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Clinical Technique/Case Report

Esthetic Challenges in Rehabilitating the Anterior Maxilla: A Case Report

ME Miranda • KA Olivieri • FJF Rigolin
AA de Vasconcellos

Clinical Relevance

The reestablishment of esthetics and function of anterior teeth can be achieved with correct treatment planning using a conservative technique to condition soft tissues and full metal-free crowns to provide an esthetic smile.

SUMMARY

The rehabilitation of an unesthetic smile in the anterior maxilla is always a clinical challenge, especially when an improper shape and size, old restorations, and unesthetic shading are present. In addition, an irregular gingival zenith contour in the anterior maxilla can affect the smile's harmony. Thus, detailed treatment planning is needed to define a functional and esthetic prosthetic rehabilitation. This study describes a clinical case in which a 55-year-old woman was rehabilitated using Digital Smile Design planning and full ceramic crowns (metal free) in the anterior zone of the maxilla and mandible. To normalize the gingival zenith, a dynamic compression technique was performed using provisional restorations to condition the gingival tissues and harmonize the proportional length of the anterior upper teeth.

*Milton Edson Miranda, DDS, MS, PhD, graduate prosthodontics, director, São Leopoldo Mandic School of Dentistry, Campinas, São Paulo, Brazil

Karina Andrea Olivieri, DDS, MS, PhD, graduate prosthodontics, assistant professor, São Leopoldo Mandic School of Dentistry, Campinas, São Paulo, Brazil

Fernando José Ferreira Rigolin, DDS, MS, graduate prosthodontics, assistant professor, São Leopoldo Mandic School of Dentistry, Campinas, São Paulo, Brazil

Andréa Araújo de Vasconcellos, DDS, MS, PhD, Faculty of Dentistry, Federal University of Ceará, Sobral, Ceará, Brazil

*Corresponding author: Av. Barão de Itapura 2294 Cjs. 63-69, Guanabara, Campinas, São Paulo 13073-300, Brazil; e-mail: memiranda@memiranda.com.br

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INTRODUCTION

Oral rehabilitation using all-ceramic systems has become widespread all over the world because it is reliable and successful, considering its ability to simulate the optical properties of teeth in relation to color, surface texture, and translucency; low biofilm adherence;[1] wear resistance; and biocompatibility.[2] However, rehabilitation of unesthetic teeth in the anterior maxilla to achieve natural-looking restorations becomes a major challenge,[3] considering the presence of improper shape and size of the existing teeth, irregular gingival contour, and unesthetic shade. In addition, the dental professional and dental lab technician must work together closely to achieve the patient's expectation, as the esthetic outcomes are of utmost importance.[4]

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Figure 1. *Anterior view, with periodontal disease and unpleasant esthetics in the anterior zone of the maxilla.*

To obtain better predictability in esthetic rehabilitation using all-ceramic crowns, the design of dental restorations should be previously defined.[5] Digital Smile Design (DSD) is a useful tool that allows a detailed analysis of the patient's dental and facial characteristics through clinical, photographic, and diagnostic wax-up evaluations, enabling the identification of discrepancies in soft and hard tissue morphology.[6]

To provide an optimal esthetic appearance, adequate contour of the gingival zenith for the esthetic teeth is an important aspect that should be evaluated. The recontouring of gingival zeniths may be performed using periodontal surgery or a provisional restoration that conditions the soft tissue.[7,8] The first option may be performed using flapless surgery to remove the gingival tissue to create an appropriate clinical crown length.[7] From a clinical perspective, the second option is more conservative, considering that soft tissue conditioning is achieved using provisional restorations.[8] These techniques aim to determine the location of the crown margin, the final contour of the gingival zenith, and soft tissue architecture.

Therefore, the purpose of this article is to describe a clinical case in which the anterior area of the maxilla was rehabilitated using DSD planning, a dynamic compression technique was performed using provisional restorations to the conditioning of the gingiva, and metal-free ceramic crowns were placed.

CASE REPORT

A 55-year-old woman, in good general health, presented for treatment with the primary complaint of unpleasant esthetics in the anterior zone of her maxilla. An esthetic analysis of her teeth revealed periodontal disease, restorations that were old and

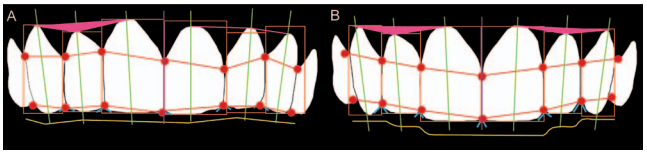

Figure 2. *(a) Initial arrangement of teeth; (b) Modifications and improvements in the anterior maxilla based on esthetic principles obtained using Digital Smile Design.*

not color matched, and an irregular contour of the gingival tissue in the anterior region of the maxilla (Figure 1). No temporomandibular disorders or parafunctional habits were reported.

Taking into account that the patient was positively motivated and wished to improve the esthetic appearance of her smile, a treatment plan was established based on a DSD protocol. For this purpose, impressions were made of the maxilla and mandible using an irreversible hydrocolloid (Hidrogun, Zhermack, Badian Polesine, Italy). Study casts (Kromotypo4, Lascod, Firenze, Italy) were fabricated and mounted in a semiadjustable articulator. In addition, a photographic protocol was performed, allowing a careful analysis of the horizontal reference plane, facial midline, color and smile design, tooth shape and arrangement, and DSD planning.[6]

Many modifications and improvements in the anterior zone of the maxilla based on esthetic principles were considered in the current case using DSD planning (Figure 2a,b). Initially, it was observed that the tooth axis and the gingival zenith contours were not satisfactory. In addition, the interproximal contacts and the height of interproximal papillae were irregular and unesthetic. Considering the dental arrangement, the initial design of the incisal edge and the balance of triangles of the incisors and canines were not satisfactory compared with a harmonic dental arrangement obtained by DSD planning.

With the study casts mounted on the articulator and modifications established with DSD, a diagnostic wax-up was obtained, enabling the observation of an ideal contour, size, shape, and occlusion of the anterior region of the maxilla (Figure 3a,b). The diagnostic wax-up was presented to the patient to confirm the treatment plan. The patient agreed with the treatment plan, which included using zirconia-reinforced ceramic copings for all anterior maxillary teeth, including premolars and anterior mandibular teeth.

Prior to initiating the prosthetic rehabilitation, periodontal treatment was performed, providing an adequate oral health for the patient. It is important

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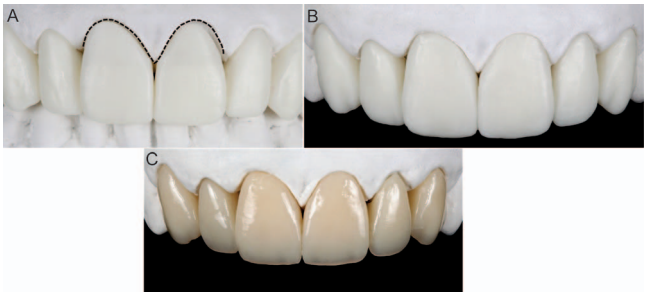

Figure 3. *(a,b) Diagnostic wax-up before and after creating the adequate gingival zenith contour, highlighting an ideal contour, size and shape; (c) Provisional restorations.*

to highlight the necessity of normalizing the gingival contour zenith to provide an optimal esthetic appearance; this was especially true for the left central incisor in this current case. A connective graft was the first treatment option discussed with the patient to reestablish the esthetic appearance for the left central incisor, considering that the gingiva on the right central incisor was too coronal compared to the left central incisor. However, the patient refused this treatment option. Another option to improve the esthetic appearance without surgical procedures was to use a dynamic compression technique with provisional crowns to condition the gingiva.

For this, provisional restorations were made according to the diagnostic wax-up (Figure 3c). This technique consists of a dynamic compression of the gingiva with a concave and a convex approach, performed weekly. Every week, a selective pressure was applied through the addition of light-cured acrylic resin (SNAP, Parkell, Farmingdale, NY, USA) on the cervical region of specific provisional restorations. After 4 weeks, adequate contour of the gingival margin was observed, greatly improving the esthetics of the anterior maxillary teeth.

The teeth were prepared, the provisional restorations were cemented (Figure 4), and the patient was followed for 4 weeks to condition the soft tissues and to achieve a regular gingival zenith contour in the maxillary anterior teeth.

To guide the treatment sequence, a silicone index (Speedex, Coltène/Whaledent Company, Altstatten, Switzerland) was fabricated according to the diagnostic wax-up. After soft tissue conditioning, the provisional restorations were removed, and shade selection was performed (Figure 5), trying to mimic the optical properties of the tooth structure.

For the final impression, retraction cord was used for gingival retraction (Ultrapak no. 0, Ultradent

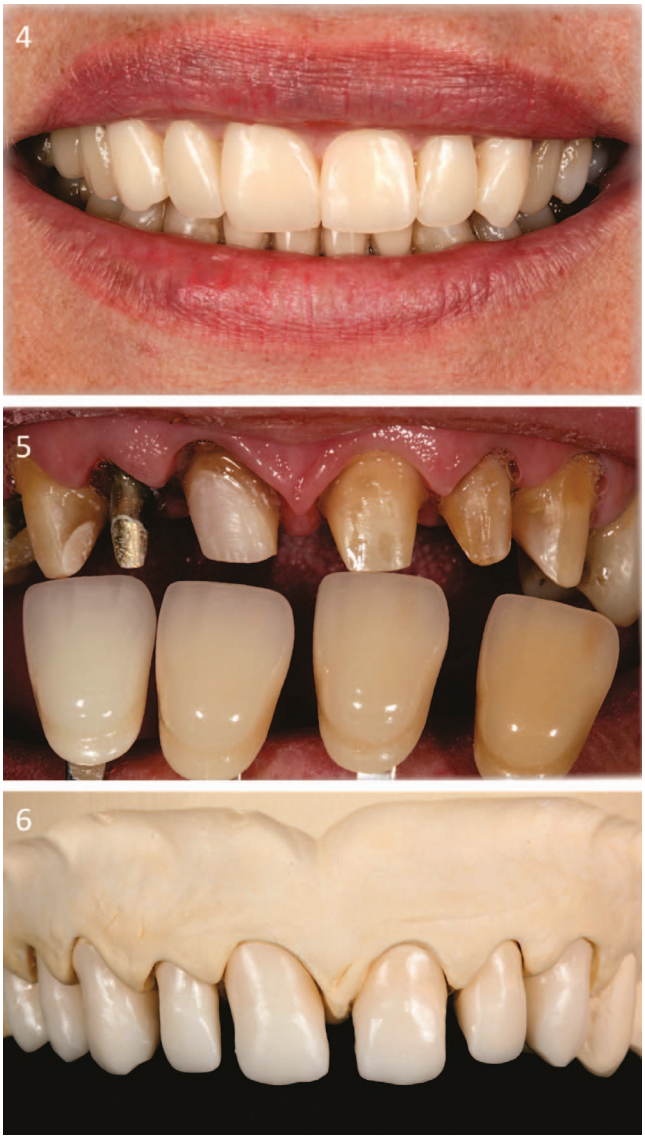

Figure 4. *Anterior view with provisional crowns.* Figure 5. *Tooth preparation and shade selection.* Figure 6. *Zirconia copings.*

Products, South Jordan, UT, USA), and a double-mix impression technique, with addition silicone (Elite HD, Zhermack), was used to reproduce the teeth and surrounding soft tissue. Working casts were obtained for the laboratory procedures.

To obtain the zirconia copings (Lava System, 3M ESPE, St Paul, MN, USA), a computer-aided design/computer-aided manufacturing system was used (Figure 6). In the sequence, the ceramic (IPS e.max Ceram, Ivoclar-Vivadent, Schaan, Liechtenstein) was fired in different steps over the zirconia copings to build the full ceramic restorations. During the ceramic application and firing, a silicone index was used based on the diagnostic wax-up to guide the

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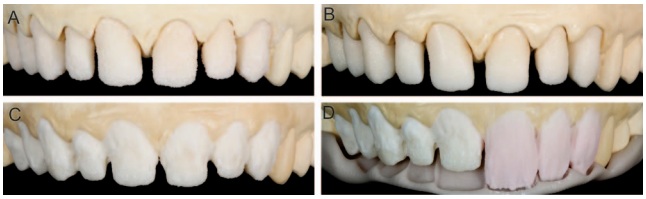

Figure 7. *(a-d) Ceramic firing based on the diagnostic wax-up using a heavy silicone index.*

previously defined esthetic principles related to size and shape (Figure 7a-d).

An interesting aspect related to the maxillary central incisor restorations is the difference in the gingival contour among the anterior teeth. In this case, the metal-free restorations were made according to the dynamic compression technique, with a concave and a convex approach. Therefore, considering a concave approach, the cervical border moves the gingiva down (Figure 8a), and with the convex approach, the cervical border moves the gingiva up (Figure 8b), resulting in a more harmonic gingival zenith aspect.

Before final cementation, a prophylaxis using pumice was performed. A resin cement was used (RelyX 100, 3M ESPE) to cement the final restorations. Careful positioning of the metal-free crowns occurred during cementation, and then the resin cement was polymerized for 40 seconds. During cementation, oral fluids and any hemorrhage process were controlled. Afterward, the excess resin cement was removed. The occlusal and interproximal contacts were assessed, and marginal adaptation was performed according to the established biologic and esthetic parameters. It was possible to observe the difference in gingival zenith contours during the soft tissue conditioning through the provisional restorations and after the prosthetic rehabilitation. The dynamic compression technique was an effective treatment to provide favorable esthetic results in this area with the regularization of the gingival zenith contour (Figure 9a,b). A beautiful and

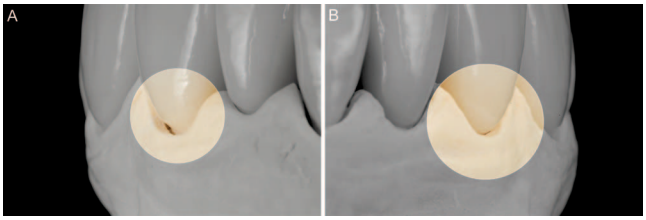

Figure 8. *(a) Provisionals used for tissue conditioning and (b) final ceramic crowns and the improved gingival zenith.*

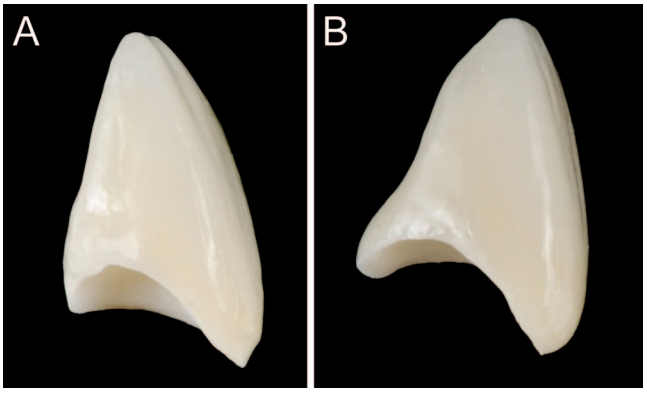

Figure 9. *Highlight to the (a) concave and (b) convex borders of the ceramic restorations.*

pleasant result was obtained, changing the patient's smile (Figure 10a-d).

DISCUSSION

The elevated expectation of patients and dentists for esthetic restorations has resulted in a trend to substitute metal-ceramic restorations with metal-free restorations.[9,10] The ceramic systems offer improved esthetics, biocompatibility, and long-lasting restorations and are an excellent alternative for the rehabilitation of anterior teeth, having been increasingly used with high success rates.[11]

To achieve esthetic and functional harmony, treatment planning is usually realized using wax-ups for diagnosis.[12] However, DSD was used initially in the current case for an esthetic diagnosis and to provide better communication with the patient and technician. When considering these aspects, a digital photography protocol allows better visualization and analysis of issues that are usually observed clinically.[6] In addition, it is possible to establish excellent communication with the patient to realize preferences related to shape, morphology, and size of the teeth and to forward all these aspects to the

Figure 10. *(a,b) Before prosthetic rehabilitation. (c,d) After rehabilitation, presenting a beautiful and pleasant result.*

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technician, increasing the predictability of the restorations.[13] With all this information, a three-dimensional wax-up may also be used for the mock-up and to guide the technician during ceramic firing.[14]

A challenge related to the esthetic smile in the present case is asymmetry among the anterior maxillary teeth, taking into account that the gingival contour was modified. The gingival zenith can be defined as the most apical point of the marginal gingiva.[15] However, the quantitative orientation of the gingiva in the mesio-distal and apico-coronal directions has not been reported in the literature.[16] A previous study showed that, in the upper anterior teeth, the gingival zenith of the canine is apical in relation to central incisors and that the gingival zenith of the lateral incisor is approximately 17% below the gingival line when considering the head positioned on the axial orbital plane.[17] These aspects are important as guidelines for obtaining predictable esthetic results.

To provide an adequate gingival zenith and achieve outstanding anterior esthetics with ceramic restorations, different techniques may be used. The periodontal modification may be performed using gingivoplasty, with or without the involvement of osteotomy or osteoplasty.[7] However, the discrepancy of the gingival zenith for the left upper central incisor was treated in the current case through a dynamic compression technique using provisional crowns. This technique consists of conditioning soft tissues in the esthetic area to establish an adequate emergence profile using a concave or a convex approach and provide harmony with the gingiva of the adjacent teeth.[7,8]

Ceramic restorations are widely used in the rehabilitation of anterior and posterior teeth, and many ceramic systems have been developed for clinical use.[18] Zirconia-based dental ceramics are stronger than conventional glass-ceramic restorations and have excellent mechanical strength properties.[19] They can be used to fabricate single crowns and three-unit fixed-bridge frameworks, considering that zirconia flexural strength is approximately 900-1100 MPa.[20] In the present case, zirconia copings were used for all restorations. However, a zirconia core is opaque and lacks translucency.[21] For this reason, IPS e.max Ceram was used over the zirconia copings to improve the esthetic appearance. This system consists of a nanofluorapatite glass ceramic distinguished from all previous ceramic systems by specific features, such as improved translucency and unique opalescent shades that are achieved with the help of opacifiers and ion coloring, while also providing high strength, considering that a very high crystalline content of approximately 70% can be included in the glass matrix to increase the strength without compromising translucency.[22,23] Thus, IPS e.max Ceram allows the creation of natural and lifelike restorations, with adjustable translucency, brightness, and opalescence combinations, which are characterized by improved stability, shape, and color.[24]

CONCLUSION

Successful anterior restorations can be achieved when using a detailed treatment plan and when considering the esthetic and functional parameters. The use of a conservative technique to condition soft tissues is attractive to the patient, and metal-free crowns improve the dental arrangement and shade matching, providing a pleasant smile for the patient.

Acknowledgement

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Regulatory Statement

This case was conducted at the São Leopoldo Mandic School of Dentistry, in Campinas, Brazil.

Conflict of Interest

The authors of this article certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company that is presented in this article.

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