

Esthetic Rehabilitation of the Maxillary Anterior Sextant: The Periodontal-Restorative Connection

The management of maxillary anterior esthetics has become more challenging as we enter the 21st century. Two factors have led to an increase in the number of anterior esthetic reconstructions being performed: society and technological advancement.

Society

"Looking Good"

Today's patients demand and expect more from dentists. The advertising industry and the media put pressure on individuals to look good. Success is associated with looking good; looking good is associated with feeling good. Research has shown this is true (*Psychology Today*, 119-131, November 1973). Research also has demonstrated that better-looking people achieve more financial success.

Good-looking models and actors are frequently used to sell products, movies, and magazines. One of the leading implant companies uses a nationally known model in their advertisements to market dental implants. A pleasing, esthetic, harmonious smile is one of the most powerful tools in the projection of a good-looking face. Patzer has shown that it is the most important factor in determining one's facial image.^{1,2}

The Dentist's Role in Appearance Enhancement

As dentists, we are in the unique position of being able to change people's appearances by changing their smiles. Dentists frequently are called on to play a significant role in a patient's overall physical reconstruction. I submit that the changes we, as dentists, are able to make for patients frequently result in a more significant and pleasant esthetic change than those performed by most plastic surgeons (Figures 1A through 1F). This series of photographs illustrates the improvement in this patient's appearance as a result of her dental treatment. The patient's cosmetic and functional rehabilitation was achieved through periodontal crown lengthening and restoration with porcelain crowns (**Creation® Porcelain, Jensen Industries, Inc.**). The change in her appearance and the way in which she perceives herself is obvious.

Technological Advances

Restorative Dentistry

The second factor that has led to an increase in the number of anterior restorations being performed is technological advancement, both in restorative dentistry and in periodontics. Improvements in restorative techniques have made it possible to re-create more natural-looking restorations. Porcelain crowns and veneers appear more lifelike. Light reflects and illuminates these restorations more naturally. Bleaching techniques



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have also improved and have undergone a significant revolution.

Periodontics

In addition, periodontics has experienced a renaissance in the last decade. Periodontics is no longer confined to the control of disease through pocket reduction.

In the past, periodontal surgery was associated with pocket elimination and esthetic disfigurement. This is no longer true. Periodontal treatment now includes the establishment of gingival health, as well as the esthetic amelioration of the patient.

The development of periodontal plastic surgery^{3,4} allows for predictable esthetic crown lengthening of teeth in the esthetic zone, as well as for soft-tissue grafting to cover denuded roots. The combination of these two techniques allows the surgeon to reconstruct dental gingival harmony in the esthetic zone. This creates the esthetic foundation for the restorative dentist to place a reconstruction.

A Case For Maxillary Anterior Esthetic Reconstruction

A 22-year-old woman presented to our office with the chief complaint that she did not like her smile (Figures 2A and 2B). She had completed orthodontic therapy 5 years before her initial visit. She was congenitally missing her left lateral incisor (tooth No. 10).

The space was closed during orthodontic treatment by moving the left canine (tooth No. 11) into the lateral incisor position, and the left first premolar (tooth No. 12) into the left canine position. In addition, her right lateral incisor (tooth No. 7) was shorter in an incisal apical direction than average. This left her with a multiplicity of anterior esthetic discrepancies. Radiographically, the tooth-size discrepancies are clearly evident (Figure 2C).

Ideal orthodontic treatment would have been to place the left canine in its proper position in the arch. This would leave room for a normal-sized left lateral incisor. This space could then be restored with a lateral incisor of ideal proportions. Restorative options could have included a single-tooth implant or a bonded bridge.

The patient was informed of this option, but she had no desire to undergo orthodontic therapy again. She requested that we esthetically rehabilitate her teeth in their present position. This left us with a number of esthetic discrepancies that needed to be addressed periodontally before any restorative treatment could be discussed.

The Esthetic Diagnosis

The esthetic diagnosis began with an analysis of the patient's smile line (Figures 2A, 2B, 2D, and 2E). It revealed asymmetry between the

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Figure 1A—Intraoral preoperative view reveals many alterations in ideal dental and dentogingival relationships. Anterior flaring, diastemas alterations in dentogingival heights, and teeth discolorations are evident.



Figure 1D—Postoperative smile view reveals improved appearance. Teeth are in better balance, and more tooth structure is shown.



Figure 1B—Smile view shows minimal display of teeth as a result of tooth wear and decreased vertical dimension.



Figure 1E—Preoperative facial appearance before beginning dental reconstruction.



Figure 1C—Postoperative restoration displays reestablishment of proper dental and gingival relationships. Cosmetic and functional improvement has been achieved through periodontal crown lengthening and crowning of maxillary teeth. (Restorative dentistry courtesy of Dr. Stephen Rothenberg, Darien, Conn. Ceramics courtesy of Taki Nishihata of St. Barthelemy, French West Indies.)



Figure 1F—Postoperative facial view. Esthetic appearance is greatly improved. Patient appears happier and more confident.

“lateral incisors,” teeth Nos. 7 and 11. Tooth No. 7 was too short in an incisal apical dimension, and tooth No. 11 was too long incisal apically.

Ideally, on smiling, the upper lip should show the height of contour of the central incisors and canines.⁵⁻⁹ One to two millimeters of gingiva should be seen above the lateral incisors. This patient revealed gingival tissue only above tooth No. 7. A slight amount of labial protrusion of tooth No. 11 was also evident (Figure 2B).

An intraoral view revealed additional esthetic discrepancies resulting in dentogingival dishar-

mony. Ideally, the apical extent of the dentogingival junction of the central incisors should be in line with the canines.⁵⁻¹⁰

The lateral incisor dentogingi-

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val junction should be approximately 1.5 mm incisal from a line joined from the dentogingival junction of the canines and the central incisors.

Bilateral symmetry should also exist between the similar contralateral teeth. In addition, the height of contour of the apex of the central incisors should curve slightly to the distal.^{5,7,8,10,11}

Central Incisor Discrepancies

The central incisors were in a fairly good position. The incisal edges were even, and the contact points appropriate. However, the height of contour of the gingival zeniths was not symmetrical. The

amount of tooth structure showing in the cervical thirds of the central incisors was dissimilar.

Lateral Incisor Discrepancies

Tooth No. 7 was almost a peg lateral; therefore, it was too short incisal apically. The distance between its gingival margin and the adjacent central incisor was almost 4 mm (Figure 2D). Compared to its contralateral lateral tooth (No. 11), it was significantly shorter. This was also because tooth No. 11 was too long incisal apically to be a normal-looking lateral incisor. In fact, the gingival margin of tooth No. 11 was apical to the central incisors (Figure 2E).



Figure 2A—Initial presentation of patient's smile. The “laterals” and “canines” are asymmetrical. Labial gingiva is seen apical to tooth No. 7 but not to tooth No. 11 (in the lateral position). Discoloration is also evident. Smile is not balanced.



Figure 2B—Intraoral view of initial presentation shows peg lateral (tooth No. 7) and asymmetry between laterals and canines. Gingival labial profile is not harmonious. Contralateral teeth are of different incisal apical lengths.

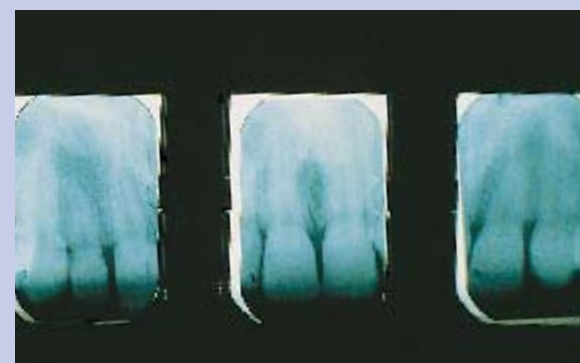


Figure 2C—Radiograph showing tooth No. 11 in the No. 10 position and tooth No. 12 in the No. 11 position. Bone levels appear good with absence of periodontal disease.



Figure 2D—Right lateral preoperative view shows short-ened lateral in need of crown lengthening. Central and canine relationships look good.



Figure 2E—Left lateral preoperative view shows canine in lateral position. Note minimal band of attached gingiva about canine. Dentogingival junction canine is apical to that of the central and adjacent premolar, giving an unbalanced appearance. Note the restoration in cervical third of tooth No. 11, which must be removed before gingival grafting.

Canine Discrepancies

Tooth No. 6 was the only maxillary anterior tooth that appeared to be in an ideal position. However, the dentogingival margin of its contralateral partner (tooth No. 12) was too incisal in comparison (Figure 2B) because tooth No. 12 was masquerading as a canine. Its dentogingival margin needed to be moved apically if it was to achieve symmetry with tooth No. 6. The labial shape of tooth No. 12 was also not in harmony with that of a canine.

The Treatment Plan: Identifying the Goals of Therapy

The first step in establishing any treatment plan is to develop and identify the goals of therapy. These goals are developed both by the patient and the treating dentist, especially when treatment is elective and of an esthetic nature. Congruent goals established at the outset facilitate good communication and improve the prognosis that both patient and doctor will be satisfied with the final result.

In analyzing a patient's esthetic rehabilitation, the periodontium must be addressed first. It is the foundation on which the final restoration will rest. Excellent oral hygiene must first be established, and gingival inflammation must be controlled. This patient presented with good home care, and pocket depth was minimal. The absence of any bone loss was verified radiographically (Figure 2C).

The goals of therapy were the creation of harmonious, esthetically balanced dentogingival relationships in the esthetic zone. In short, this patient wanted a pleasing, attractive smile. The periodontal requirement was correcting the dentogingival discrepancies described above. This

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Figure 2F—SCTG has just been completed. Root was treated with finishing burs and tetracycline. Note lack of bleeding and good tissue adaptation. Gingival margin has been repositioned incisally, which will lead to an increased amount of keratinized gingiva, as well as an improved esthetic result.

Figure 2G—Two-week postoperative healing of SCTG. Healing is excellent, and root coverage is anticipated. Improved dentogingival relationship is already evident.



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required both regeneration and reduction of gingival tissues.

Periodontal Treatment Plan

- Augment gingival tissue on the labial surface of tooth No. 11 to allow establishment of a proper dentogingival profile. This would be established with a subepithelial connective-tissue graft (SCTG).
- Crown lengthening the labial surfaces of teeth Nos. 7 and 12 to achieve balance with their contralateral partners.
- Reshaping, via gingivectomy, of the gingival zeniths of teeth Nos. 8 and 9 to establish bilateral symmetry of the central incisors.
- Reevaluation of the dentogingival architecture to assure stability and balance before proceeding with the final restorative treatment. The restorative treatment plan would not commence until the periodontal therapy was completed and deemed stable.

Restorative Treatment Plan

- Bonding of the labial surface of tooth No. 7 to re-create a natural, normal-sized lateral incisor.
- Full-coverage, all-porcelain restorations of teeth Nos. 11 and 12. The crown on tooth No. 11 would be fabricated so it would give the illusion of a lateral incisor. Similarly, the crown on tooth No. 12 would give it the illusion of being a canine.

Periodontal Clinical Treatment

The initial periodontal surgical procedure was an SCTG on tooth No. 11. This technique was originally presented by Langer and Langer¹² and subsequently modified by others.¹³⁻¹⁵



Figure 2H—Two-month postoperative healing of SCTG of tooth No. 11. Root coverage was successful. However, tissue is bulbous and crown lengthening is still indicated for teeth Nos. 7 and 12.



Figure 2I—Smile shot taken same day as Figure 2H. Note that gingiva is positioned more incisally on tooth No. 11. Compare to Figure 2A. However, teeth are still not symmetrical, and thickened tissue is seen over tooth No. 11.

When a combination of procedures is contemplated for an anterior reconstruction, the regenerative procedures are performed first because the final position of the free gingival margin with an SCTG cannot always be precisely determined. This allows the clinician to later modify the gingival margins with crown lengthening procedures to achieve a precise result. Also, although SCTGs have excellent success, individual patient variability can occasionally lead to a less-than-ideal result. Therefore, it is important to know what the potential for regeneration in this patient is before committing the patient to restoration and crown lengthening.

Phase One

In this case, tooth No. 11 was previously restored with a bonded restoration (Figure 2E), which was removed. After the administration of local anesthesia, the root of the tooth was meticulously root planed with high-speed **finishing burs (Brasseler USA®)** under sterile water irrigation.

Using a 15c carbon steel surgical blade, a split-thickness flap was then elevated from the distal of tooth No. 9 to the midroot of tooth No. 12. A tetracycline paste was prepared with 5 cc of saline and 500 mg of tetracycline and applied to the root with a cotton pellet for 5 minutes.

While the root was being treated with the tetracycline, an SCTG was harvested from the palate. The palatal wound was then closed.

The graft was sutured in place with **(5-0) gut sutures with a P-3 cutting needle (ETHICON, INC.)** (Figure 2F). Gauze pressure was applied for 5 minutes, and the patient was dismissed after receiving postoperative instructions.

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Figure 2J—Gingivoplasty was performed on tooth No. 11 to eliminate thickened tissue. Stage-one crown lengthening initiated on tooth No. 12. Note two vertical incisions at the mesial and distal labial line angles of tooth No. 12. Papillae are not touched. Only labial osteotomy is performed on this day.

Figure 2K—Stage one of two-stage crown lengthening being performed on tooth No. 7. Osteotomy has just been completed. Two vertical incisions were made at the labial line angle to allow access to the labial bone of tooth No. 7. The anticipated free gingival labial margin of tooth No. 7 will be 3 mm from the crest of bone. A slight gingivectomy was also performed on the labial of teeth Nos. 8 and 9 to improve esthetics.



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The patient was instructed to rinse with **Peridex® (Zila, Inc.)** mouthwash for 4 weeks and suspend all mechanical oral hygiene over the grafted area for 4 weeks. She was also placed on a soft diet for 2 weeks. The patient was seen weekly for follow-up care.

At 2 weeks (Figure 2G), the graft tissue was edematous and reddened. About 5 mm of root coverage was seen; this was a good sign that necrosis did not exist.

We waited 2 months for complete healing and maturation of the graft before proceeding with any of the associated crown lengthening procedures. We wanted complete stability of this area before altering any of the other dentogingival relationships (Figures 2H and 2I).

Phase Two

The second phase of periodontal treatment is the performance of a two-stage crown lengthening procedure on teeth Nos. 7 and 12. This technique was introduced recently in the literature by the author.⁷ The indication for this technique is the necessity of removing bone to expose more clinical crown in an esthetic area.

Briefly, this crown lengthening technique is performed in 2 surgical visits separated by 6 weeks. The first visit, the stage-one procedure, is the elevation of a flap and performance of an osteotomy. The flap is then replaced to its original position and allowed to heal.

Six weeks later, the second stage procedure, a gingivectomy, is performed. The benefit of staging the procedure is to better control the final position of the free gingival margin. Frequently, there is much edema after the osteotomy procedure, and the position of



Figure 2L—The flap is sutured in place with (5-0) gut suture after ostectomy. An attempt is made to reposition tissue. Healing should be uneventful as a result of atraumatic handling of the tissues.



Figure 2M—The labial flap over tooth No. 12 is seen sutured after ostectomy. Note the reddened denuded tissue over tooth No. 11, which has just received a gingivoplasty.

the flap margin can change depending on the amount of recession and resolution of swelling.

Flap surgery also results in bone resorption, especially in thin labial bone. This can alter the final position of the free gingival margin. Therefore, staging the procedure gives the clinician much greater control of the final position of the free gingival margin. This is extremely critical when the goals of therapy are cosmetic in nature and the clinician is working in the esthetic zone.

First Stage—The first stage is the elevation of a flap and ostectomy (Figures 2J and 2K). Initial incisions are made with a 15c carbon steel surgical blade at the mesial and distal labial line angles of the teeth that are to be lengthened. Care is taken not to reflect the papilla.

After elevation of the flap, bone is removed to a point 3 mm to 4 mm from the anticipated free gingival margin. This allows room for the biologic width reform. At least 3 mm are necessary for the sulcus, epithelial attachment apparatus, and the connective tissue attachment.¹⁶⁻¹⁹ This is quite predictable.¹⁷ The flap is then replaced and sutured using (5-0) gut sutures with a P-3 cutting needle at or close to its original position (Figures 2L and 2M).

During this patient's stage-one crown lengthening procedure, two other minor surgical procedures were also completed. Gingival dermabrasion was performed over the previously grafted tooth No. 11 (Figures 2K and 2M).

Quite often, healing of the SCTG results in slightly bulbous tissue, and a minor gingivoplasty must be performed to idealize esthetics. A gingivectomy was also performed on teeth Nos. 8

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Figure 2N—One-week postoperative healing after stage-one crown lengthening and dermabrasion. Healing is proceeding well.



Figure 2O—Six weeks after stage-one crown lengthening, the patient was scheduled for second-stage surgery—a gingivectomy on the labial surface of teeth Nos. 7 and 11. Slight gingival reshaping was also performed on the mesial labial of tooth No. 9.

and 9 to place the gingival zenith of these teeth slightly distal to the midline (Figure 2K).

One week after these 3 procedures (gingivoplasty of the SCTG, gingivectomy of teeth Nos. 8 and 9, and stage-one crown lengthening), the healing appears uneventful (Figure 2N). The gingival tissues are slightly reddened. The crown-lengthened sites, teeth Nos. 7 and 12, were then allowed to heal for 6 weeks.

Second Stage—The final periodontal surgical procedure is the stage-two crown lengthening, a gingivectomy of teeth Nos. 7 and 12 (Figure 2O). This minor procedure takes just a few minutes. Healing is usually complete within 7 to 10 days.

Restorative Temporization

Two weeks after the gingivectomy, healing is complete (Figures 2P and 2Q). The restorative dentist is given the go-ahead to temporize teeth Nos. 11 and 12 (Figure 2Q). Note that the cemento-enamel junction (CEJ) of tooth No. 7 is now exposed (Figure 2P). This will eventually be bonded.

The restorative dentist now has the freedom and time to work out the proper esthetic relationships between teeth Nos. 11 and 12 and their contralateral teeth, Nos. 6 and 7. The restorative dentist maintained the patient 5 months in the provisional phase before the final impressions were made.

Provisionalization Phase

The importance of the provisionalization phase cannot be overemphasized. This is the “dress rehearsal.” It is during this phase of treatment that the patient’s input is sought. Nuances of shape, form, emergence profile, embrasure space, oral hygiene,

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Figure 2P—Right side 2-month postgingivectomy healing is complete. Note the CEJ is now exposed on tooth No. 7. However, the gingival labial position is in harmony with teeth Nos. 6 and 8.



Figure 2Q—Left side 2-month postgingivectomy healing is complete. Teeth Nos. 11 and 12 are now in provisional restorations.

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and function can be established.

As soon as the dentist and patient are satisfied, the final impression can be made, and the final restoration can be fabricated. All too often, dentists tell patients not to worry about the “temporary crowns” because they are only the temporaries. Dentists frequently say to patients, “We will fix this in the final restoration.”

Without a well-fitting, functional, and esthetic provisional, it is impossible to predictably deliver a final restoration that is always esthetic, functional, and in proper relationship to the underlying periodontium.

The time spent in fabricating an excellent provisional restoration is time well spent. In fact, it actually saves time for the patient, dentist, and laboratory because the provisional serves as a model for the final restoration that is easily communicated to all members of the dental team.

Patient satisfaction is higher because they know what the final restoration will look like before it is delivered. More importantly, patients become our co-therapists and have input into the restoration they will ultimately receive because they have an opportunity to wear it.

Lastly, the laboratory has a model of the final restoration so they do not work blindly. An alginate impression of the provisional serves as a guide for the laboratory technicians. In short, everyone works from the same page with maximum information.

Porcelain Restorations

The final, all-ceramic porcelain restorations (**In-Ceram®**, **Vita Zahnfabrik, Germany**, distributed in US by **Vident™**) for this patient were a recapitulation



Figure 2R—Right side final restoration. The harmony between teeth is excellent. Tooth No. 7 received a bonded restoration. Compare to Figure 2D. (Restorative dentistry courtesy of Dr. Jon Chadys, Monroe, Conn.)



Figure 2S—Left side final restoration. Full-coverage, all-ceramic crowns are present on teeth Nos. 11 and 12. Crowns give the illusion of teeth in their normal position. Note the newly established healthy gingival position on tooth No. 11. Compare to Figure 2E.



Figure 2T—Occlusal view of completed restoration. Note how the all-ceramic crowns on teeth Nos. 11 and 12 attempt to mimic teeth Nos. 10 and 11.



Figure 2U—Intraoral view of completed restoration. To the untrained eye, tooth No. 12 appears to be a canine, and tooth No. 11 appears to be a lateral. Note the improved dentogingival relationships established through the combination of gingival grafting and selective crown lengthening and gingivectomy. Compare to Figure 2B.



Figure 2V—Extraoral smile view shows gingival harmony and symmetry. Compare to Figures 2A and 2I. Patient is very pleased.

of her provisional restoration. The provisionals were not fabricated until the position of the dentogingival complex was established and stabilized. Periodontal surgery was performed precisely and under control in a step-by-step fashion. This led to a predictable result and a satisfied patient.

The final restoration (Figures 2R through 2V) reveals symmetry between the laterals and canines. The gingival margins are idealized. An occlusal view reveals how the eye is fooled by changing the shape of teeth Nos. 11 and 12 with crowns (Figure 2T). The smile shot reveals ideal gingival symmetry and harmony (Figure 2V). Note that gingiva is now visible above both lateral incisors.

The Final Reward

The genesis of the final restoration was in the diagnosis and treatment planning.

Coordination between periodontist, restorative dentist, and laboratory was essential in the achievement of a predictable final cosmetic result. A satisfied patient, whose expectations were not only met, but exceeded, was the final reward.

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Product References

For more information on the products mentioned in this article, please see contact information below.

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