (Figs 3 and 4). In this way, aesthetic rehabilitation with MICL, with cervical-incisal and mesial-distal increase, was indicated on teeth 12, 11, 21 and 22.

In order to carry out this treatment plan, extra and intraoral photographic series of the patient and measurement of the dental structures sizes according to the protocol suggested by 11. The protocol was performed to create a virtual file, obtaining the digital planning, simplifying the diagnosis and the communication with patient, periodontist and ceramist.[3] By means of the analysis of digital planning the patient showed more enthusiasm with the treatment (Figs 5 and 6).

Figure 3: Occlusal pattern.

Figure 4: Clinical aspect of gingival contour. It was decided by aesthetic periodontal surgery.

Figure 5: Digital lines to collaborate on smile planning.

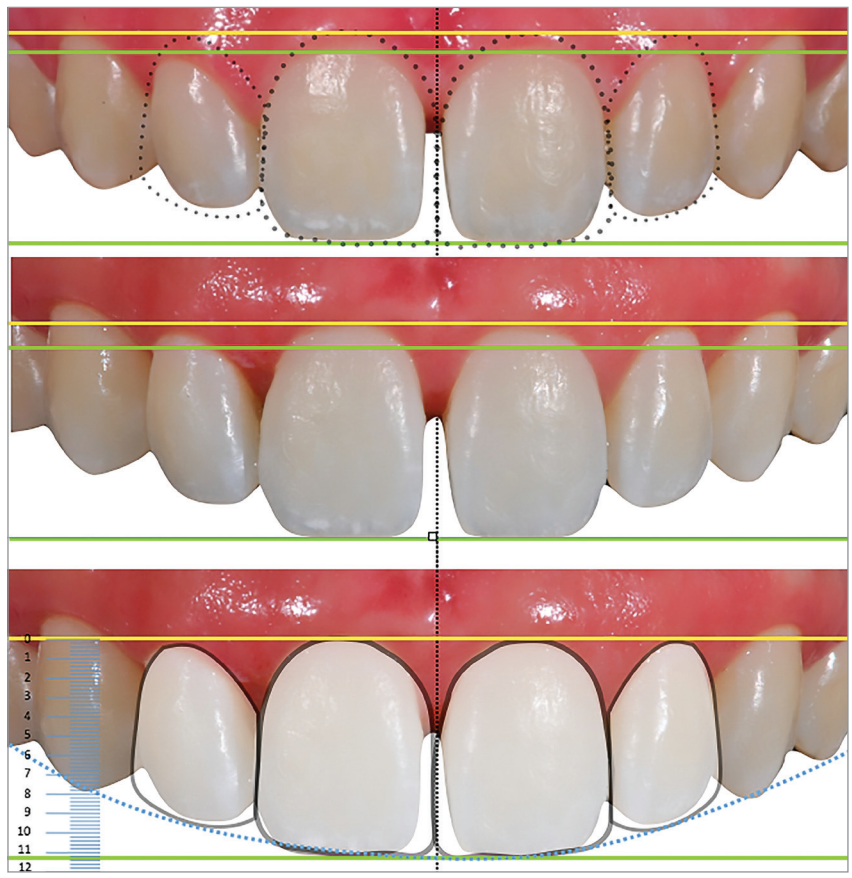

Figure 6: Virtual planning to help on clinician – technician's communication.

Periodontal evaluation was performed through clinical and imaging examination. After identifying the patient's periodontal biotype, a wide range of gingiva inserted and a large bone volume in the buccal board, a cone beam tomography examination was requested. The analysis of the images showed a contour of the alveolar ridge between 0.5 and 1.0 mm away from the cement-enamel junction of the teeth involved in restorative planning, a determining factor in the periodontal surgical procedure indication.

In order to expose the enamel of the teeth in question, an increase of the clinical crown was planned by means of osteoplasty and flap positioned apically. After local anesthesia (Mepivacaine 1: 100,000 New DFL, Brazil), periodontal surgery was performed with an increasing clinical crow purpose. The tissue excess over the elements from 13 to 23 was removed, the flap was displaced apically for bone access. Osteoplasty was performed by buccal osteoplasty to recontour the alveolar bone with spherical diamond tip (# 1801PM.6, KG Sorensen, Brazil) and conical diamond tip (# 440F KG Sorensen), on constant irrigation of sterile saline solution. After the procedure, and with the suture of the flap positioned apical to maintain the appropriate gingival contour (Figs 7 and 8). Were prescribed anti-inflammatory (Ibuprofen 400mg, 3 times a day for 3 days) and mouthwash with chlorhexidine 0.12%, twice a day, for 7 days, until the sutures were removed. After 60 days of periodontal surgery (Fig 9).

Figure 7: Periodontal surgery with kit Periodont (KG Sorensen).

Figure 8: Bone remodeling with kit Periodont (KG Sorensen).

Figure 9: 60 days follow up after periodontal surgery.

After sixty days of the periodontal surgery, the diagnostic waxing was prepared, following the reverse planning, through the measurements obtained from Digital Planning (Fig 10). Ceramic additions were planned on the buccal, proximal and incisal surfaces, this stage is named as Wax-UP. Two addition silicone guides were made from Wax-Up, one for guiding during the minimally invasive preparation (Fig 11) and the other for the preparation of Mock-UP (Fig 12). The wax-up was replicated in mouth with Bis-Acrylic resin A2 (Structur 2, Voco, Germany) (Fig 13 and 14). To ensure a better cervical contour and papillary contour, the guide was customized with cutouts on the cervical edges of the teeth, which facilitated the flow of the excess and improved the adaptation. The adjustments were then made through wear and increase, respecting the function and expectation of the patient.

Figure 10: Wax up for future ceramic veneers.

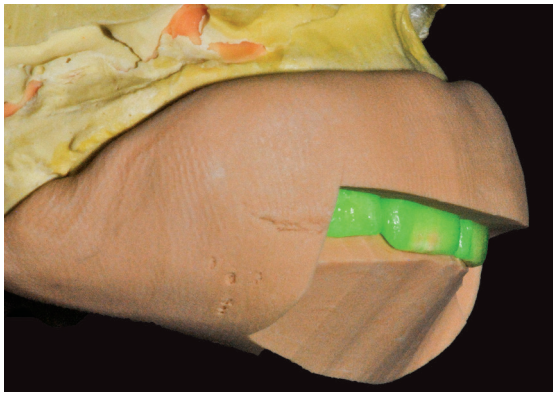

Figure 11: Silicon guide for dental prep orientation.

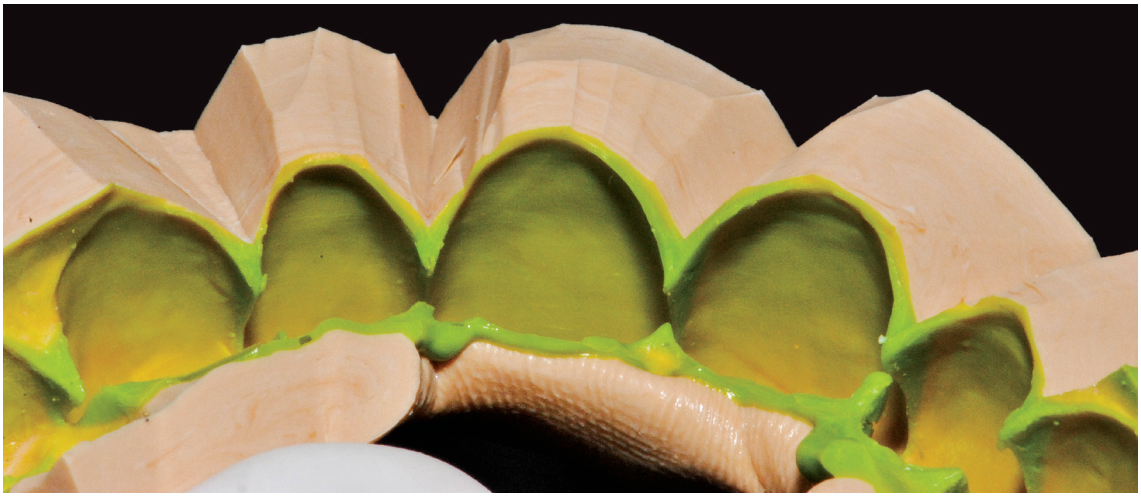

Figure 12: Adjust of Silicon guide for *wax-up*.

Figure 13: Final aspect of *mock-up* with bis-acryl resin.

Figure 14: Zoom view of *mock-up*.

Minimally invasive prepare were performed on the buccal surface of the teeth, with a conical diamond tip 2135F (Kit 6720, KG Sorensen) and high-speed turbine with constant irrigation (Cobra LED UV, Gnatus, Brazil) in the buccal and incisal region (Figs 16 and 17). To conduct the wear, the silicone guide was tested (Fig 18). This wear was superficial and sought to remove only the enamel that may interfere in the ceramic facet insertion (Fig 19). To facilitate the veneers adaptation, support was provided on the distal faces of the teeth 11 and 21, and on the proximal of teeth 12 and 22.

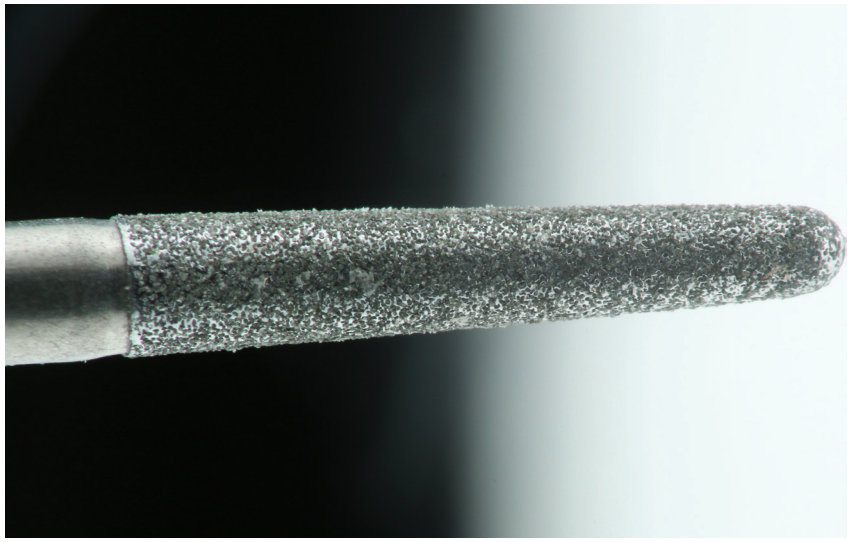

Figure 15: Position of Diamond bur 2135F for dental prep with Cobra LED UV (Gnatus).

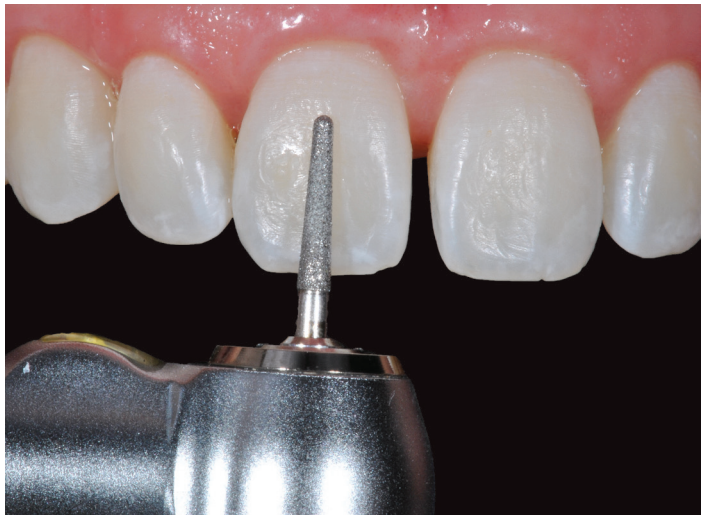

Figure 16: Diamond bur 2135F for incisal reduction.

Figure 17: Lateral view of Diamond bur position.

Figure 18: Silicon guide to calculate how many dental structure was removed.

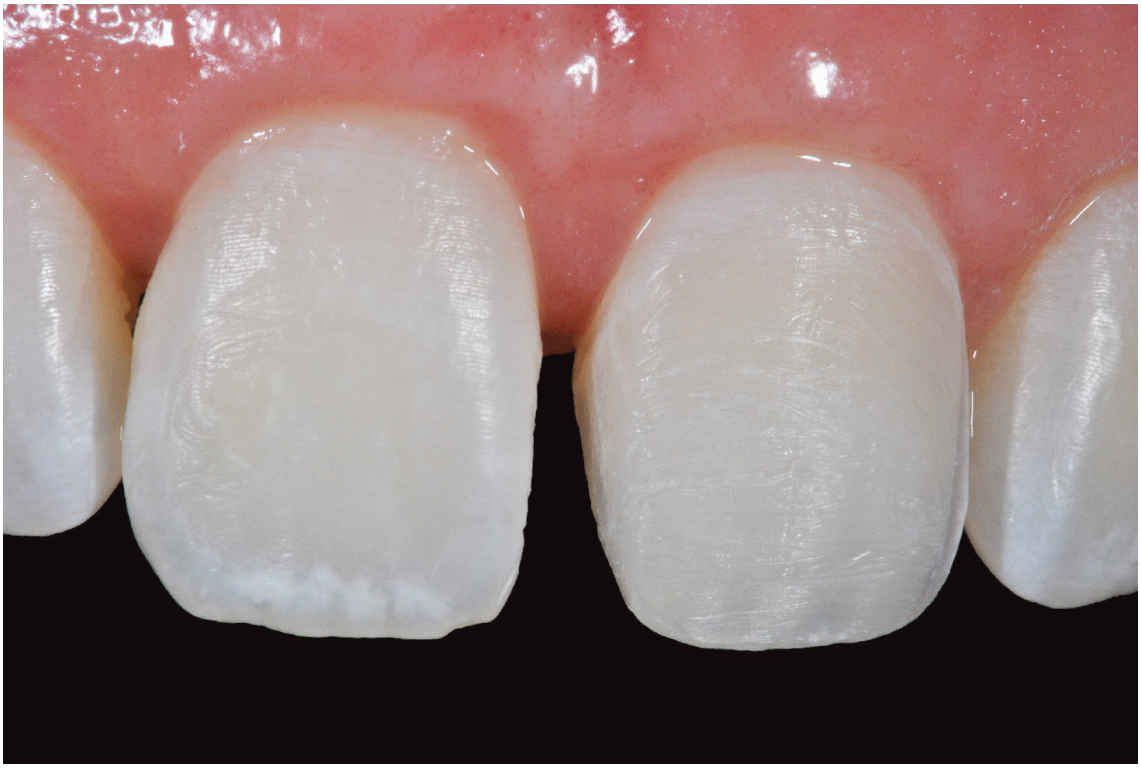

Figure 19: Comparison with maxillary incisors with and without minimally invasive preparation.

In the same session, the impression process was started with insertion of the retraction cord # 000 (Pro Retract, FGM) in the gingival sulcus (Figure 20), which allowed better impression quality of the cervical region. The impression was made with addition silicone (President, Coltene, Brazil) in a single step (Fig 21). Then, the work model for making the venneers was done (Fig 22). The facets did not involve the palatal face and had a mean thickness of 0.4mm (Figure 23). The wet proof of the pieces was applied with water-soluble gel application to reduce the friction and cracks propagation (Fig 24). Before the cementation stage, using the Try-In color A2 paste (Alcem Veneer Try-In, FGM) was carried out the test or simulation phase of the resin cement. This step is fundamental to evaluate the cement effect on the restorations final color (Fig 25). Then, under relative isolation, the dental substrate was prepared with the enamel surface treatment with 37% Phosphoric Acid (Condac, FGM) for 30s (Fig 26). It was washed with air-water spray for 30s and dried. The conventional adhesive system (Ambar, FGM) was applied using a brush (KG Brush Fine, Kg Sorensen) (Fig 27). The excesses were removed and not light-cured, which prevented possible maladjustments during the veneers insertion.

Figure 20: Minimally invasive preparation and retract cord insertion.

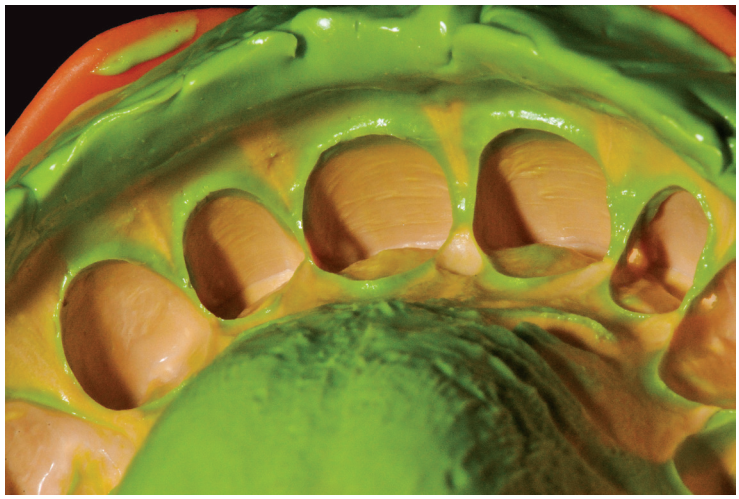

Figure 21: Single-step Silicon impression.

Figure 22: View of work model.

Figure 23: Ceramic veneers emphasizing incisal adaptation.

Figure 24: Try-In step of ceramic veneers with translucency gel.

Figure 25: Try-In step with color A2.

Figure 26: Surface treatment with phosphoric acid 37%, per 30s.

Figure 27: Bond application.

Subsequently, the Lithium disilicate veneers surface (e-Max, Ivoclar) treatment was carried out by conditioning with 10% Fluoridric Acid (Condac Porcelana, FGM) for 20 seconds 12 (Fig 28). After treatment time, the acid was washed and 37% phosphoric acid was applied for 60 seconds (Fig 29). Regular KG Brush (KG Sorensen) was used on friction motions for complete removal of the precipitate formed by the reaction of the acid with the silica. The acid was washed and dried.

The silane (Prosil, FGM) was applied using KG Brush (KG Brush Regular, KG Sorensen). The product was spread over the entire pre-conditioned inner surface, and 60 seconds await, which allowed chemical bonding of the ceramic with the resin cement (Fig 30). This was followed by the insertion phase of the A2 photo-activated resin cement (Allcem Veneer, FGM) carefully applied inside the veneer (Fig 31). After removing the excesses the cement was light-cured for 60s each edge of the piece, using photo with intensity 1200mW / Cm 2 (Radii-cal, SDI, Australia) (Fig 32). Excess removal and finishing and polishing were performed (Kit 8090D, KG Sorensen) (Fig 33).

Figure 28: Ceramic treatment with HF 10% 20s.

Figure 29: Cleaning with phosphoric acid 37%.

Figure 30: Silane application.

Figure 31: Insertion of resin cement.

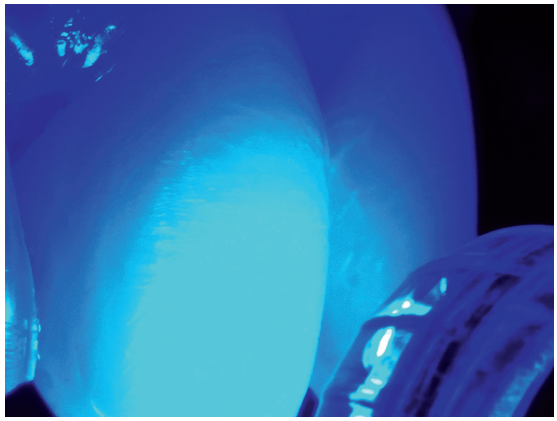

Figure 32: Light curing by 60s.

Figure 33: Finishing and Polishing with fine and extra-fine diamond burs.

The occlusion was verified on maximal habitual intercuspation and eccentric movements. The immediate result was functionally and aesthetically satisfactory (Fig 34 and 35), also observed by the 12-month (Fig 36), 36 months follow-up photos (Fig 37).

Figure 34: Frontal and lateral view after ceramic veneers bonding.

Figure 35: Final aspect of face view.

Figure 36: Satisfaction of patient after ending of treatment.

Figure 37: 3 years Follow-up.

Figure 38 Intra-buccal analysis after 3 years.

DISCUSSION

Anatomical variations are routine present in dental practice. Among them, diastemas affect, on average, 21% of the young population.[13,14] The presence of unwanted characteristics causes an imbalance of smile harmony, impairing beauty, functional pattern, phonetic, occlusion; can relate to the reduction of self-esteem and psychosocial well-being.[6,8,15] Thus, restoring a patient's dentofacial aesthetics is one of the most relevant themes of restorative dentistry.[1,16]

The fundamentals of aesthetics are based on the ratio between teeth and the perfect balance between white architecture (teeth) and pink architecture (gingival tissue).[16] The proportion that is based on the gradual sequence of the central incisor for the canine, called the golden ratio[17] and the aesthetic rehabilitations are related to the ideology of visagism, in which the characteristics of the individual are unique: based on originality, authenticity and individuality.[18]

Different rehabilitation protocols can be offered as treatment options, from the most conservative to the most invasive. The choice of technique and material is directly related to the cause of the aesthetic interference.[3,19] The achievement of the advancement of techniques and materials allows the application of a min-

imally invasive and conservative rehabilitation concept of dental structure. This concept is based on the theory of adhesion and conservation of dental structure.[6,19-21]

The minimally invasive preparations act only on the enamel surface, which allows to preserve dental structure differently from the conventional laminated veneers, which involve greater depth in the execution and consequent greater dental wear. In the same way, adhesion has its quality increased, due to the bond strength in the enamel being greater than in the dentin, using conventional adhesive systems.[3,22,23] The authors recommend that cementation of MICL should preferably be performed with cements (Photo-activated), because they present better working time and greater color stability.[2,3,12,19,20,24] Composite resin restorations have a more favorable cost and shorter working time[2,25,26] however, present a high failure rate when applied in large reconstructions,[27] color instability and failure rate of 2.9% per year.[28,29]

Ceramics are a great choice for indirect restorations for the ability to reproduce the appearance of natural teeth and present biomechanics similar to enamel. In addition, it exhibits resistance to compression and wear, surface smoothness, gloss and small plate buildup. The e-Max ceramic system (Ivoclar Vivadent, Liechtenstein) used in this case is a vitreous-based ceramic reinforced by the addition of Lithium disilicate crystals. This condition difficult cracks propagation inside the material, promoting the increases of its resistance and structural stability of the restoration. The failure index is between 0 and 5% in the period from 1 to 5 years.[10,30]

Treatment planning can be worked in conjunction with orthodontic movement, periodontics and ceramic restorations.[3,19] Reverse planning techniques can be used to facilitate communication with patients and collaborators (virtual planning, wax-up and mock-up). The use of periodontal surgery favors the length gain of the coronal portion, influences aesthetic improvement and increases adhesion area. The effective interaction of planning between professionals and patients associated with the choice of the appropriate technique and material provides the desired result for the patient to the aesthetic problem.

CONCLUSION

The association of the concepts of periodontics and dentistry, reverse planning and use of MICL's reinforced by Lithium disilicate allowed the functional and aesthetic rehabilitation of the patient's smile. These protocols allow for predictability, longer longevity of the adhesive interface and provide patient satisfaction and team success.

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