

A Complex Maxillary Anterior Esthetic Case Study: Interdisciplinary Approach

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In recent years, implant dentistry has been increasingly influenced by esthetic considerations. In addition to successful osseointegration, the implant restoration must be surrounded by a soft and hard tissue environment in harmony with the existing dentitions. Often, managing complex dental implant patient with demanding esthetics requires a multi-disciplinary approach involving orthodontics, periodontics, dental implantology, restorative dentistry, and dental occlusion. Furthermore, these disciplines must be employed in proper sequence to render a treatment, which is effective, practical and patient oriented.

Frequently the cause of the failure to satisfy the esthetic needs of the patients starts with inadequate examination of the soft and hard tissues surrounding the surgical sites and the natural dentitions. This leads to incorrect diagnosis, which leads to incorrect treatment plan. Incorrect treatment plan combined with selection of inappropriate surgical approaches or techniques will result in disastrous esthetic outcomes. Therefore, proper treatment starts with thorough examination of the patient and the surgical sites. Depending on the patient's circumstances, different treatment options can be considered, but appropriate treatment plans are always derived from the accurate diagnosis of the findings of the examination. Finally, to make the treatment more patients oriented, the treatment plan must be properly sequenced before starting the treatment.

The objective of this paper is first outline the examination and thought process involved in the diagnosis and treatment planning of a complex maxillary anterior case with dentogingival disharmony. Then it will describe and illustrate the rationale and techniques of the treatment approaches used to provide a long-term stable esthetic outcome. A three and a half year follow up is provided.

Components of Esthetic Examination¹⁻⁹

1. Chief complaint: Better attention to this will minimize misunderstanding of patient's needs, and it will help direct the clinician to provide more a patient oriented treatment.
2. Esthetic zone: Often the esthetic areas of the mouth which are not visible to others may still be of importance to a patient. Instead of depending on the lip line of a patient, it is prudent to ask the patient what he or she thinks the esthetic zone is.
3. Tooth position: The labial gingival margin of the tooth being extracted can influence the surgical approach as well as the final outcome.
4. Gingival form: A high scalloped gingival form has a higher degree of interdental papilla shrinkage after extraction than the flatter gingival form.
5. Osseous crest position: Underlying bone level can determine the long term stability of the gingival

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margins of the implant restorations. The osseous position can also influence the surgical incision design and approach.

6. Biotype of periodontium: A thicker gingiva or biotype over implant restorations have lower chances of recession and are more stable. If the surgical site has thinner biotype, a gingival augmentation may be needed to enhance the biotype, thus increasing the long term stability of the gingiva.
7. Tooth shape: Triangular shaped teeth can result in an increased likelihood of the formation of interdental black triangles after extraction. The reshaping of the adjacent teeth may be necessary to obtain harmony between the implant restorations and the surrounding gingiva.
8. Horizontal deficiency and vertical deficiency: The quantity of soft and hard tissue deficiency in the edentulous ridge, as well as the quality of the gingiva will factor into the selection of the surgical approach.
9. Occlusion: Status of the patient's occlusion, such as the occlusal wear pattern and the presence and absence of canine guidance, can influence the treatment plan.

Patient Dental History and Chief Complaint

The patient was a twenty-eight year old female

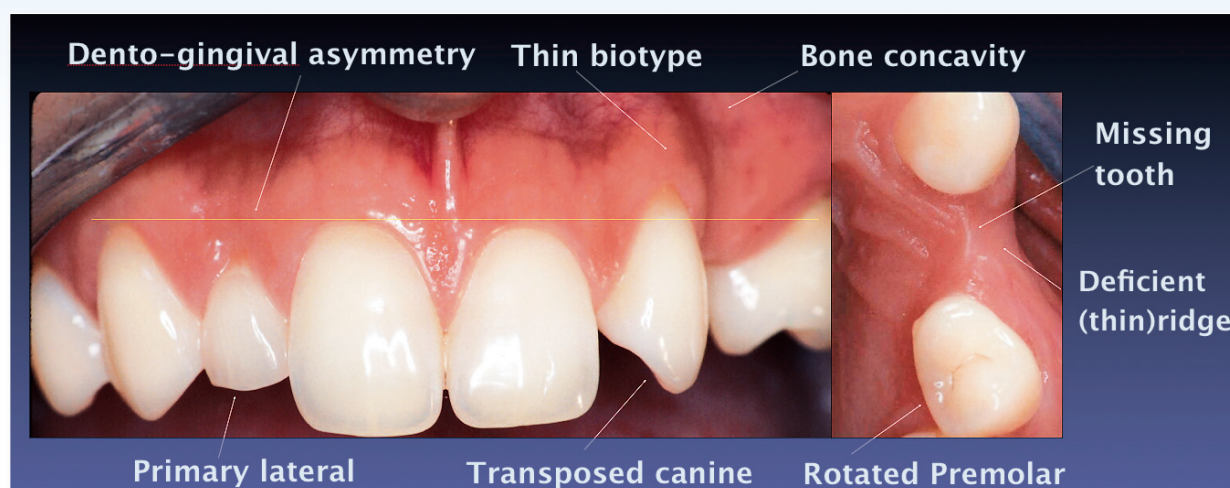
professional. She did not present any medical contraindication for dental treatments. Previously, she had received five years of orthodontic therapy during which the orthodontist had moved her left canine to the lateral position, resulting in a poor esthetic result. Understandably, she had a high degree of dental anxiety.

The patient's chief complaint was the missing canine, wanting a dental implant as soon as possible. She did not like her "fang" like appearance, and she wished to have a "more even smile".

Examination and Diagnosis

Following is the diagnosis of the examination findings (Fig. 1):

1. Dento-gingival asymmetry due to the low gingival level of the right maxillary primary lateral incisor and the high gingival level of the left maxillary canine.
2. A thin biotype over the left canine in the lateral position, which may or may not need correction depending on the treatment approach.
3. Bony concavity in the apical area of the edentulous ridge, which may result in fenestration with implantation.
4. Missing tooth in canine position, the chief complaint of the patient.



■ Fig. 1: Diagnosis of findings of the examination

5. Relatively thin edentulous ridge crest with a slight horizontal deficiency.
6. Rotated left maxillary first premolar, resulting in a tight space for implant placement (Fig. 2).
7. Left Maxillary canine transposed to the lateral position with high gingival margin. This caused a "fang" like appearance and was the major cause of the dento-gingival asymmetry.
8. Retained right primary lateral with severely resorbed roots (Fig. 3). However, the problem is not symptomatic.
2. Restore the missing tooth
3. Provisionalize as soon as possible
4. Create dental symmetry
5. Provide esthetic dento-gingival harmony in the final restorations

Whether these items are addressed in the treatment plan is decided only after discussion with the patient.

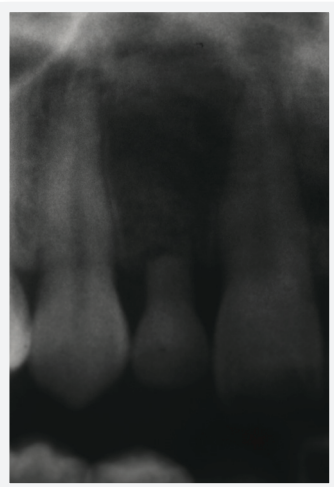
Treatment

1. Create gingival harmony

Visualizing the final outcome mentally or with the help of computer imaging is helpful in formulating the treatment plan. Also, the treatment objective should accommodate any "special requests" of the patient if at all possible. The motivation behind this patient's seeking of dental care was her wedding in 6 weeks. She is looking forward to a long honeymoon, and due to her age, she is planning to become pregnant as soon as possible. She did not want any treatment to interfere with pregnancy and understandably, she did not want any removable provisionals. Furthermore, due to her busy schedule and the long distance drive to the clinic, she wanted



■ Fig. 2: Implant site



■ Fig. 3: Retained primary lateral

the treatment completed with as few visits possible. Finally, due to her high dental anxiety, she was very concerned of the possibility of dental pain during the treatment.

Treatment Options

Basically, there were two treatment options available for this patient to achieve dento-gingival harmony,

as well as the other treatment objectives. One involved an orthodontics approach while the other was a surgical approach.

In the orthodontic approach, the left canine will be repositioned to the canine site and the premolar will be rotated back to the proper position. Gingival leveling will be done concurrently. In addition, a dental implant will be placed in the lateral position. This approach can be considered conservative and non-surgical. However, in consultation with orthodontists, the repositioning of the canine is not always predictable. In addition, in this case the patient had a strong objection to this approach due to her time constraint and her negative past experience with orthodontic treatment.

In the surgical approach, the missing tooth can be replaced with a dental implant placed in the canine position. This can be accomplished in either a one or two stage implant surgery approach. The missing tooth can also be replaced by providing a fixed partial restoration from transposed canine in lateral position to the rotated premolar. However, the patient preferred an implant. The gingival symmetry problem can be corrected surgically by performing a root coverage procedure over the transposed left canine. The ridge deficiency of the canine site can be corrected with soft or hard tissue grafting, either in a delayed approach or simultaneously with the placement of the implant. The right primary lateral can either be removed or retained depending on the patient's preference, and the dental symmetry problem can be corrected with composite reshaping

or porcelain restoration. Provisionalization can be handled with either a removable or a fixed type.

Of these two approaches, the surgical approach was more appropriate for the needs and requests of the patient. Thus it was selected as the preferred treatment.

Treatment Plan (Surgical approach)

After considering these treatment options with the patient and her restorative dentist, the following surgical approach was selected as the one that best met the patient's needs and requests (Fig. 4):

1. Missing tooth: A Dental implant will be placed in a one stage surgical approach.
2. Deficient ridge: A ridge augmentation will be done simultaneously with a "rolled" soft tissue graft.¹⁰⁻¹¹
3. Bone fenestration: Allograft bone with a resorbable membrane will be used to correct the anticipated fenestration over the dental implant.

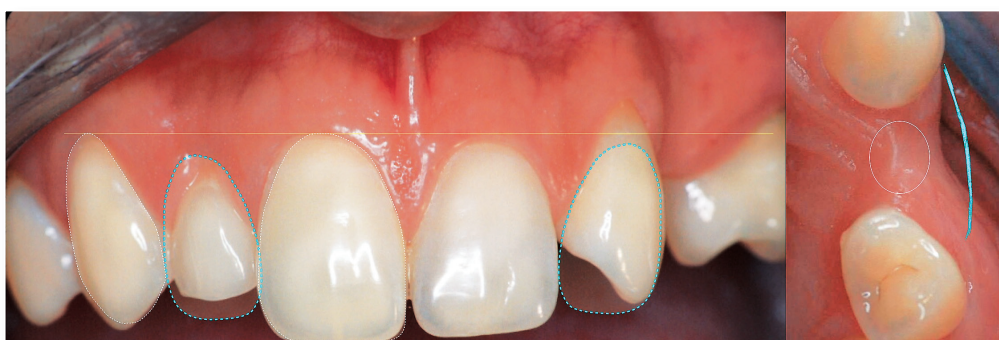
4. Retained primary lateral: It will be kept and maintained for the present time.

5. Dental symmetry: The retained lateral and transposed canine will be reshaped with composite initially. The final restorations in porcelain will be performed at later date.

6. Gingival symmetry: The high gingival margin over the canine will be corrected with root coverage surgery, and the low gingival line of the retained lateral will be corrected with minor gingival crown lengthening.

7. Provisionalization: A denture tooth will be bonded to the rotated premolar. An immediate provisionalization over the implant can also be considered.

At first glance of the edentulous ridge, there seems to be a likelihood of a dehiscence of the implant due to the narrowness of the ridge. This would make this case unsuitable for a one staged approach. However, once a new gingival margin is created at a more coronal position on the transposed canine, the proper apical position for the implant placement is



■ Fig. 4: Diagram of the surgical and restorative treatment plan

much more apical than the exiting ridge crest. Thus it is required that a ridge reduction be performed, which will widen the ridge at the crest level and avoid dehiscence at the time of implant placement (Fig. 5). A one staged implant surgical approach is now acceptable for this situation. This approach of implant placement allows simultaneous flap management for root coverage of the transposed canine and ridge augmentation of the implant site. The end result is less treatment time and trauma for the patient.

Surgical Esthetic Strategy

Any form of surgical techniques or flap management employed must preserve what gingival architecture is present, if the existent parts are compatible with the final expected gingival esthetic outcome. It is much easier to preserve what is present than recreating what is lost. However, if vertical or horizontal ridge augmentation is needed, it is always advisable to over-build by at least 30% to compensate for the shrinkage that will occur during healing.¹²⁻¹³ Sometimes “papillary illusion” can be

created more easily if regeneration and respective techniques are used in combination rather than alone. In planning the surgical outcome of the papilla height, keep in mind the average papilla height that can be achieved for the given situation, so that unrealistic expectations of the surgical outcome can be avoided by clinicians and patients.

Surgical Procedures

1. Creating a new cemento-enamel junction over a transposed canine¹⁴⁻¹⁵

Many root coverage techniques are available today, but none work on an enamel surface. Therefore, the first step in the root coverage surgery is to create a new CEJ on the canine, creating a harmonious and symmetrical gingival architecture for esthetic purposes. Using a high speed finishing bur, enamel layer coronal to the existing CEJ was removed in a parabolic shape to the dentine layer (Fig. 6). It is important that all enamel layers is removed near the line angles to ensure good connective tissue attachment to the grafted tissue. Then, ten percent



■ Fig. 5:
Amount of ridge reduction required prior to implant placement



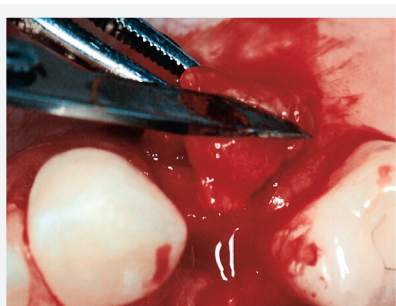
■ Fig. 6: New CEJ created



■ Fig. 7: Root conditioning with tetracycline paste



■ Fig. 8: Incision design with interdental papilla intact



■ Fig. 9: Epithelium on the connective pedicle is removed

tetracycline conditioning should be done to remove the smear layer (Fig. 7). A rough reshaping of the canine to the form of a lateral was done before the opening of the flap to avoid too much debris in the tissues.

2. Flap design for implant placement and “roll” ridge augmentation technique

A vertical incision with the interdental papilla intact was then used to obtain an independent surgical site for root coverage and implant placement with expected fenestration (Fig. 8). Preservation of the interdental papilla ensures the conservation of the interdental papillary heights. This enhances the blood supply to the connective tissue graft which will be placed over the denuded root surface. Next, a crestal incision was made on the palatal side to utilize the palatal connective tissue which was rolled over to the labial surface for simultaneous soft tissue ridge augmentation. The epithelium of the connective pedicle was removed prior to rolling it into the buccal pouch (Fig. 9). For a single tooth span horizontal deficiency with adjacent normal bone thickness, this “palatal roll” is an effective, non-traumatic, and long term stable ridge augmentation technique.¹⁰⁻¹¹ It also provided 3-4mm thick gingival biotype with harmonious color and marginal stability labial to the implant.

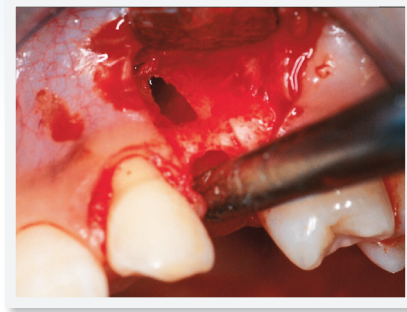
3. Proper implant placement and suturing

Once a new gingival margin has been created at a more coronal position on the transposed canine, the proper apical position for the implant placement can be determined. Since the gingival margin of the canine is usually about 0.5-1mm apical to the gingival margin of the lateral, the correct apical position of the implant is approximately 4mm apical to the newly created CEJ of the transposed canine.

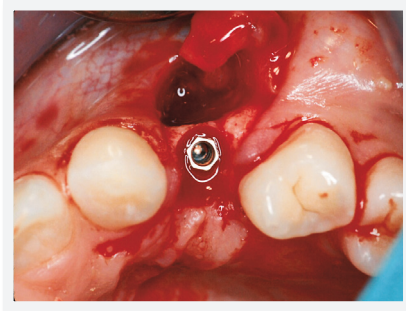
The existing ridge crest is coronal to that position and a ridge reduction was performed before placement of the implant. This provided a wider ridge platform to place the implant into without dehiscence (Fig. 10). The angulation of the implant should avoid adjacent roots and should be no more than 15 degrees angulation off from the long axis of the normal root. In addition, Bucco-lingual positioning of the implant must be within the out line of the crown and the mesio-distal position must ensure that there is sufficient room for the interdental papilla (Fig. 11). All these precautions will ensure a proper implant emergence profile as well as a hygienic esthetic restoration. Furthermore, in cases of fenestration of the implant fixtures, the implant apex should be placed into solid bone to provide bi-cortical stabilization. After placing the implant in a proper position, a 4mm healing abutment was connected. The exposed implant surface was packed through bone fenestration with allograft bone particles and covered with resorbable membrane to stabilize the particles under the flap. The palatal connective tissue pedicle was folded or "rolled" and tucked into the buccal side and stabilized with sutures slightly coronal to the expected final gingival margin, thus compensating for possible recession (Fig. 12).

4. Root coverage over canine

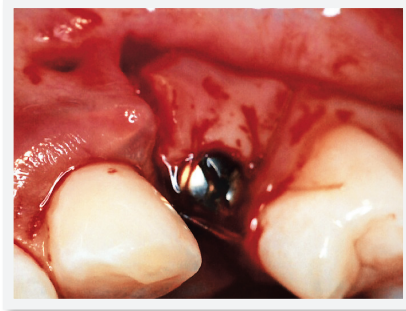
Once the implant was placed and the flap over the implant is secure, a partial thickness flap was raised with a #15 blade apical to the gingival margin of the canine using the modified tunnel technique.¹⁶



■ Fig. 10:
Implant recipient site with fenestration but without dehiscence



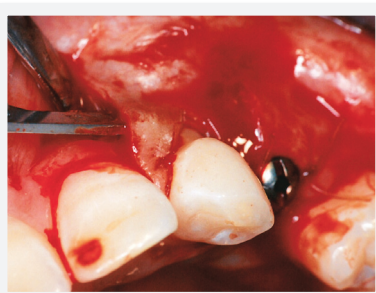
■ Fig. 11: *Occlusal view of implant placement*



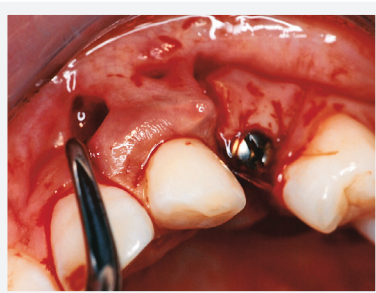
■ Fig. 12: *Palatal tissue rolled and sutured to labial position*

A vertical incision was added to the distal line angle of the left central incisor to facilitate tunnel flap reflection and connective tissue graft insertion (Fig. 13). Through the use of micro-blades, this procedure can be accomplished without vertical incision. Care must be taken to keep in tact the

interdental papilla so that the connective tissue graft placed underneath will have an enhanced blood supply. The recipient site must have sufficient vertical flap release under the papilla so that the connective tissue graft underneath is not displaced apical from the CEJ position during healing (Fig. 14). Approximately 0.5 mm thick connective tissue was harvested from the ipsilateral palate. Connective tissue thicker than that will cause an abnormal lump



■ Fig. 13: A tunnel flap reflection with a vertical incision



■ Fig. 14:
Recipient flap with sufficient vertical release under the papilla



■ Fig. 15: Connective tissue placed under the recipient flap

in gingiva. The graft was placed under the recipient flap and secured to the underlying periosteum just under the new CEJ (Fig. 15). An outer flap was placed over the connective tissue at the new CEJ level without visible tension.

Flaps were sutured in such a manner that outer lip movement did not result in any marginal flap movement or blanching of the surgical sites (Fig. 16). This ensures adequate blood supply to the grafted tissues during healing. A slight gingiectomy over the retained primary lateral was also completed. A severely reabsorbed root was of concern, and only a minimal amount of gingival was removed to lengthen the crown.

Surgical Result

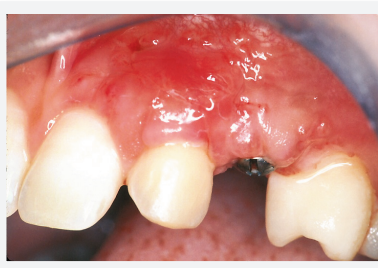
Ten day after the operation, there was good healing without any signs of flap necrosis.

A new viable gingival margin with adequate biotype was present at the new CEJ of the transposed canine (Fig. 17). An adequate ridge augmentation labial to the implant was accomplished with a proper margin and contour to provide gingival harmony for the implant restoration (Fig. 18). The implant possessed strong primary stability, and it was in a good position to provide implant prosthesis with the proper emergence profile (Fig. 19).

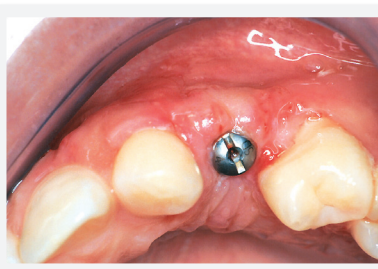
There are different approaches and surgical techniques available in treating this situation with similar end results. The advantage of this approach



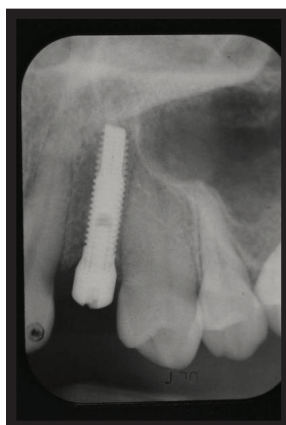
■ Fig. 16: Sutured stable flaps for optimal healing



■ Fig. 17: Ten days post operative healing



■ Fig. 18: Ten days healing of the ridge augmentation area



■ Fig. 19: Ten days healing of the ridge augmentation area

is that with one surgery and minimal discomfort to the patient, root coverage, implant placement with ridge augmentation, and most importantly, the gingival harmony of the patient's maxillary anterior was accomplished.

Restorative Result

Five weeks after the surgery, the retained lateral and altered canine were reshaped with composite. In addition, a denture tooth was bonded to the adjacent premolar over the healing abutment of the implant for a fixed provisional restoration (Fig. 20). The palatal side of attached tooth was hollowed out for easy access to oral hygiene. The immediate attachment of provisional to the implant was decided against due to the minimal thickness of the crestal bone surrounding the implant.

The patient returned from her honeymoon, became pregnant soon after, and received a final canine implant restoration from the restorative dentist five months after the surgery. She wanted to postpone the final porcelain restorations to the retained right lateral as well as the transposed canine in lateral position for personal reasons. With her new baby and work, the patient did not return for a follow up treatment until three and a half years later. At this point, dento-gingival harmony of her maxillary anterior was still present (Fig. 21). The root coverage and the horizontally augmented ridge were stable with thick biotype. In addition, there were no sign of progressive recession or shrinkage over the three and half year period (Fig. 22). The bone around



■ Fig. 20:
5 weeks after the surgery with fixed provisional restoration bonded over the implant healing abutment



■ Fig. 21: 3 1/2 year follow up with stable dentogingival harmony

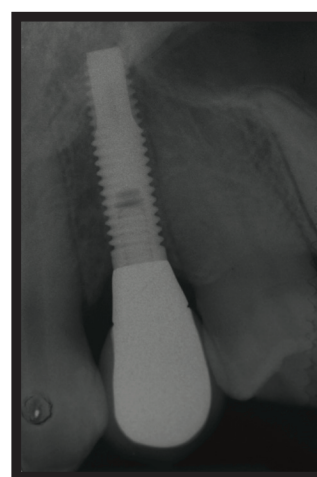
the implant was stable at the level of the implant platform (Fig. 23). The composite restorations were worn and needed replacing, but again due to her time constraint, the patient wanted to postpone the treatment to a later date. The retained primary lateral also showed increased mobility. The final restorative treatment plan for the patient is the extraction and the replacement of the retained right primary lateral with an implant restoration, replacement of the composite restoration of the transposed left canine with a ceramic restoration, and reshaping of the existing canine implant prosthesis for better restorative harmony.

Summary

In this case study, the examination process,



■ Fig. 22:
3 1/2 year view of the stable root coverage and ridge augmented area



■ Fig. 23: 3 1/2 year radiograph. Bone around the implant is stable

diagnosis, treatment planning and treatment of a complex maxillary anterior case with dento-gingival disharmony was described. Since all treatment starts with the examination of the soft and hard tissues surrounding the surgical sites, it is important to develop thorough examination skill and clinical judgment to derive an accurate diagnosis. Today, with so many innovative surgical approaches and techniques available for dental implant and esthetic treatments, clinicians should be familiar

with the different surgical techniques available in order to select the approach most appropriate for the patient. Respecting the biologic principles and limitations of each procedure will maximize the success rate. Finally, by keeping an opened mind to new approaches, it is easier for clinicians to keep up with the rapid changes taking place in the discipline of dental implantology and esthetics.

References

1. Salama H, Salama MA, Garber D, Adar P. The interproximal height of bone: a guidepost to predictable aesthetic strategies and soft tissue contours in anterior tooth replacement. *Pract Periodontics Aesthet Dent*. 1998 Nov-Dec; 10(9):1131-41; quiz 1142.
2. Tarnow DP, Cho SC, Wallace SS. The effect of inter-implant distance on the height of inter-implant bone crest. *J Periodontol*. 2000 Apr; 71(4):546-9.
3. Tarnow D, Elian N, Fletcher P, Froum S, Magner A, Cho SC, Salama M, Salama H, Garber DA. Vertical distance from the crest of bone to the height of the interproximal papilla between adjacent implants. *J Periodontol*. 2003 Dec; 74(12):1785-8.
4. Becker W, Ochsenbein C, Tibbetts L, Becker BE. Alveolar bone anatomic profiles as measured from dry skulls. *Clinical ramifications*. *J Clin Periodontol*. 1997 Oct; 24(10):727-31.
5. Kan JY, Rungcharassaeng K, Umezaki K, Kois JC. Dimensions of peri-implant mucosa: an evaluation of maxillary anterior single implants in humans. *J Periodontol*. 2003 Apr; 74(4):557-62.
6. Kois JC. Predictable single-tooth peri-implant esthetics: five diagnostic keys. *Compend Contin Educ Dent*. 2004 Nov; 25(11):895-6, 898, 900 passim; quiz 906-7.
7. Grunder U, Gracis S, Capelli M. Influence of the 3-D bone-to-implant relationship on esthetics. *Int J Periodontics Restorative Dent*. 2005 Apr; 25(2):113-9.
8. Grunder U. Stability of the mucosal topography around single-tooth implants and adjacent teeth: 1-year results. *Int J Periodontics Restorative Dent*. 2000 Feb; 20(1):11-7.
9. Green MS, Levine DF. Occlusion and the periodontium: a review and rationale for treatment. *J Calif Dent Assoc*. 1996 Oct; 24(10):19-27. Review.
10. Abrams L. Augmentation of the deformed residual edentulous ridge for fixed prosthesis. *Compend Contin Educ Gen Dent*. 1980 May-Jun; 1(3):205-13.
11. Scharf DR, Tarnow DP. Modified roll technique for localized alveolar ridge augmentation. *Int J Periodontics Restorative Dent*. 1992; 12(5):415-25.
12. Buser D, Dula K, Belser UC, Hirt HP, Berthold H. Localized ridge augmentation using guided bone regeneration. II. Surgical procedure in the mandible. *Int J Periodontics Restorative Dent*. 1995 Feb; 15(1):10-29.
13. Rasmusson L, Sennerby L, Lundgren D, Nyman S. Morphological and dimensional changes after barrier removal in bone formed beyond the skeletal borders at titanium implants. A kinetic study in the rabbit tibia. *Clin Oral Implants Res*. 1997 Apr; 8(2):103.
14. Han TJ. Autogenic Graft for Root Coverage. 2002 American Academy of Periodontology-Specialty conference Presentation, Chicago, Illinois. May 17-19, 2002.
15. McNeely TE. Coronally Repositioning the Cemento-Enamel Junction to Address Gingival Margin discrepancies. *J Perio*. 2005 Jan; 76(1):138-42.
16. Mahn DH. Treatment of gingival recession with a modified "tunnel" technique and an acellular dermal connective tissue allograft. *Pract Proced Aesthet Dent*. 2001 Jan-Feb; 13(1):69-74.

