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Clinical case

Maximum Preservation Aesthetic Treatment with Feldspathic Veneers in the Anterior Maxillary Sector

Floriberto Calixto-Arellano[1], Vianey Lino-Aguilar[2]

1. Profesor-Investigador. Maestría en Rehabilitación bucal. Facultad de Estomatología de la Benemérita Universidad Autónoma de Puebla, Puebla, Puebla, México.
2. Profesor-Investigador. Maestría en Ciencias Odontológicas en el área de Periodoncia con Implantología oral. Facultad de Estomatología de la Benemérita Universidad Autónoma de Puebla, Puebla, Puebla, México.

Correspondence author:
Floriberto Calixto-Arellano
E-mail: calixto.arellano@gmail.com

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ABSTRACT

Introduction: Current dentistry offers different aesthetic alternatives with minimal invasion. For patients seeking to improve dental appearance, the preparation of aesthetic veneers is a good alternative in the case of short clinical crowns, dental re-anatomization and color changes. **Objective:** To show the interdisciplinary treatment of a patient to improve the aesthetic conditions of the anterior maxillary sector in a minimally invasive manner. **Case Presentation:** A 21-year-old female patient attended a dental evaluation appointment. During the examination the following was observed: diastemas in the upper anterior teeth and short clinical crowns. After the smile design was carried out, aesthetic crown lengthening of teeth 13 to 23 was performed and then

oral rehabilitation began. **Conclusions:** When planning clinical cases in which dental aesthetics are involved, it is important to look for different options that together achieve good aesthetic and functional results. In this patient, dental aesthetics were achieved with maximum preservation procedures for dental tissues.

Keywords: crown lengthening, biological thickness, maximum preservation, dental aesthetics, dental veneers, adhesion, sandblasting, aluminum oxide.

INTRODUCTION

Aesthetic dentistry is an area that involves several disciplines ranging from preventive to surgical dentistry[1]. Among the aesthetic treatments are the placement of dental veneers and according to the glossary of prosthodontic terms, dental veneers are defined as thin ceramic restorations that repair the vestibular surface and part of the proximal surfaces of the teeth that require aesthetic interventions[2], indicated mainly for dental re-anatomization and, in a smaller number of cases, for dyschromia. The most commonly-used ceramics are those with a vitreous matrix, because they are more aesthetically pleasing, as compared to polycrystalline ceramics[3]. Natural glass ceramics such as feldspar are indicated for teeth without dischromia with more than 70% of enamel surface available[4], although their fracture resistance is lower (70-90MPa) before cementation[5]. Therefore, it is important to assess the risk of flexion resulting from interference in posterior centric relation, which tends to be greater when attached to dentin[6]. Another factor that influences the success of the restoration is the thickness of the restoration, which must be at least 0.5 mm, which improves the survival rate for feldspar, which can reach up to 91.77%[7].

Within macro aesthetics it is necessary to control some variables such as: incisal length, incisal profile, gingival levels and dental proportions, as well as phonation to determine the position of the incisal edges[8], without leaving aside the degree of exposure of the gum when smiling, the smile arc, the midline and the colour of the teeth[9]. In some cases, controlling incisal lengths requires controlling gingival levels, which makes it necessary to perform surgical procedures such as prosthetically guided crown lengthening.

Clinical crown lengthening aims to expose more tooth structure around a tooth or group of teeth[10]. Whether due to subgingival caries, crown or root fractures, altered passive eruption or short clinical abutment, as well as to eliminate gingival excess[11] and to achieve dento-gingival harmony. Thus, improve and correct gingival asymmetry and direct the position of the gingival zeniths to achieve dental proportions between homologues. The purpose for crown lengthening is to restore biological width[12].

On the other hand, the biological width is defined as the dimension of the soft tissue that joins the coronal portion of the tooth to the crest of the alveolar bone[13-14] involving the sum of the junctional epithelium and the connective insertion dimensions. The vertical measurements of the biological width are known thanks to the study by Gargiulo *et al.*[15]; however, such measurements are not constant, because they depend on the location/inclination of the tooth in the oral cavity, so they vary between teeth, their sites and gingival biotypes, and on average their length is 3 mm[16]. Therefore, the invasion of the biological width can cause lesions to the periodontal tissues, resulting in chronic inflammation of the soft tissues around the restoration,

bleeding on periodontal probing, gingival hyperplasia, gingival recession, periodontal pocket with clinical attachment loss and progressive loss of alveolar bone, in addition to difficulties in the adaptation of the restorations[16].

CLINICAL CASE PRESENTATION

A 21-year-old female patient came for a dental evaluation to improve dental aesthetics, because she did not like the spaces between the teeth in the anterior maxillary sector. The initial clinical examination included: analysis of the occlusal scheme (verification of the absence of posterior interferences in centric relation with a Leaf Gauge), verification of mutually protected occlusion, which did not require alteration, dentoalveolar radiographs and a photographic protocol. Additionally, clinical examination revealed a right-shifted midline with a raised incisal plane on the left side, diastemas between teeth 13 to 23 with small areas of incisal attrition on teeth 21 and 11 (Figure 1. a-c). The phoneme "S" was evaluated to determine the position of the incisal edge and establish dental proportions, as well as the position of the gingival levels.

Mounting was carried out on an articulator (Whip Mix 2000 Series, Model 2240, Whip Mix, Kentucky, USA) aided by facial reference glasses (Facial Reference Glasses 3.0, Kois Center, LLC, Washington, USA) and the LazrTrak together with the facial analyser (LazrTrak, Kois Dento-Facial Analyzer, Kois Center, LLC, Washington, USA) to establish the interpupillary, incisal and Camper planes. The dental dimensions were decided based on the available prosthetic space, from the vertex of the mesial papilla to the vertex of the distal papilla of the 2 maxillary central teeth to make a rule of 3 with 80% width and 100% length. A direct mock-up was made freehand with resin. The position of the incisal edge was recorded with polysiloxane to create the wax-up according to the dental proportions. The periodontal examination included clinical evaluation and periodontal probing. Good oral hygiene was observed without the presence of suspicious lesions in the mucosa and a healthy periodontium was diagnosed with a thick scalloped periodontal phenotype. According to the prosthetic indications, it was determined to perform crown lengthening of the anterior teeth 13 to 23, leaving a Class 1 aesthetic gingival line for the subsequent placement of the veneers.

Before starting the surgical procedure, the patient was asked to rinse her mouth with 0.12% chlorhexidine gluconate for 1 min and the extra-oral region was disinfected with povidone-iodine. Then, teeth 13 to 23 were anesthetized locally to make internal bevel and intrasulcal incisions, a full-thickness flap was elevated respecting the position and height of the interdental papillae, the ostectomy varied from 1-2 mm. Subsequently, the osteoplasty was continued and the mucoperiosteal flap was adapted with coronal suspensory stitches and simple stitches, and sutured with 6-0 polyglycolic acid (Figure 1. d-f).

At 90 days of healing (Figure 2. a), a polyvinyl siloxane impression was taken of each arch to produce a study model with type IV plaster (Super Rock, Kuraray Noritake Dental Inc., Okayama, Japan). Polyvinyl siloxane was selected because it offers stability and the possibility of obtaining more than one model with equal precision from the same impression. Later, a cross-mounting was performed with the new model and the previous mount, and an additive wax-up was performed with the characteristics of the real gingival architecture and ideal triangular-shaped teeth.

The wax-up was presented to the patient and after her approval, the mock-up was made. The model was immersed in soapy water for 30 minutes and the silicone key was made with

Figure 1. Initial case and crown lengthening. a. Initial photograph. b. Left dentoalveolar radiograph. c. Right dentoalveolar radiograph. d. Preoperative measurements. e. Surgical procedure. f. Suturing.

PVS using the double-intension putty-wash technique. Bisacrylic resin (3M™ Protemp™ 4, 3M Espe Deutschland GmbH, Germany) was applied for the mock-up without acid etching and excess resin was removed. From there, the aesthetics, position of the incisal edges at rest and their approximation with the antagonists in the "S" phonemes, as well as the dental exposure at rest and smile were evaluated to determine the correct location of the smile curve. This case did not require modification and the patient accepted the treatment plan with feldspar ceramic veneers.

A conservative approach was decided for tooth preparation. Typical enamel reduction for ceramic veneers is 0.3 mm in the cervical third, 0.5 mm in the middle and incisal thirds and 1.0 mm for the incisal overlay[17]. This classic veneer preparation is based on the thickness of the restorative material. However, in most cases, the average enamel thickness in the cervical area is less than 0.3 mm, 0.9 mm in the middle third and 1 mm in the incisal third[18].

There are two techniques for veneer preparations: those guided by the existing tooth surfaces and those guided by the final volume predicted by the wax-up. In our case, axial, coronal and incisal carving guides were developed (Figure 2. b-d), planning a horizontal insertion. Only incisal-proximal angle contouring was performed with Snap-on diamond discs to preserve most of the enamel structure and obtain a 1 mm space with the base of the wax-up, leaving a convergent face towards the palate. This allows for an ultra-conservative and long-lasting approach, since the length of the incisal edge of the natural tooth is not modified because it will become longer. During the carving, silicone keys were introduced to perform the ameloplasty in the strictly necessary places and preserve as much enamel structure as possible. All teeth involved in the treatment were prepared with the same technique and with relative isolation.

The colour was recorded before and after the carvings with the colorimeter (Vita classical A1-D4® shade guide, Vita Zahnfabrik, Bad Säckingen, Germany), and artificial gum (Gumy, Shofu Dental GmbH, Ratingen, Germany), to reduce the bias in colour perception. The gingival displacement was carried out using a double-thread technique impregnated with 25% aluminium chloride (Hemodent®, Premier Dental Co., Pennsylvania, USA) diluted 50% with double-distilled water. Because the difference between #000 and #00 threads is not clinically significant,

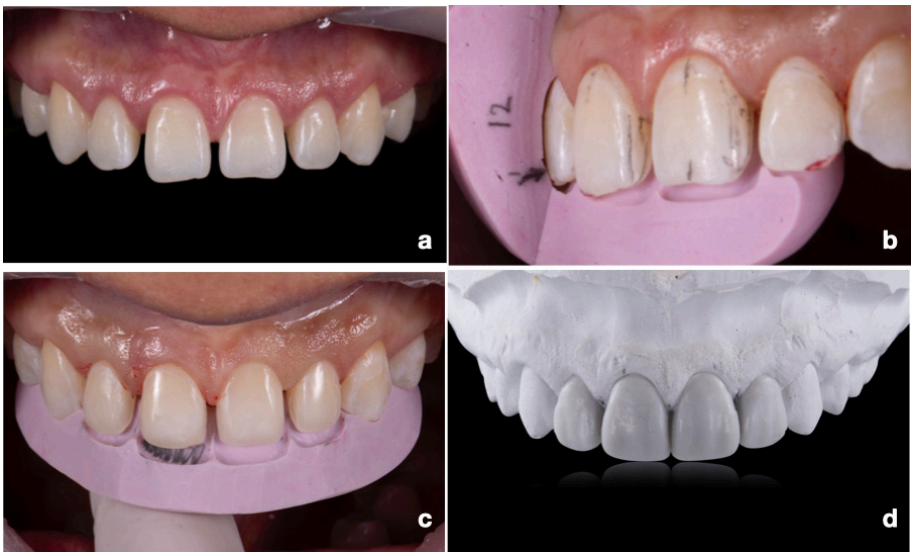

Figure 2. Beginning of rehabilitation. a. Healing of crown lengthening. b and c. Milling guides. d. Diagnostic wax-up.

thread #000 (0.89 mm thick) was placed at the bottom and #0 (1.14 mm) (Ultrapak™, Ultradent Products Inc., Utah, USA) on top for a period of 10 minutes. The impression technique used was dual-intension putty-wash, so while waiting for the thread, the putty impression (Silagum Putty, DMG Chemisch-Pharmazeutische Fabrik GmbH, Hamburg, Germany) was taken with plastic. At the end of this time, the outermost thread was removed and washed with mouthwash, rinsed with water, dried and the light silicone was applied (Figure 3. a-d).

After the final impression, the provisional restoration was fabricated using the silicone key from the mock-up. Before placing the resin, the finishing line was outlined with a pencil and the displaced gingival sulcus was avoided. The bisacrylic resin was injected into the silicone matrix and placed inside the patient's mouth, removing excess with a #12 scalpel blade.

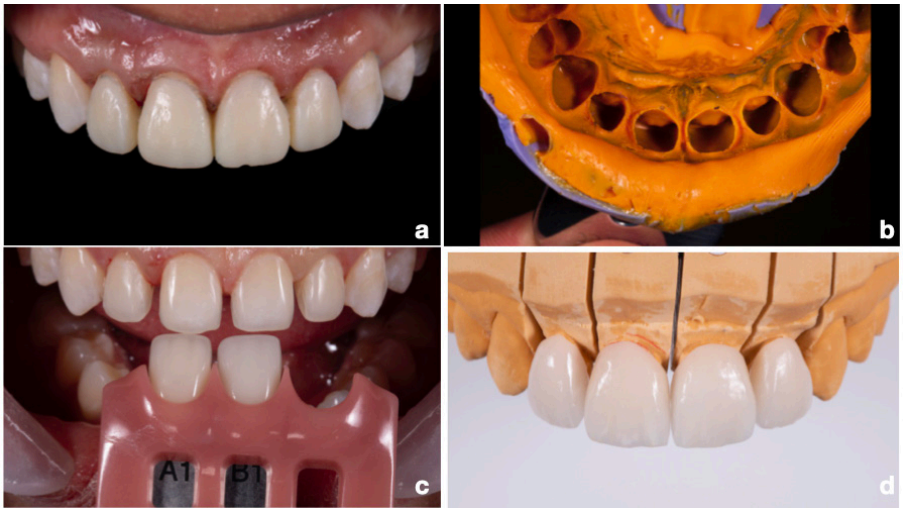

Figure 3. Tooth preparation. a. Post-impression provisionalisation. b. Definitive impression taking. C. Shade taking. d. Finished ceramic elements.

A feldspar-based glass ceramic was selected, passive settlement was checked and it was verified that it did not invade the gingival sulcus. In our case, cement colours were not tested because no colour changes were made with the restorations. The patient was anesthetized to avoid discomfort during the cementation procedure. Teeth 14 to 24 were completely isolated with a medium rubber dam (Dental Dam, Nic Tone®, MDC® Dental, Zapopan, Mexico), and prior degreasing was carried out with pure acetone on the shiny side, using Teflon on the cervical side to horizontally separate the dam (Figure 4. a). It was also verified that the isolation did not interfere with the passive seating of the veneers (Figure 4. b). The self-etching dual cementation system (Panavia™ V5 Kit, Kuraray Noritake Dental Inc., Okayama, Japan) and dental conditioning consisted of sandblasting with 50-micron aluminium oxide at 2.5 bar for 5 seconds each tooth, to perform selective etching for 10 seconds with orthophosphoric acid. It was washed thoroughly to apply the dental primer (Panavia™ V5 Tooth Primer, Kuraray Noritake Dental Inc., Okayama, Japan), the cement (Clearfil™ Universal Bond, Kuraray Noritake Dental Inc., Okayama, Japan) was mixed and placed on the restoration, excess was removed with a brush and polymerised. The above procedure was performed for each tooth while protecting the adjacent teeth with Teflon. At the end of cementation, glycerin gel (Panavia™ F 2.0, Oxyguard™ II, Kuraray Noritake Dental Inc., Okayama, Japan) was applied and polymerised through it. The isolation was removed and the occlusion and sealing of the restoration were verified by taking a dentoalveolar radiograph (Figure 4. c-d).

DISCUSSION

Maximum enamel preservation is crucial for the success of indirect ceramic veneers, which have proven to be predictable, long-lasting and conservative treatments[20]. This is why Edelhoff and Sorensen[21] demonstrated that the loss of dental substance in terms of weight when carving a maxillary incisor for a veneer is 16.7% of the weight in typodont. However, in the same natural tooth, it was determined that only 15.1% was lost. Based on this precept, a maximum preservation approach guided by mock-up was decided upon[22]. Therefore, a protocol

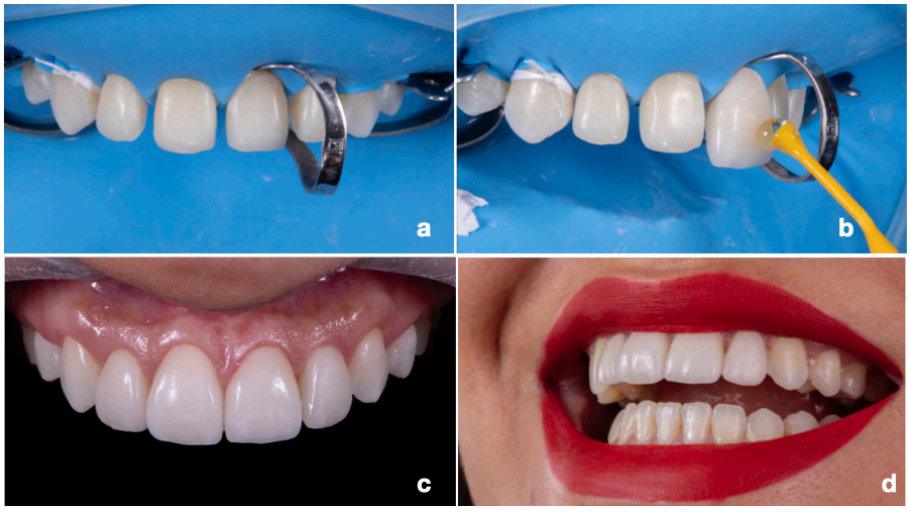

Figure 4. Completed case. a. Absolute isolation. b. Veneer seating test. c. Final cementation. d. Final smile.

determined by the aesthetic-functional diagnosis was established, which involved performing aesthetic crown lengthening prior to placing the final restorations. The crown lengthening procedure is performed to increase the length of the clinical crown for aesthetic and proportional reasons, without breaking the biological width. Similarly, these procedures are used to improve the appearance and retention of restorations placed within the aesthetic zone[20] by re-establishing the insertion of the supracrestal tissue. When this space is damaged, either with restoration margins or with apically positioned flaps, there is bone resorption, gingival recession, chronic inflammation or gingival hypertrophy[21]. The above was considered in the patient's case to avoid alterations in the periodontal tissues, the final prosthetic treatment began three months after the surgical procedure, and thus the free gingival margin was established in a final vertical position[23].

CONCLUSIONS

The clinical success of maximum preservation veneers depends on five main factors: enamel preservation, ceramic selection (etching ceramic), adhesion, occlusion, and periodontal biology. The ultraconservative preparation approach used in combination with crown lengthening facilitated clinical and laboratory success, and are also minimally invasive alternatives for the teeth. In our patient, excellent aesthetic and functional results were obtained because a good dental proportion was achieved by closing the present diastemas, helping to maintain periodontal health and stability.

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