

The Use of Periodontal Plastic Surgery Procedures in Aiding Esthetic Restorative Results

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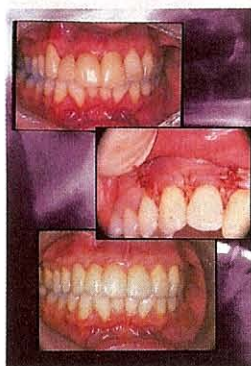
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Abstract: *The creation of an esthetic dental restoration with gingival harmony can provide a reconstructive challenge. The use of periodontal plastic surgical procedures can aid in evening-out the gingival margins and in creating ovate pontics that improve not only the overall esthetic result but also the phonetic result for the patients. Working closely with an esthetic-driven periodontal office using evidence-based procedures can set the stage for a truly esthetic restoration.*



Periodontal plastic surgery to correct esthetic and/or phonetic dilemmas has become the standard of care in many dental practices.¹⁻⁷ During the initial examination of the patient's dentition and periodontium, the astute clinician is able to use many of the current periodontal plastic surgery procedures to complement the final prosthetic result. Evaluation of the patients' needs and values through conversation frequently enables the dentist to help patients more fully appreciate what is possible, predictable, and evidence-based.⁸ Restorative esthetic-driven practices

working with restorative esthetic-driven periodontal offices in an interdisciplinary approach provide the patient with a comprehensive restorative team committed to total case success. Good communication between offices enables them to provide optimal care and results.^{4,5,7,9}

Periodontal plastic surgery procedures include subepithelial connective-tissue grafting for root coverage,¹⁰⁻¹² osseous clinical crown lengthening,¹³⁻¹⁸ and soft-tissue ridge augmentation.^{19,20}

Subepithelial Connective-Tissue Grafting

Subepithelial connective-tissue grafting¹² is a plastic surgery procedure with many applications and is used in single-recession, as well as multiple-recession, areas in class I and class II recession defects.²¹ Patient comfort is improved because primary closure of the palatal donor site is nearly gained and the blood supply minimally compromised by eliminating the use of vertical incisions on the palate. In addition, using aspects of the blood supply from the interproximal papillae, the underneath periosteum, and overlying partial-thickness coronally positioned flap enables predictable root coverage in the correctly treatment-planned cases (type I and type II²¹).

Factors important to success include a careful surgical technique, a papilla width of at least 3 mm for optimal blood supply to the graft, and the patient being a nonsmoker if possible.²²

Surgical Osseous Crown Lengthening

Regardless of whether surgical osseous crown lengthening is to be

Learning Objectives:

After reading this article, the reader should be able to:

- discuss the significance of correct diagnosis and treatment of esthetic-periodontal problems before the prosthetic phase of treatment.
- explain the importance of team communication between the restorative and periodontal offices.
- describe how the role of 3 different soft-tissue periodontal plastic surgical procedures can provide esthetic results.



Figure 1—Full smile of patient at presentation to periodontal office. Noticeable gingival asymmetry with gingival recession, especially at tooth No. 6, is seen.



Figure 3—Intraoral presentation to periodontal office. New fixed provisional at teeth Nos. 6 through 9.

treatment planned in the esthetic zone, adequate sound tooth structure of at least 3 mm to 4 mm is required to provide sufficient space for the biologic width and intracrevicular margin placement.^{23,24} This important determinant is often ignored or inadequately treated, creating a severe gingival response of biologic-width impingement,²⁵ which can lead to osseous-crest resorption or periodontal pocketing. When this procedure is attempted in the esthetic zone with gummy-smile reduction, it also can be used in the single-tooth application, when gingival asymmetry is present, or multiple-tooth application, as is the common practice. In this approach, when porcelain veneers or crowns are anticipated, final gingival marginal height is established first, which, with an average to high lip line, may cause extension of the procedure posteriorly to the maxillary first molars for an even flow of the gingival tissues. After the final margins are established according to esthetic determinants, the osseous crests are then reduced frequently using only a facial approach with special burs and osseous hand instruments. This helps maintain interproximal bone height and thus control postoperative recession and interproximal “black triangles.”

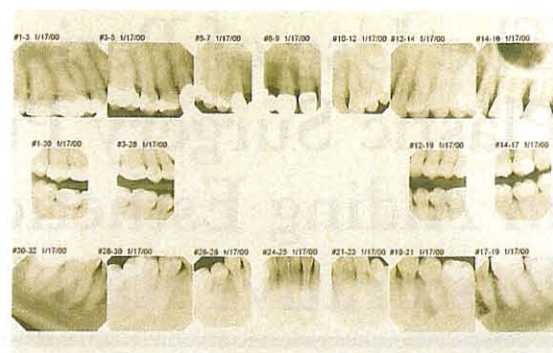


Figure 2—Full-mouth x-ray examination from presentation to restorative office.

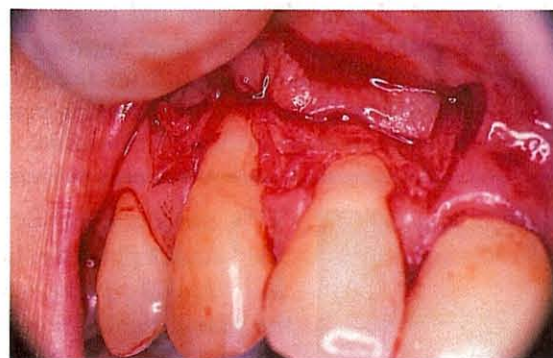


Figure 4—Subepithelial connective-tissue graft procedure on area of teeth Nos. 10 to 11 for esthetic root coverage. Root surfaces have been scaled and planed, reducing the convexity of the root surface and the surface area for coverage. Citric acid has been burnished on the root surface for 30 seconds. A partial-thickness flap has been created with vertical releasing incisions on the distal-buccal area of tooth No. 9 and mesial-buccal of tooth No. 12.

Osteoplasty of the facial interproximal bone with high-speed large round burs completes this procedure via festooning of the osseous architecture to allow for more favorable flap adaptation after the surgery and reduction of a thick-periodontium look when this case type is treated. As soon as the pre-prosthetic osseous surgery is completed, a 3-mm midbuccal dentogingival space should be measured (after suturing) to provide the healing space required for the biologic width of 2 mm and a crown margin of 1 mm to 2 mm.¹⁷

In the event that osseous surgery may be contraindicated in the esthetic zone because of the sacrifice of postoperative esthetics and phonetics for a single tooth, an alternative would be forced eruption (vertical extrusion) to convert a 3-tooth (minimum) osseous procedure into a single-tooth osseous procedure after its completion. If the crown-to-root ratio is poor, endodontic problems pre-exist, or an overinstrumented root canal presents itself with a conical-root forced eruption until tooth

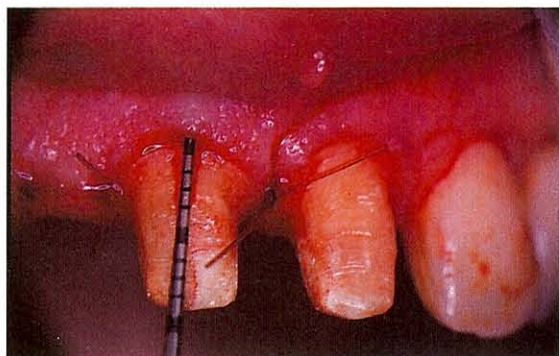


Figure 9—After suturing the maxillary anterior area, a 3-mm dentogingival space has been created to provide room for the biologic width.



Figure 11—Postsurgical follow-up appointment. Note extension of approximately 3 mm of soft tissue at the level of tooth No. 6, with the shortening of the provisional acrylic height. The area of tooth No. 7 has been bulked out facially with a soft-tissue augmentation procedure. The No. 8 apically positioned osseous surgery (crown-lengthening) procedure has been completed.



Figure 10—Pretreatment of teeth Nos. 6 through 8 in the provisional stage. Excessive length of tooth No. 6 is apparent because of history of facial recession.



Figure 12—Facial view showing improved gingival symmetry of teeth Nos. 6, 8, 9, and 11 at a postoperative surgical visit. Ovate pontic creation of tooth No. 7 is pending.

soft-tissue procedures to aid in providing the restorative dentist with an esthetic result.

The patient, who works with the public as a tennis instructor, was healthy (no medications, no allergies, and nonsmoker) with a history of diabetes on her father's side and periodontal disease on both sides. Her compliance history³⁰ to periodontal therapy was erratic, only receiving 1 professional cleaning a year. She admitted to parafunctional habits of clenching and bruxism. Her first bridgework was provided more than 20 years before, in the area of teeth Nos. 6 through 9. The patient's chief concerns were as follows:

1. Her cuspid teeth, Nos. 6 and 11, had significant facial recession and, in her words, looked "long in the tooth" in these areas.
2. Phonetic concerns with pontic space recession on tooth No. 7.
3. Uneven, asymmetrical gingival margins on teeth Nos. 8 and 9.

A periodontal clinical examination revealed an angle class I malocclusion with a 5-mm overbite and 4-mm overjet, as well as no

significant recorded mobilities. Gingival asymmetry was noted on the buccal-gingival margins of teeth Nos. 8 and 9 with inadequate zones of attached keratinized gingiva noted at teeth Nos. 5, 6, 11, 21, 22, and 26. Up to 6 mm of facial attachment loss (tooth No. 11) with 0 mm of attached keratinized gingiva (above noted teeth) were also observed. Generalized bleeding when probing was noted, especially posteriorly, in both jaws, with probing depths ranging from 4 mm to 5 mm in the maxillary molars and 4 mm to 6 mm in the mandibular molars. A ridge defect (class III¹⁹) was recorded in the edentulous area of tooth No. 7.

The periodontal diagnosis included: generalized mild periodontitis with localized moderate periodontitis; inadequate zones of attached keratinized gingiva on teeth Nos. 5, 6, 10, 11, 21, 22, and 26 (type I and type II²¹); parafunctional clenching and bruxism habit; gingival asymmetry in teeth Nos. 8 and 9; and soft- and hard-tissue defect on tooth No. 7.

Treatment Plan

The recommended periodontal treatment plan included nonsurgical periodontal therapy

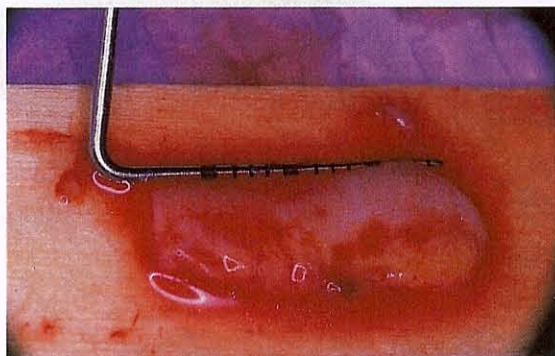


Figure 5—Connective-tissue graft taken from the upper left palatal donor site.

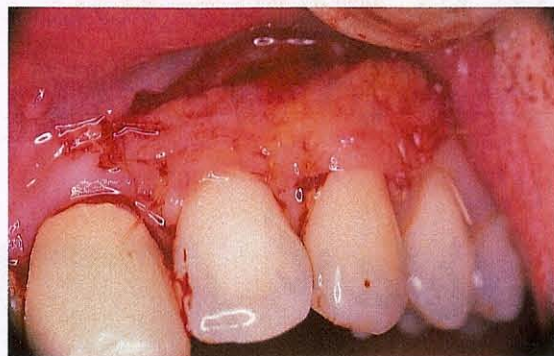


Figure 6—1-mm thick palatal connective tissue sutured into place with a Surgical Gut Suture—Plain (5-0).



Figure 7—Overlying partial-thickness coronally positioned flap located above the graft and sutured with GORE RESOLUT (6-0).



Figure 8—Osteotomy of the buccal osseous margin of tooth No. 8 to create osseous harmony with tooth No. 9.

extraction²⁶ may be a viable approach to solving this problem. This approach can be used if gingival margins of the tooth to be treated are at the same level as or apical to its contralateral tooth because extrusion will position the soft and hard tissues coronally. However, if the gingival margin is coronal to the contralateral tooth, extraction with immediate implant placement may be a treatment alternative because 1 mm to 2 mm of postoperative recession can be anticipated after extraction, which would be advantageous in creating a symmetrical gingival marginal height.²⁷

Soft-tissue Augmentation

The diagnosis and treatment of the soft and hard tissues in the esthetic zone via augmentation procedures depends on the prosthetic treatment plan. When a type III defect (both buccal-lingual and occlusal-apical loss)¹⁹ is present, the decision to create an ovate pontic or an implant restoration ultimately aids the surgeon in recommending a procedure based on the desired prosthetic treatment. If an implant is desired, a hard-tissue guided bone regeneration procedure may be necessary using autogenous and/or allograft or xenograft material,^{28,29} with a membrane to recapture the

lost osseous dimensions and prepare the site for adequate buccal-lingual dimensions of bone for an implant, after 6 to 9 months of healing.

Soft-tissue augmentation also may be required at the time of implant placement to fully create a buccal convexity of the tissues. However, if the same patient desires a conventional crown and bridge, the soft-tissue augmentation procedure, with either an onlay graft or connective-tissue grafts from the palate (or tuberosity) or the use of a dermal graft, would be more frequently recommended to create the illusion of the tooth coming out of the tissues using the principles of the ovate-pontic design. Unlike a ridge-lap pontic, the ovate pontic helps improve not only the esthetic but also the phonetic outcome.

Case Report

A 43-year-old woman presented to a restorative dentist with the following chief complaint: "I don't like my smile anymore." Esthetic concerns for her smile resulted from a failing crown and bridge and visible gingival recession (Figures 1 and 2). After a comprehensive examination, formulation of a tentative restorative plan was discussed, including referring the patient to the periodontist for



Figure 13—Pretreatment of the tooth No. 7 area (incisal view of buccal-lingual ridge defect of hard and soft tissue).



Figure 14—Postsurgical treatment of tooth No. 7 (incisal view) on the day of ovate-pontic creation. Note significant increase in buccal dimension of soft tissue.

and plaque-control reinforcement (with the restorative office). Provisionalization of teeth Nos. 6 through 9 was provided before the referral process (Figure 3). It was decided that periodontal plastic surgery would concentrate on the upper jaw because of financial constraints and would be completed in 2 surgical visits. The first surgery would involve free gingival grafting using the subepithelial connective-tissue graft on teeth Nos. 10 and 11, with the primary objective of increasing the zone of attached keratinized gingiva and the secondary objective of esthetic root coverage, with soft-tissue ridge augmentation on tooth No. 7 using the subepithelial connective-tissue grafting technique. The second surgery, 8 weeks later, would begin the gingival grafting procedures on teeth Nos. 5 and 6, with soft- and hard-tissue crown lengthening on teeth Nos. 8 and 9 and creation of an ovate pontic on tooth No. 7 (the previously treated augmented area).

Restorative therapy would begin at least 3 months after surgery with a maxillary hard acrylic night guard to control the patient's parafunctional habits. The final restorative plan would be for porcelain laminate veneers on teeth Nos. 4, 5, and 10 through 13, IPS Empress® 2^a fixed bridge on teeth Nos. 6 through 8, and a single IPS Empress®^a crown for tooth No. 9. Periodontal maintenance or recall would be scheduled every 3 months, with future gingival grafting procedures at the area of teeth Nos. 21, 22, and 26.

Prosthetic Phase

The original porcelain-fused-to-metal anterior restorative work was removed, and a temporary bridge was fabricated for teeth Nos. 6 through 9 (Figure 3). The temporary bridge

was fabricated from an alginate before removal of the old bridge. The abutment teeth were reprepared and examined for recurrent decay with Seek®.^b Crown build-ups were completed with ENCORE®^c build-up material, and temporary crowns were fabricated with Snap™.^d acrylic. The temporary bridge was cemented with TempBond NE®.

On May 23, 2000, after provisionalization, the first 2 periodontal plastic surgery procedures were completed. The patient was premedicated with chlorhexidine gluconate as a rinse, along with a methylprednisolone dose-pack and a non-steroidal anti-inflammatory drug. Using both sides of the palate for donor tissues, the site of tooth No. 7 was treated with a connective-tissue graft (10 mm × 7 mm × 3 mm) from the upper right palate and sutured with GORE RESOLUT (6-0)^e and a PRE-2 needle. The area of teeth Nos. 10 and 11 was treated using a connective-tissue graft (20 mm × 10 mm) from the upper left palate (Figures 4 and 5). Aggressive scaling and planing of the root's surface was conducted to reduce its convexity and thus reduce the total root surface area, followed by 30 seconds of citric-acid burnishing.

The Surgical Gut Suture—Plain (5-0)^f with a P-2 needle was used to suture the connective-tissue graft in place (Figure 6); the GORE RESOLUT (6-0) was used to hold the coronally positioned partial-thickness flap over the graft (Figure 7). Full coverage of the graft, providing a double blood supply (periosteum plus overlying coronally positioned flap),

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Figure 15—Ovate-pontic creation at tooth No. 7 with buccal gingivoplasty at the area of tooth No. 5 to thin the tissues.



Figure 17—Final full smile of patient after completion. Compare with Figure 1.

was completed. The palatal areas were primarily sutured with GORE RESOLUT material and covered with a prefabricated custom palatal acrylic stent to be worn by the patient for the first few days. No periodontal dressings were used for swelling in the area of tooth No. 7. The pontic was slightly adjusted to allow swelling, with minimal pressure on the grafted area.

The postoperative appointment on June 2, 2000, found the patient healing very well with no narcotic medication needed postoperatively. The patient noted minimal discomfort after the surgery. The sutures were then removed.

On August 8, 2000, the second periodontal plastic surgery procedure was performed. After local anesthesia was administered, full-thickness flaps with internal bevel incisions from teeth Nos. 8 and 9 were completed with a facial approach (Figure 8). A 3-mm distance to the osseous crest was created where the symmetrically designed gingival margins would be situated postsurgically, creating adequate room for the biologic width (Figure 9). This distance was created with hand instrumentation and osseous crown-lengthening burs. The provisional bridge on tooth No. 6 was facially reduced by removing the acrylic to the level anticipated for the gingival margin of the final restoration



Figure 16—Relining of provisional bridge, extending the margins of teeth Nos. 8 and 9 to the newly created gingival margins, as well as addition of acrylic into the created ovate-pontic space.

(Figure 10). The upper right palate was the donor for this subepithelial connective-tissue graft (16 mm × 10 mm), using a similar technique described.

The postoperative appointment was on August 29, 2000 (Figure 11). Sutures were removed in the area of teeth Nos. 8 and 9 only, and postoperative plaque control procedures were instituted using a 2-row toothbrush (GUM® Sulcus^h) in the area of teeth Nos. 8 and 9 and cotton swabs dipped in chlorhexidine rinse for 8 weeks in the areas of root coverage (Figure 12). On September 15, 2000, the provisional bridge was removed, the area of teeth Nos. 5 through 7 anesthetized, an ovate pontic created with an 8-round diamond bur, and a buccal gingivoplasty was conducted in the area of teeth Nos. 5 and 6 (Figures 13 through 15).

The patient returned to the restorative office approximately 6 months after the initial visit with the periodontist. During this time the temporary (provisional) bridge was modified to develop the ovate pontic form for an esthetic result in the final restoration. When the tissue maturation was complete, an alginate impression and a shade were taken to develop a diagnostic wax-up, a preparation guide, and a matrix for a temporary bridge to be fabricated out of a flowable composite resin (Matrixx™ Flowable^h) at the time of final preparation. This technique was used because of the need to temporize the teeth that were going to be restored with porcelain veneers. Tooth preparation included laminate veneer preparations for teeth Nos. 4, 5, and 10 through 13, as well as final preparations for teeth Nos. 6 through 8, with IPS Empress® 2 all-ceramic bridges. A single IPS Empress® crown preparation for tooth No. 9 was also made.

^hJohn O Butler Company, Chicago, IL 60630; (888) 528-8537



Figure 18—Final intraoral view of completed patient. Compare with Figure 2. Note gingival symmetry created, accomplishing the goals of the patient, restorative dentist, and periodontist.

The impression-taking procedure involved all margins being kept at or above the gingival height. No retraction cord was used for the impression technique. Splash!^{®i} was used for the final impression material, the impression was used in the single-phase wash with the addition of putty in 1 step, and a custom tray was used for the final impression. The bite was registered using PRESIDENT^{®j} polyvinyl registration material, and the final shade was selected. The temporary was fabricated in 1 piece using Matrixx[™] Flowable.

Each preparation was spot-etched for 10 seconds and then thoroughly rinsed and dried. The clear acrylic shell was fabricated from the wax-up, lined on the facial aspect of the laminated teeth, filled in the areas of the bridge and single crown with a flowable composite, and seated on the entire upper arch (Figure 16). A light was used to cure the composite through the clear acrylic shell. The shell was then removed, and the excess was trimmed with a Sickel scaler and fine flame-shaped diamonds.

The occlusion was checked in centric and lateral excursions for working and nonworking interferences. It was important at this time to assure the temporary was in contact where the ovate pontic was to be placed (in the area of tooth No. 7). If this were left deficient, the final restoration would not seat properly because of soft-tissue changes in this temporary phase.

Seating of the Final Restorations

The temporary was removed using scalers and bade pliers. When a composite is cured to full-crown preparations, it can be difficult to remove the temporary. Care must be taken not to fracture the tooth preparations, and all compos-



Figure 19—Final Panorex taken March 27, 2001.

ite material must be removed from the spot-etched areas. The preparations were cleaned with Concepsis^{®b}.

This part of the procedure was achieved without local anesthesia because of the need to evaluate the patient's smile-line dimensions. The laminates and bridgework were tried in with NEXUS 2^{™,c} try-in paste. The patient and the restorative dentist then evaluated the appearance and color. Local anesthesia was then administered, and the teeth were isolated with a split dam technique. The teeth were etched in 2 phases so they would not be left in the acid for over 20 seconds. Gluma[®] Desensitizer^k was applied for 30 seconds to rewet the teeth. Clearfil[®] SE Bond^l was used for the primer and bonding agent. The bonding agent was not light cured before seating the restorations.

The porcelain restorations were treated with saline, and the cement was placed into each restoration at once. No catalyst was used for this procedure, therefore allowing sufficient working time, and the operatory light was turned away from the teeth to prevent premature setting of the composite. Floss was placed interproximally and under the pontic space with the use of a floss threader. The composite was then spot-cured to tack the restoration in place. Excess cement was cleaned from the margins and interproximal areas. This technique keeps the clean-up after curing quick and the use of the hand piece minimal. Glycerin was placed on all margins, and the final cure was completed. The light exposure time was longer on the bridge and single crown because of the thickness of the porcelain. Final occlusion was evaluated centrically. Canine guidance was achieved with no working or nonworking interferences. Final polish was achieved with porcelain-polishing paste and rubber points (Figures 17 through 19).

ⁱDiscus Dental[®], Inc, Culver City, CA 90232; (800) 422-9448
^jColtène/Whaledent[®] Inc, Mahwah, NJ 07430; (800) 221-3046

^bHeraeus Kulzer, Inc, Armonk, NY 10504; (800) 431-1785
^cKuraray America, Inc, New York, NY 10022; (800) 879-1676

Discussion

Correct initial diagnosis of the case is the key to successful treatment.³¹ Esthetic results desired by patients frequently cannot be achieved without involving the restoratively oriented esthetic periodontist. The creation of an esthetic smile with proper phonetics may involve single or multiple procedures. Understanding patients by discussing their desires, concerns, and values enables practitioners to establish customized treatment planning. However, when it comes to handling soft tissues, the esthetic result can be compromised; often, the periodontist is not consulted, and a poor result with asymmetry may occur.

Lack of keratinized gingiva, resulting in further gingival recession or showing of new prosthetic margins, may also occur. Moreover, impingement on the biologic width may create a poor gingival response.³² Good communication with the dental specialist, in general, enables dentists to perform at the most state-of-the-art level with the highest predictability, while also sharing responsibility and liability.

Patients expect excellent results, and dentists have the materials and knowledge to impress their patients and themselves. This type of dentistry changes people's lives, boosting their self-esteem, and can be exercised routinely. Communication between all caregivers is essential in providing satisfactory outcomes.

Disclosure

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