BILAMINAR SUBEPITHELIAL CONNECTIVE TISSUE GRAFTS FOR IMMEDIATE IMPLANT PLACEMENT AND PROVISIONALIZATION IN THE ESTHETIC ZONE

Joseph Y.K. Kan, DDS, MS; Kitichai Rungcharassaeng, DDS, MS; and Jaime L. Lozada, DDS

ABSTRACT

Immediate implant placement and provisionalization has been considered as a preservative procedure when replacing failing teeth, especially in the esthetic zone. Nevertheless, an average facial gingival tissue recession of 1 mm is still common after one year of function. Furthermore, facial gingival recession of thin periodontal biotype seems to be more pronounced than that of thick biotype. Biotype conversion around both natural teeth and implants with subepithelial connective tissue graft has been advocated, and the resulting tissues appear to be more resistant to recession. A technique combining subepithelial connective tissue graft and immediate implant placement and provisionalization is devised to achieve a more stable peri-implant tissue in thin biotype situations. This article describes the surgical and prosthodontic approach of this procedure as well as its clinical rationale.

Esthetics has been a dominating force in dictating the direction of development in implant dentistry for the past decade. Esthetics in implant dentistry encompasses not only the natural-looking restorations, but also the unaltered states of the surrounding tissue architecture.[1] Papilla loss, black triangles, facial tissue recession, etc. are the terms used to describe esthetically challenged situations. Studies had been conducted to identify the etiologies of



Guest editor / Joseph Y.K. Kan, DDS, MS, is associate professor, Department of Restorative Dentistry, Loma Linda University School of Dentistry.

Authors / Kitichai Rungcharassaeng, DDS, MS, is associate professor, Department of Restorative Dentistry; resident, Department of Orthodontics, Loma Linda University School of Dentistry.

Jaime L. Lozada, DDS, is professor, Department of Restorative Dentistry, and director of Post-Graduate Program in Implant Dentistry, Loma Linda University School of Dentistry.

Figure 1. Pretreatment view of the failing tooth No. 9 (left maxillary central incisor) due to external root resorption. Note the high gingival scallop and thin tissue biotype.

Figure 2. Periapical radiograph shows external root resorption of the apex of tooth No. 9.

Figure 3. Facial dentogingival complex dimension of 3 mm was verified using bone-sounding technique. Since the free gingival margin of the failing tooth (No. 9) was also more coronal to that of the contralateral tooth (No. 8), immediate tooth replacement was indicated in this situation.

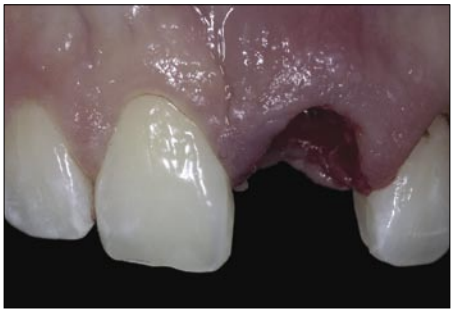
Figures 4a and b. Customized provisional restoration was fabricated in the laboratory prior to the surgery.

Figure 5. Minor soft tissue recontouring (gingivoplasty) was performed on teeth Nos. 9 and 10 to create harmonious gingival architecture with surrounding dentition.

tissue loss and techniques developed to prevent or minimize its occurrence.[2,3] The concept of tissue preservation has, therefore, been advocated and extensively used to enhance the esthetic outcome. This concept entails immediate implant placement and provisionalization where osseous architecture is preserved by immediate implant placement and soft tissue architecture is maintained with immediate provisionalization.[4-6]

The success of this concept, however, is influenced by a number of factors that can be identified as extrinsic or intrinsic. Extrinsic factors include proper 3-D implant position and angulation, as well as appropriate contour of the provisional restoration.[7] These factors are clinician-dependent and guidelines regarding these issues have been established and satisfactory outcome reported.[2] Intrinsic factors, on the other hand, are patient-dependent and therefore, can be favorable or unfavorable. These factors include bone level, hard and soft tissue relationship, bone thickness, and soft tissue biotype.[7] Conversion of unfavorable traits to favorable ones is vital to achieving esthetic outcome. Bone level and hard and soft tissue relationship are usually proactively modified via orthodontic and/or periodontic treatment prior to, while bone thickness may be enhanced by bone grafting simultaneously with immediate tooth replacement procedure.[5] The propensity to recession after surgical insults of thin gingival tissue has been validated and reconstructive procedures (free gingival or connective tissue grafts) are usually the treatment of choice for natural teeth with receded gingiva. However, these reconstructive procedures have not been shown to be predictable for their implant counterpart. On the other hand, successful tissue enhancement had been reported when connective tissue graft was performed at the time of implant placement or abutment connection.[3,8,9] Nevertheless, connective tissue graft at the time of immediate tooth replacement had not been reported.

This article describes a technique of gingival tissue enhancement using



Figures 6a and b. Atraumatic tooth extraction resulting in a well-preserved gingival architecture.

Figure 7. Occlusal view of the extraction showing thin facial gingival tissue.

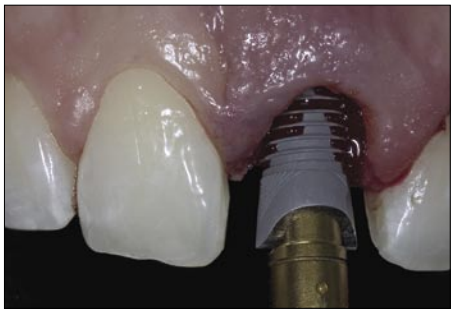


Figure 8. An implant (NobelPerfect Groovy, Nobel Biocare) was placed immediately in the extraction socket without flap reflection.

bilaminar subepithelial connective tissue graft, SCTG, in conjunction with immediate implant placement and provisionalization in the esthetic zone.

Case Presentation

Case 1

A 28-year-old female patient presented with external root resorption of the maxillary left central incisor, No. 9, and had been advised that the tooth should be extracted (**Figure 1**). Radiographic and clinical evaluations showed no signs or symptoms of active infection (**Figure 2**). Periodontal evaluation revealed a thin and scalloped periodontium. Bone sounding measurement of 3 mm at the facial aspect of tooth No. 9 revealed a normal osseous/gingival tissue relationship (**Figure 3**).[10] Furthermore, the facial free gingival margin of tooth No. 9 was more coronal than that of the contralateral tooth No. 8. After discussing the risks and benefits with the patient, she agreed to having bilaminar SCTG in conjunction with immediate tooth replacement as her final treatment.

Presurgical Procedures

Fabrication of Provisional Restoration

A preliminary impression was made using vinyl poly-siloxane (Reprosil, Dentsply International Inc., Milford, Del.) and diagnostic casts were fabricated with Type III dental stone (Microstone, Whip Mix Corp., Louisville, Ky.). A diagnostic waxing of the failing tooth was executed to match the contralateral tooth. The cast was duplicated and a silicone matrix (Sil-Tech, Ivoclar North America Inc., Amherst, N.Y.) was made. The to-be implanted tooth on the cast was then under-prepared with a 1 mm subgingival margin. The silicone matrix was used as the guide to form the contour of the acrylic resin provisional shell (Vita Zeta, Vident, Brea, Calif.). The finished provisional shell was then disinfected for the implant surgery (**Figure 4**).

Surgical Procedures

Immediate Implant Placement

At the time of surgery, gingivectomy with an inverse bevel incision and transeptal fiberectomy was performed around Nos. 9 and 10 to create a harmonious gingival architecture with the surrounding dentition (**Figure 5**). Subsequently, the failing tooth was removed atraumatically with the aid of a periotome (Nobel Biocare, Yorba Linda, Calif.) while preserving the gingival architecture (**Figures 6 and 7**). An implant (NobelPerfect Groovy, Nobel Biocare) was then placed immediately in the extraction socket without flap reflection (**Figure 8**). Primary implant stability was achieved by engaging the palatal wall and the bone 4 mm to 5 mm beyond the apex of the extraction socket. The implant-prosthetic platform was placed 3 mm from the predetermined gingival margin.

Recipient Site (Bilaminar Envelope) Preparation

An intrasulcular incision was made with a surgical blade (No. 15c, Kai, Japan) on the labial aspect of tooth No. 9 creating an initial separation between the gingival from the underlying bone. A curette (Younger-Good 7/8 curette, Hu-Friedy, Chicago, Ill.) was then used to further separate the gingiva from the bone extending to the mucogingival junction. A partial thickness sharp dissection was made apically and mesiodistally (No. 1/2 Orban DE knife, Hu-Friedy) leaving the underlying periosteum in place, while releasing residual flap tension that facilitated passive coronal displacement of the flap.

Figure 9. A bilaminar envelope was created to receive the subepithelial connective tissue graft before the bone grafting material was placed in the gap between the implant and the facial plate.

Figure 10. An abutment (Nobel Perfect Groovy 10-degree Abutment) was hand tightened onto the implant.

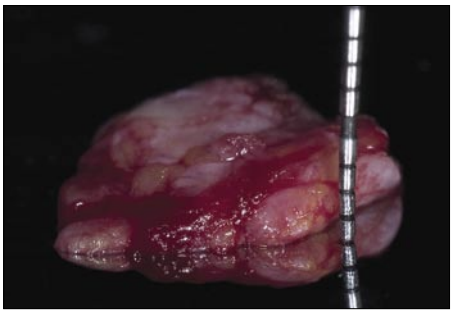


Figure 11. Connective tissue graft with a minimal vertical length of 9 mm, 2 mm in thickness, and the width consistent with the mesiodistal width of the recipient site was harvested from the palate.

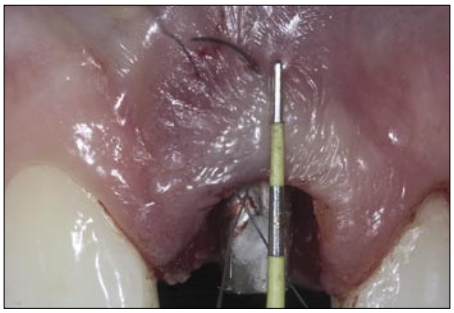
The gap between the implant and facial bone plate was then filled with xenograft (Bio-Oss, Osteohealth Co, Shirley, N.Y.) (**Figure 9**).

Finalization of Abutment and Provisional Restoration

An abutment (Nobel Perfect 10-degree abutment, Nobel Biocare) was placed onto the implant for the reception of the previously prepared provisional shell. The provisional shell was relined with light polymerizing acrylic resin (Revolution Formula 2, Kerr, Orange, Calif.) and was adjusted to clear all centric and eccentric contacts. The abutment-provisional restoration assembly was refined extraorally to ascertain optimal fit. The abutment was then hand tightened onto the implant (**Figure 10**) and the site was prepared for SCTG.

Harvesting Connective Tissue Graft

The SCTG with a minimal dimension of 9 mm in length, 1.5 mm in thickness, and the width consistent with the mesiodistal width of the recipient site was harvested from the palate utilizing a single-incision technique (F**igure 11**).[11] A single incision was made to the bone with a surgical blade (No. 15, Kai) orientated perpendicular to the palatal tissue in a horizontal direction approximately 2 mm to 3 mm apical to the gingival margin of the maxillary teeth. A partial thickness sharp dissection was made parallel to the long axis of the teeth, leaving the graft attached to the underlying bone, while maintaining an adequate thickness of the overlying palatal flap to minimize sloughing. The connective tissue with the underlying periosteum was then elevated and dissected from the palate with the use of the combination of suture pliers (Corn Suture Pliers, Hu-Friedy), an elevator (Buser Periosteal Elevator, Hu-Friedy), and surgical blade (No. 15, Kai). After removal of the adipose tissue, the harvested graft was maintained in a moist environment to prevent desiccation prior to its placement. Primary closure of the donor site was attained using resorbable sutures (P-3 5-0 Vicryl, Johnson & Johnson Ethicon, England).



Figures 12a and b. After the abutment placement, the suture needle was passed through the outer surface of the prepared envelope ~6 mm from the free gingival margin and ~3 mm vertically and 2 mm horizontally from one end of the SCTG.

Placement of Graft and Provisional Restoration

The suture needle (S14 6-0 Chromic gut blue, Johnson & Johnson Ethicon) entered the outer surface of the prepared envelope ~6 mm from the free gingival margin (**Figure 12a**). While the graft was being secured with the suture pliers (No. 20 Corn Suture Pliers, Hu-Friedy), the needle was passed through its de-epithlialized surface from one end ~3 mm vertically and 2 mm horizontally (**Figure 12b**). Once exited, the needle gained entry through the periosteal surface of the graft at the same vertical


Figures 13a and b. The SCTG was gently drawn into the envelope simultaneously with the placement of the provisional restoration.


Figures 14a and b. A cross-sling suture was placed at the coronal aspect of the envelope flap to secure the flap over the graft. Both gingival tissue height and thickness were enhanced with this procedure.

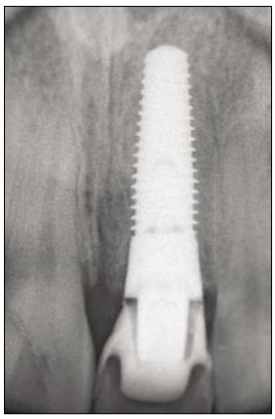


Figure 15. Postoperative periapical radiograph of implant No. 9.

Figure 16. Pretreatment view of the failing tooth No. 9 (left maxillary central incisor) due to endodontic failure.

position but ~2 mm from the other end of the graft horizontally. Finally, the needle exited through the envelope at the same vertical position as the entry point while maintaining the horizontal distance between the entry and exit points of ~3 mm (**Figures 12a and b**).

The SCTG was drawn in the prepared envelope with the periosteal side of the graft facing the osseous surface of the recipient site simultaneously with the cementation (Temp-bond, Kerr USA, Romulus, Mich.) of the provisional restoration (**Figures 13a and b**). The amount of cement used should be minimal and mostly isolated at the intaglio incisal and lingual area of the provisional for the ease of cement removal. A cross-sling suture was placed at the coronal aspect of the envelope flap to secure the flap over the graft (**Figures 14a and b**). Light finger pressure was then applied over the grafted site with moist gauze for five minutes to minimize blood clot formation between the graft and its underlying and overlying tissues. Periapical radiograph was made to ascertain the fit of the prosthesis (**Figure 15**).

Postoperative Instruction

Appropriate antibiotic and analgesics were prescribed for postoperative use. The patient was instructed not to brush the surgical site, but to rinse gently with 0.12 percent chlorhexidine gluconate (Peridex, Procter & Gamble, Cincinnati, Ohio), and be on a liquid diet for two weeks. A soft diet was recommended for the remaining duration of the implant healing phase (four months). The patient was also advised against functioning or activities to the surgical site. The final restoration has not been placed at the time of this publication.

Case 2

A 57-year-old female patient presented with endodontic failure of the maxillary left central incisor, No. 9, (**Figure 16**). The tooth was extracted and bilaminar SCTG in conjunction with immediate tooth replacement was initiated (**Figures 17a and b**). The final implant impression was made approximately four months following the SCTG and implant surgery using vinyl poly-siloxane (Reprosil, Dentsply International Inc.). The abutment was torqued to 35 Ncm (manufacturer's recommendation, Nobel Biocare) and the definitive restoration was cemented (**Figure 18**).

Figures 17a and b. The SCTG was gently drawn into the envelope followed with the placement of the provisional restoration.

Figure 18. Facial view of the definitive restoration.

Discussion

Thin biotype and non-keratinized gingiva around natural dentition possess an inherent risk of recession when subjected to surgical, restorative and/or mechanical trauma.[12,13] Interestingly, a similar phenomenon can also be observed on peri-implant mucosa.[14] In studies that involved immediate implant placement and provisionalization procedures (one-stage), an average of 1 mm of facial gingival recession had been reported one-year following the surgery.[2,3] However, these studies did not attempt to correlate the amount of recession to different gingival biotype. Nevertheless, bone-sounding measurements around two-stage implants revealed that thin gingival biotype is associated with significantly lesser peri-implant mucosa dimension than that of thick biotype, indicative of its propensity to tissue recession.[15] According to these results, it is logical to deduce that thin biotype may lead to greater gingival recession following immediate tooth replacement. Under such circumstances, to minimize gingival recession from implant surgery, one of the objectives should be to increase the quality and quantity of the gingival tissue via gingival grafts. SCTG with mucogingival bilaminar flaps on natural dentition had been shown to be effective in significantly increasing the thickness of the marginal gingival tissue as well as the width of the keratinized tissue.[13,16-21] Furthermore, gingivoplasty after the healing of SCTG has been recommended to improve the esthetics and increase surface keratinization.[22-25] However, the occurrence of surface keratinization after gingivoplasty has not been consistently confirmed.[20] It has been postulated that surface keratinizatiton may be induced by the genetic potential of the subepithelial connective tissue graft or the migration of the surrounding epithelial cells.[19,21,26,27]

Partial thickness sharp dissection is often recommended when preparing the recipient site envelope flap as it may enhance initial revascularization of SCTG.[24,28] When comparing the healing of free gingival grafts placed in a recipient bed of either denuded bone or bone with retained periosteum, Caffesse et al. showed that denuded cortical bone underwent initial resorption, delaying vascular proliferation and thus compromising early stages of healing.[29] On the other hand, Nelson reported excellent clinical results even though full thickness flaps were used to cover connective tissue grafts.[30] Despite the conflicting data, in the authors' opinion, partial thickness site preparation is preferred as initial revascularization may be critical for grafting around nonvascularized implant surface. Nevertheless, making a partial thickness sharp dissection on thin and friable gingiva is technique-sensitive and risk of perforation resulting in tissue necrosis is high.[24] Under such circumstances, full thickness blunt dissection is recommended to develop the initial access to the recipient envelope; from the free gingival margin to the mucogingival junction. Beyond that point, the gingival tissue is usually thicker, and a partial thickness sharp dissection can be achieved.

The size of the SCTG for implant gingival biotype conversion is usually larger than that for natural teeth root coverage. In this article, it is the authors' opinion that the harvested graft should have a minimal vertical height of 9 mm, a horizontal width consistent with the mesiodistal width of the recipient site, and a minimal thickness of 1.5 mm. The recommended distance between the facial gingival and its underlying bone for immediate implant placement and provisionalization is 3 mm.[7] Under such circumstances, a vertical tissue graft height of 9 mm will allow for a minimal of 6 mm of the graft to be contained within vital bone and periosteum to ensure graft survival. A graft width consistent with the mesiodistal width of the recipient site will enhance gingival emergence esthetics. Finally, clinicians have advocated a minimal graft thickness of 1.5 mm for easy of handling and minimal graft

shrinkage following surgery.[31,32]

Spaces present between the graft and its overlying and underlying recipient flaps had been suggested to be the culprit for graft failures.[33] These dead spaces harbor thick blood clots that potentially hinder the anastomosis of new capillary buds from the recipient bed, thus jeopardizing the graft survival.[34] Therefore, it is recommended that pressure be applied with moistened gauze at the grafted site for a minimum of five minutes to facilitate hemostasis and minimize blood clot thickness.[24] In addition, a cross-sling suture placed at the coronal aspect of the envelope flap may assist graft immobilization further enhancing graft success.

Since the buccal bony plate underneath the thin gingival tissue is also generally thin and prone to fracture, extraction, flap management as well as SCTG placement, must be performed with extreme care. Bone grafting material placed in the gap between the implant and the buccal bony plate prior to flap manipulation and SCTG may help minimize the risk.

Conclusions

Based on short-term clinical follow-up, besides being able to maintain existing osseous and gingival architecture, bilaminar subepithelial connective tissue graft simultaneously with immediate implant placement and provisionalization also improved gingival quality and quantity. This is especially advantageous to the thin periodontium, where, without the gingival graft, greater tissue recession is likely to occur. Nevertheless, this technically demanding procedure, with variables that are still not conclusive, warrants additional studies. Furthermore, although the favorable initial results reported with this treatment modality might suggest it as a viable and predictable treatment option, careful patient selection, and treatment planning are still as important as or even more important than the treatment itself. CDA

References / **1.** Kan JYK, Rungcharassaeng K, Site development for anterior implant esthetics: the dentulous site. *Compend Cont Educ Dent* 22:221-6, 2001.

2. Kan JYK, Runcharassaeng K, Lozada J, Immediate placement and provisionalization of maxillary anterior single implants: one-year prospective study. *Int J Oral Maxillofac Implants* 18:31-9, 2003.

3. Grunder U, Stability of the mucosal topography around single-tooth implants and adjacent teeth: one-year results. *Int J Periodontics Restorative Dent* 20:11-7, 2000.

4. Wohrle PS, Single-tooth replacement in the aesthetic zone with immediate provisionalization: Fourteen consecutive cases reports. *Pract Periodont Aesthet Dent* 10:1107-14, 1998.

5. Kan JYK, Rungcharassaeng K, Immediate placement and provisionalization of maxillary anterior single implant: A surgical and prosthodontic rationale. *Pract Periodont Aesthet Dent* 12:817-24, 2000.

6. Garber DA, Salama MA, Salama H, Immediate total tooth replacement. *Compend Cont Ed Dent* 22:210-8, 2001.

7. Kois JC, Kan JY, Predictable peri-implant gingival esthetics: surgical and prosthodontic rationales. *Pract Proced Aesthet Dent* 13:711-5, 2001.

8. Bianchi AE, Sanfilippo F, Single-tooth replacement by immediate implant and connective tissue graft: a one- to nine-year clinical evaluation. *Clin Oral Impl Res* 15:269-77, 2004.

9. Leziy SS, Miller BA, Replacement of adjacent missing anterior teeth with scalloped implants: a case report. *Pract Proced Aesthet Dent* 17:331-8, 2005.

10. Kois J, Altering gingival levels: The restorative connection, Part I: biologic variables. *J Esthet Dent* 6:3-9, 1994.

11. Lorenzana ER, Allen EA, The single-incision palatal harvest technique: a strategy for esthetics and patient comfort. *Int J Periodontics Restorative Dent* 20:297-305, 2000.

12. Muller HP, Eger T, Gingival phenotypes in young male adults. *J Clin Periodontol* 24:65-71, 1997.

13. Muller HP, Eger T, Sorb A, Gingival dimensions after root coverage with free connective tissue grafts. *J Clin Periodontol* 1998;25:424-30.

14. Bengazi F, Wennstrom JL, Lekholm U, Recession of the soft tissue margin at oral implants. A two-year longitudinal prospective study. *Clin Oral Impl Res* 1996;7:303-10.

15. Kan JY, Rungcharassaeng K, et al, Dimensions of peri-implant mucosa: an evaluation of maxillary anterior single implants in humans. *J Periodontol* 74:557-62, 2003.

16. Harris RJ, A comparative study of root coverage obtained with guided tissue regeneration utilizing a resorbale membrane versus the connective tissue with partial thickness double pedicle graft. *J Periodontol* 68:779-90, 1997.

17. Paolantonio M, Treatment of gingival recessions by combined regenerative technique, guided tissue regeneration, and subpedicle connective tissue graft. A comparative clinical study. *J Periodontol* 73:53-62, 2002.

18. Paolantonio M, Dolci M, et al, Subpedicle accelular dermal matrix graft and autogenous connective tissue graft in the treatment of gingival recessions: a comparative one-year clinical study. *J Periodontol* 73:1299-1307, 2002.

19. Karring T, Cumming BR, et al, The origin of granulation tissue and its impact on postoperative results of mucogingival surgery. *J Periodontol* 46:577-85, 1975.

20. Maurer S, Hayes C, Leone C, Width of keratinized tissue after gingivoplasty of healed subepithelial connective tissue grafts. *J Periodontol* 71:729-36, 2000.

21. Donn BJ, The free connective tissue autograft: A clinical and histologic wound healing study in humans. *J Periodontol* 49:253-60, 1978.

22. Langer B, Langer L, Subepithelial connective tissue graft technique for root coverage. *J Periodontol* 56:715-20, 1985.

23. Allen AL, Use of supraperiosteal envelope in soft tissue grafting for root coverage. I Rationale and technique. *Int J Periodontics Restorative Dent* 14:216-27, 1994.

24. Allen AL, Use of supraperiosteal envelope in soft tissue grafting for root coverage. II Clinical results. *Int J Periodontics Restorative Dent* 14:303-15, 1994.

25. Bruno JF, Connective tissue graft technique assuring wide root coverage. *Int J Periodontics Restorative Dent* 14:126-37, 1994.

26. Bokan J, Potential of gingival connective tissue to induce keratinization of an alveolar mucosal flap: a long-term histologic and clinical assessment. Case report. *Quintessence Int* 28:731-6, 1997.

27. Ouhayoun JP, Sawaf MH, et al, Re-epithelization of a palatal connective tissue graft transplanted in a nonkeratinized alveolar mucosa: a histological and biochemical study in humans. *J Periodontal Res* 23:127-33, 1988.

28. Raetzke PB, Covering localized areas of root exposure employing the envelope technique. *J Periodontol* 56:397-402, 1985.

29. Caffesse RG, Burgett FG, et al, Healing of free gingival grafts with and without periosteum. *J Periodontol* 50:586-94, 1979.

30. Nelson SW, The subpedicle connective tissue grafts – A bilaminar reconstructive procedure for the coverage of denuded root surfaces. *J Periodontol* 58:95-102, 1987.

31. Langer L, Enhancing cosmetric through regenerative periodontal procedures. *Compend Contin Educ Dent* (suppl)18:699-705, 1994.

32. Mormann W, Schaer F, Firestone AR, The relationship between success of free gingival grafts and transplant thickness. Revascularization and shrinkage. A one-year clinical study. *J Periodontol* 52:74-80, 1981.

33. Takei HH, Azzi RR, Periodontal plastic and esthetic dentistry. In Newman, Takei and Carranza. *Clinical Periodontology*, W.B. Sanders Co. Philadelphia 66:851-75, 2002.

34. Nabers J, Free gingival grafts. *Periodontics* 4:243-5, 1966.

To request a printed copy of this article, please contact / Joseph Y.K. Kan, DDS, MS, Department of Restorative Dentistry, Loma Linda University School of Dentistry, Loma Linda, Calif., 92350.