

Importance of the Diagnostic Wax-up When Planning a Periodontal Surgical Guide in Esthetic Surgery

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Abstract: Periodontal plastic surgery may be indicated to re-establish smile harmony. The aim of this case report is to emphasize the importance of the diagnostic wax-up in the fabrication of a periodontal surgical guide to achieve success in esthetic surgery. In the case presented, during the preoperative testing of the guide, it was verified that the laboratory planning was incompatible with the patient's biological measures. Therefore, had crown lengthening been performed based solely on the guide, it would have caused irreparable sequelae, such as the removal of keratinized tissue and root exposure, which, in turn, could result in esthetic and functional consequences. In this case report, the periodontal surgical guide that was based on the previous diagnostic wax-up was an instrumental component in accomplishing an esthetic surgical outcome.

With an ongoing and ever-present demand for esthetic dental treatments, periodontal plastic surgery can be a significant option for patients who desire a harmonious smile.¹ An esthetic and natural smile is the result of multiple factors and its harmony depends on the relationship among tooth size, gingival zenith, gingival architecture, and amount of gingival tissue that the patient exposes when smiling.²⁻⁴ Dental exposure associated with gingival architecture has a major impact on smile composition.⁵ For a smile to be considered esthetic, the gingival zenith should be no more than 3 mm from the gingival margin.⁶⁻⁸

Patients with a “gummy” smile have a high smile line, with gingival display greater than 3 mm. There are different etiologies for a gummy smile and recognizing the reason(s) for it is fundamental to performing the correct diagnosis and determining the proper choice of treatment.^{9,10}

Depending on the diagnosis, gummy smile treatment may involve orthodontic therapy, periodontal treatment, orthognathic surgery, or a combination of these treatments. Surgical techniques have evolved with the emergence of the digital workflow, which has simplified the procedures while increasing the predictability of results.¹¹ The periodontal surgical guide is intended to direct the clinician during surgery. Thus, the guide must be stable and

demarcate the outline of the surgical incisions by accurately reproducing the initial planning.¹²

The objective of this case report is to underscore the importance of the diagnostic wax-up in the manufacture of the periodontal surgical guide to successfully achieve the planned esthetic surgical goals.

Clinical Case Report

The patient, a 27-year-old woman with leukoderma, presented desiring esthetic improvement of her smile. She had an intermediate gingival biotype with small papillae, a thin gingiva with a narrow attached gingiva band, and square-shaped maxillary incisors. The patient sought esthetic treatment to improve her smile through the modification of the size and shape of her maxillary anterior teeth.

For case planning, extraoral and intraoral photographs were taken (Figure 1 through Figure 3). An impression was taken, and a wax-up of teeth Nos. 4 through 13 was made based on the dental measurements to improve harmony and proportion among the teeth. Periodontal probing was performed, and the presence of gingiva covering the crowns of teeth Nos. 6 through 11 was verified.

In examining and planning the case, it was determined that periodontal plastic surgery would be needed to establish a new

gingival contour and increase clinical crown length, thereby meeting the patient's esthetic requests. Gingivoplasty would be performed only from tooth Nos. 6 through 11. The amount of gingiva to be removed would be aimed at making the smile more harmonious in relation to the other teeth.

In the laboratory, a periodontal surgical guide was made from the diagnostic wax-up of teeth Nos. 4 through 13, using a 1-mm thick acetate plate (Bio-Art, bioart.com.br) that was vacuumformed (PlastVac P7, Bio-Art) to avoid flexibility and instability (Figure 4 and Figure 5). This guide was intended to assist the clinician during surgery.

During the procedure, infiltrative anesthesia was performed with two tubes of articaine hydrochloride 4% with epinephrine 1:100,000 (DFL, dfl.com.br). The guide was placed in position and a periodontal probe was used to mark the zenith of each tooth (Figure 6).

Upon removal of the surgical guide, periodontal probing was conducted and new markings were made following the cemento-enamel junction (CEJ) as a reference (Figure 7 and Figure

8). After the second set of markings was made, a discrepancy of 3 mm could be observed between the markings at tooth No. 10 (Figure 9).

Due to the discrepancies between the marks, it was decided to perform the gingivoplasty without relying on the periodontal surgical guide, and instead follow the CEJ as a reference. The intention here was to preserve the keratinized gingiva and avoid root exposure. The crown lengthening was performed with a 15C blade (Figure 10), and the excision of the gingival layer was performed with a Gracey curette 5/6 (Figure 11).

After the excision, a new probing was conducted to analyze the biological width (ie, the distance between the CEJ and bone crest). In some locations, this distance was less than 3 mm and, thus, there was a need for bone recontouring, which was done with an Ochsenbein chisel (Quinelato, quinelato.com.br). In this case, no surgical repositioning of the gingival margin was done, and the patient did not need a suture because she had a short clinical crown and a thin buccal bone plate.



Fig 1. Extraoral photograph of patient preoperatively. **Fig 2 and Fig 3.** Intraoral preoperative photographs: right lateral retracted view (Fig 2) and frontal retracted view (Fig 3). Demonstrated characteristics of the patient's intermediate gingival biotype included small papillae, incisors with a rectangular characteristic, and contact surface in the interproximal regions. **Fig 4.** Diagnostic wax-up (teeth Nos. 4 through 13) based on the patient's dental proportions and dentofacial characteristics. **Fig 5.** A 1-mm thick acetate periodontal surgical guide was made from the diagnostic wax-up. **Fig 6.** Periodontal surgical guide in position and markings made following its delineation. **Fig 7 and Fig 8.** After removal of the guide, periodontal probing was done following the CEJ and new markings as references. **Fig 9.** Calibrated probe shows a 3 mm difference between the markings on tooth No. 10; the upper marking was based on the guide, and the lower one was based on the CEJ.

Extraoral and intraoral photographs taken 11 days post-treatment are shown in Figure 12 through Figure 14.

Discussion

When performing dental esthetic surgical procedures, detailed case planning serves to guide the clinical sequence that the dentist should follow. Essential components include a detailed dental history, photographic protocol, radiographs, study models, and diagnostic wax-up to provide a full preview of the case for use in both the surgical and prosthetic phases. Moreover, showing patients the planning can help make the treatment more palatable to them and easy to understand and can afford patients the opportunity to share their opinions and suggestions and ultimately give their approval to the proposed treatment. During the clinical evaluation, factors such as the gingival index, plaque control, periodontal biotype, occlusion, dental positioning, and restorative procedure to be performed should all be evaluated. If the clinician feels that any of these factors cannot be controlled, the treatment runs the risk of being completed without meeting the expectations of both the patient and the provider.

Currently, to obtain greater predictability and more detailed planning, a printed surgical guide can be used, which may be acquired through intraoral scanning associated with a cone-beam computed tomography scan with soft-tissue retraction, where both elements are then merged in a software program, enabling greater precision in the results. This technique, however, can be expensive and may not be readily available to some dentists. The periodontal surgical guide should be an accurate copy of the plan, rigid, easy to handle, and easily aseptic. This device is usually made from a wax-up of acetate or acrylic but can also be milled in CAD/CAM or 3D printed. The authors recommend using a periodontal surgical guide to perform crown lengthening because the procedure can be difficult and prone to errors without a reference.¹² At the time of waxing, the technician has no clinical information regarding the location of the CEJ and mucogingival line. The photographs, therefore, are important to serve as a reference.

Even so, it is extremely important to check the CEJ through probing during surgery in order to respect the biological limits and prevent failures, because one of the limitations when indicating this surgical technique is differentiating keratinized gingiva



Fig 10. Crown lengthening on teeth Nos. 6 through 11, which was performed with a 15C scalpel blade. **Fig 11.** Excision of the gingival layer, which was done with a periodontal curette. **Fig 12.** Extraoral photograph of the patient postoperatively. **Fig 13 and Fig 14.** Intraoral postoperative photographs: right lateral retracted view (Fig 13) and frontal retracted view (Fig 14). Note the preservation of keratinized gingiva, improved dental proportions, proper alignment, and no root exposure. **Fig 15.** In esthetic surgery, the positioning of the blade should be inclined to make an internal bevel, as shown in this example separate from the presented case, to avoid removing more tissue than necessary.

from mucosa. If there is any root exposure, it will be restored via the prosthesis with its anatomy already defined through the diagnostic wax-up. In cases of patients with full dentition, where the objective is only to expose the clinical crown, the guide may be optional because what will determine the position of the gingival margin is the CEJ, and this must be localized and checked by probing.

The position of the vestibular bone in relation to the CEJ and the amount of available keratinized tissue will determine both the gingiva that will need to go through excision and the choice of surgical technique (gingivectomy or flap surgery). The choice of surgical technique is determined through dentogingival tomographic examination or by surgically repositioning the gingival margin to visualize whether or not it is necessary to perform an osteotomy, otherwise there may be recurrence and/or invasion of the biological width. However, if there is only a small amount of keratinized tissue, the flap must be repositioned apically to preserve this critical tissue.^{13,14}

In surgery, when the guide is used as a reference, the inclination of the blade during the incision is extremely important; if the blade is inclined to make an external bevel, excess tissue may be inadvertently removed because there is a risk that the end of the incision will be 1 mm more apical than what was predetermined. This is because the incision is done at 45 degrees and the guide is 1 mm thick; thus, the positioning of the blade should be inclined to make an internal bevel (Figure 15). Another potential problem is the possibility of the incision in the demarcation of the proximal termination being lower than the ideal location; if this occurs, the papilla will suffer damage due to its more apical location.¹⁵

A strong indication of the need for a periodontal plastic surgery procedure is a situation of altered passive eruption, which is characterized clinically in adults by the bone crest being located close to and/or in contact with the CEJ. This configuration causes the gingival tissue to migrate more toward the apical region, leaving the teeth with an irregular shape (eg, more squared), which may compromise esthetics.^{7,9} This typically presents as anterior teeth that have a width equal to their coronal length.

The use of a periodontal surgical guide based only on the diagnostic wax-up, although indicated, is subject to error if the anatomy and biological characteristics of the tissues to be modified are not observed. In the case presented, if the procedure only followed the guide as a reference, the patient would have been left with sequelae, such as the removal of all keratinized tissue and resultant root exposure, leading to esthetic and functional consequences. Therefore, clinical examination with a periodontal probe to measure the distance from the gingival margin to the CEJ and the measurement of soft, keratinized, and mucosa tissues are extremely critical for a successful procedure.

Conclusion

In the case presented, the periodontal surgical guide, which was based on the previous diagnostic wax-up, was effectively used as an auxiliary method to achieve success in esthetic surgery, not discounting the knowledge and skill of the clinician. If the guide alone had been used as a reference, without clinical examination

using a periodontal probe to confirm dental measurements, esthetic and functional consequences would have resulted.

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