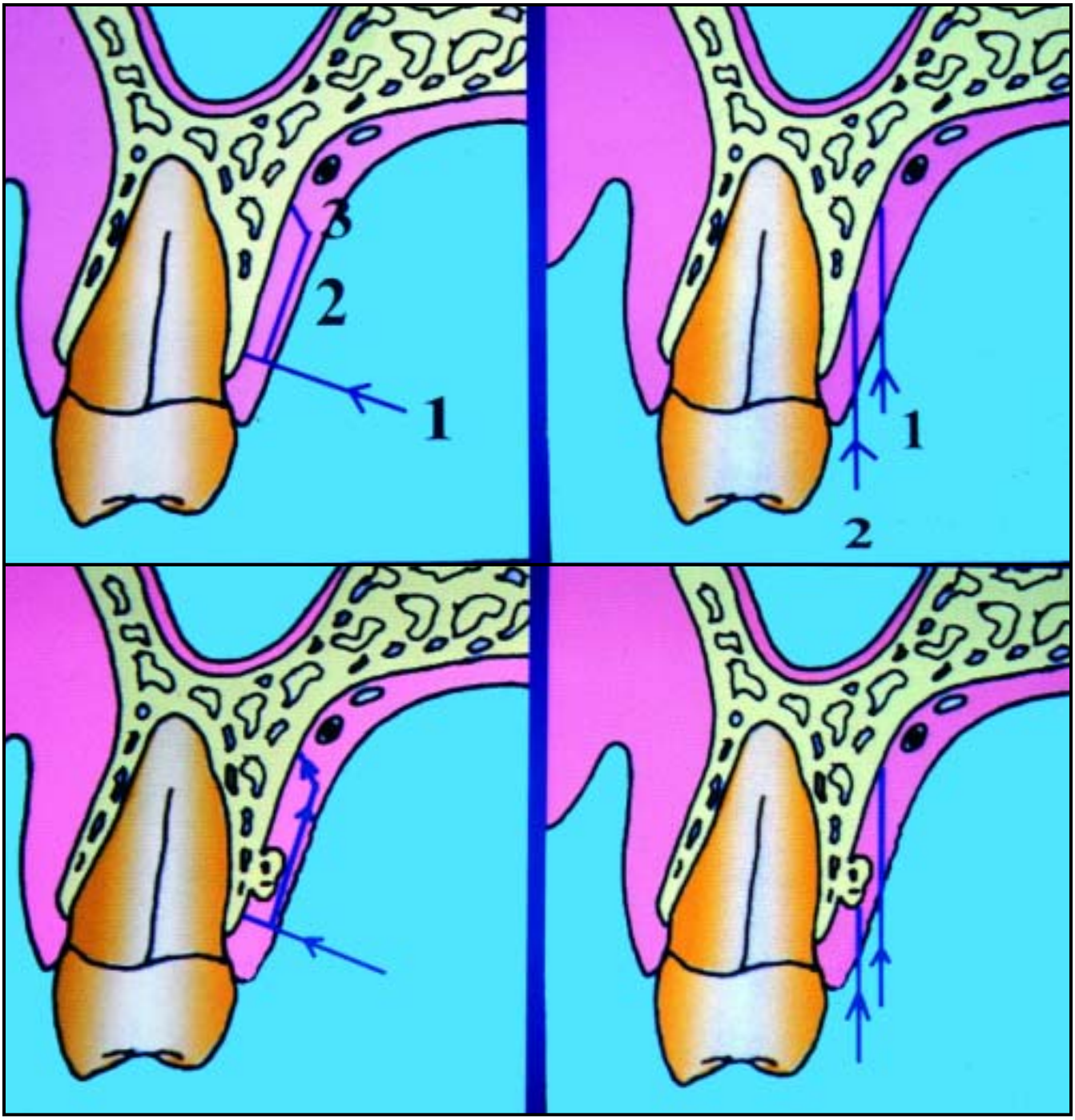

COPYRIGHT © 2002 BY QUINTESSENCE PUBLISHING CO, INC. PRINTING OF THIS DOCUMENT IS RESTRICTED TO PERSONAL USE ONLY. NO PART OF THIS ARTICLE MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM WITHOUT WRITTEN PERMISSION FROM THE PUBLISHER.

COPYRIGHT © 2002 BY QUINTESSENCE PUBLISHING CO, INC. PRINTING OF THIS DOCUMENT IS RESTRICTED TO PERSONAL USE ONLY. NO PART OF THIS ARTICLE MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM WITHOUT WRITTEN PERMISSION FROM THE PUBLISHER.

Connective Tissue Graft: A Classification for Incision Design from the Palatal Site and Clinical Case Reports

*Chiun-Lin Liu, DDS**
*Arnold S. Weisgold, DDS***

A classification system for connective tissue graft incisions is proposed. It categorizes the design of the palatal incision into three classes. In addition to the basic classification, two subclasses are mentioned in this article. Additional descriptions are included to further define the incision design. The use of such a classification should assist future communication among clinicians and researchers. This article presents representative clinical cases to aid the clinician in applying the classification for incision design from the palatal site. (Int J Periodontics Restorative Dent 2002;22:373–379.)

*Clinical Assistant Professor, Periodontal Prostheses, and Primary Care Unit Leader, Restorative Dentistry, University of Pennsylvania School of Dental Medicine, Philadelphia.
**Clinical Professor of Periodontics, and Director of Postdoctoral Periodontal Prostheses, University of Pennsylvania School of Dental Medicine, Philadelphia.

Reprint requests: Dr Chiun-Lin Liu, University of Pennsylvania School of Dental Medicine, 4001 Spruce Street, Philadelphia, Pennsylvania 19104-6003.

The connective tissue graft is a common and popular procedure for root coverage,[1–3] soft tissue augmentation for the edentulous area,[4,5] implant dentistry,[6] and cosmetic procedures.[7] The requirements of the anatomic or pathologic condition ultimately relate to the donor site flap design. The authors classify the incisions related to the palatal donor site. The purpose of this article is to describe a classification for incision design relative to the donor site preparation for subepithelial connective tissue grafting.

The classification of incision design from the palatal site is based upon:

1. The graft size required by the recipient site
2. The anatomy of the palatal vault, which is divided into high, average, and shallow[8]
3. The possibility of an exostosis[9]
4. Wound healing from the donor site (primary or secondary intention healing)[10]
5. Blood supply for the overlying flap
6. Postoperative discomfort

COPYRIGHT © 2002 BY QUINTESSENCE PUBLISHING CO, INC. PRINTING OF THIS DOCUMENT IS RESTRICTED TO PERSONAL USE ONLY. NO PART OF THIS ARTICLE MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM WITHOUT WRITTEN PERMISSION FROM THE PUBLISHER.

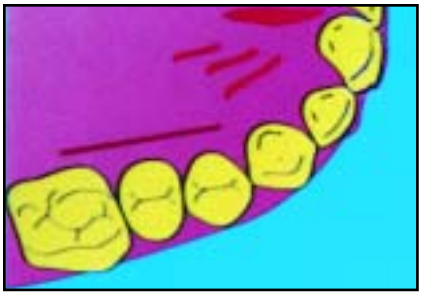

Fig 1a *Class I type A incision design.*

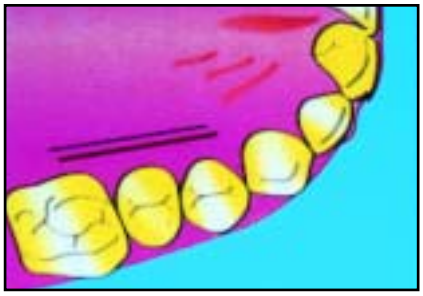

Fig 1b *Class I type B incision design.*

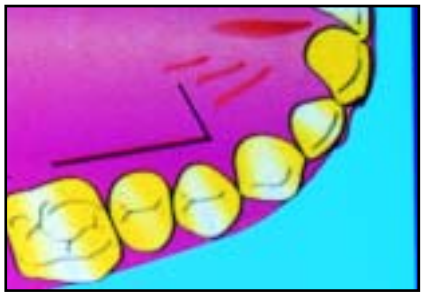

Fig 1c *Class II type A incision design.*

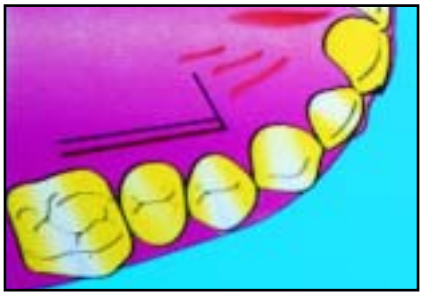

Fig 1d *Class II type B incision design.*

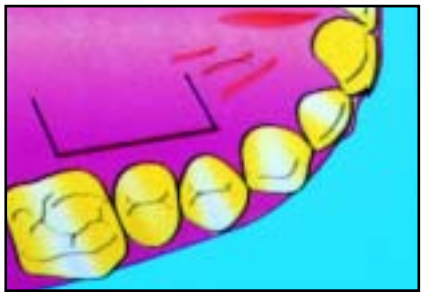

Fig 1e *Class III type A incision design.*

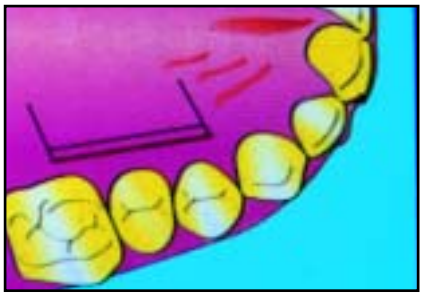

Fig 1f *Class III type B incision design.*

7. Whether sutures, stents, or hemostatic agents are required
8. Visibility of the procedure

The classification will help to determine the most effective incision/flap design to harvest the donor tissue. The incision design is as follows.

Liu classification

- *Class I:* one incision line (Figs 1a and 1b)
- *Class II:* two incision lines (L shape; Figs 1c and 1d)
- *Class III:* three incision lines (U shape; Figs 1e and 1f)
- Subclassification (horizontal incision)
  Type A: one horizontal incision (Fig 2a)
  Type B: two horizontal incisions (Fig 2b)

Class I: One incision line

This classification can be used in any connective tissue graft from the palatal site. Its advantages include:

1. Only one incision line.
2. Postoperative stent is not necessary.
3. Sutures or hemostatic agents may not be necessary.
4. The incision can be applied to varying palatal forms, including high, average, and shallow .
5. Less patient discomfort (a smaller wound at 1 week postoperative).

COPYRIGHT © 2002 BY QUINTESSENCE PUBLISHING CO, INC. PRINTING OF THIS DOCUMENT IS RESTRICTED TO PERSONAL USE ONLY. NO PART OF THIS ARTICLE MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM WITHOUT WRITTEN PERMISSION FROM THE PUBLISHER.

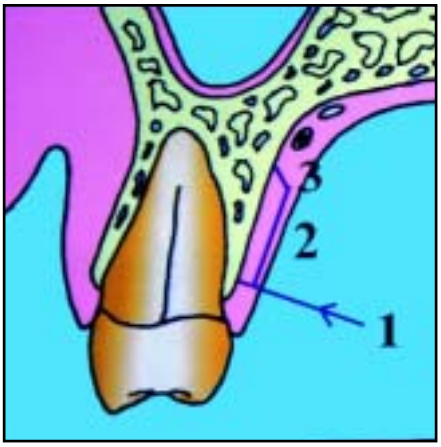

Fig 2a *Subclass type A incision design.*

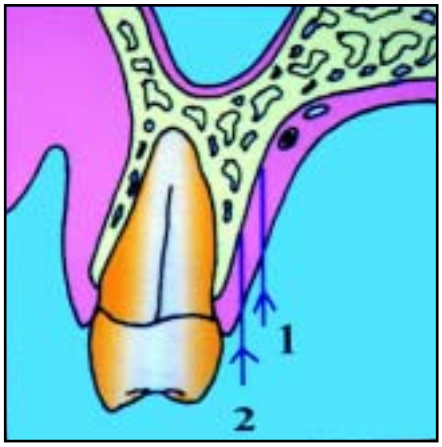

Fig 2b *Subclass type B incision design.*

6. More blood supply for the overlying flap.
7. Primary intention healing (in Class I type A) .

Disadvantages of this type of incision are:

1. Reduced visibility of the donor site during graft preparation
2. Quite difficult to execute

Class II: Two incision lines (L shape)

Indications for a Class II incision are:

1. Avoidance of the greater palatine artery and nerve
2. When third incision line is not necessary

Advantages are:

1. Smaller incision, but sufficient visibility
2. Moderate blood supply for the overlying flap
3. Relatively easy to execute

A disadvantage of this type of incision is that two incision lines may compromise the blood supply from the donor site.

Class III: Three incision lines (U shape)

Indications for a Class III incision are:

1. Concern for underlying anatomy (such as exostosis, vessels, nerves)
2. Need for larger amount of tissue

Advantages are:

1. Graft size similar to the incision design
2. Greater visibility
3. Easiest to execute

Disadvantages of this type of incision are:

1. More incision lines; possible compromise of the blood supply from the donor site
2. More postoperative pain; a larger wound at 1 week postoperative[10]
3. More sutures or stent required

COPYRIGHT © 2002 BY QUINTESSENCE PUBLISHING CO, INC. PRINTING OF THIS DOCUMENT IS RESTRICTED TO PERSONAL USE ONLY. NO PART OF THIS ARTICLE MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM WITHOUT WRITTEN PERMISSION FROM THE PUBLISHER.

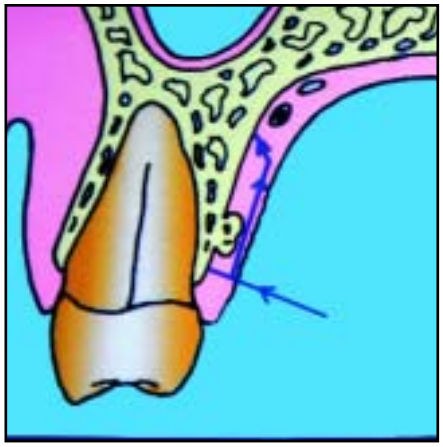

Fig 3a *Subclass type A incision design is applied to an area with an exostosis.*

Fig 3b *Subclass type B incision design is applied to an area with an exostosis.*

Subclassification (horizontal incision)

Indications for a type A (one horizontal incision[11]) design are:

1. The connective tissue graft without epithelium covering
2. Can be applied to different palatal forms, including high, average, and shallow[8]
3. Can be used in areas of minimal tissue depth (the thickness of donor site tissue is 3 mm or less, which is the average tissue depth in molar areas)
4. When a graft length (anteroposterior) larger than two premolars is needed[8] (average tissue depth in premolar region is 5 mm; in molar region average depth is 3 mm)

For a connective tissue graft that has a length greater than two premolars or greater than normal tissue depth, the use of one incision line allows harvesting of the full amount of connective tissue beneath the undermined masticatory mucosa.

Indications for a type B (two horizontal incisions) design are:

1. The tissue from the palatal site has sufficient thickness.
2. The connective tissue graft with its epithelial covering.
3. The recipient site will expose the epithelial side of the graft.

Discussion

This proposed classification system should allow for ease of communication with clinicians and offer a presurgical outline of the required flap design. The greater the incisions, the lower the blood supply; the smaller the incision(s), the more surgical expertise is required. (Larger incisions may compromise the blood supply.)

First, subclass types A and B are dependent on the recipient site. If the connective tissue graft is going to expose the epithelial area at the recipient site, the type B design (two horizontal incisions) is used. If the connective tissue graft is going to be buried underneath the recipient site, the type A design (one horizontal incision) is used.

The second concern is the thickness,[12] width, and length of the graft. The anatomy of the palatal vault[8] is divided into:

- Average palate: The average distance from the cementoenamel junction (CEJ) to the neurovascular bundle is 12 mm.
- High palate: The average distance from the CEJ to the neurovascular bundle is 17 mm.

COPYRIGHT © 2002 BY QUINTESSENCE PUBLISHING CO, INC. PRINTING OF THIS DOCUMENT IS RESTRICTED TO PERSONAL USE ONLY. NO PART OF THIS ARTICLE MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM WITHOUT WRITTEN PERMISSION FROM THE PUBLISHER.

Fig 4a *Gingival recession on the facial surfaces of the maxillary right canine and first premolar. Note that an orthodontic appliance is being used to erupt the lateral incisor.*

Fig 4b *Class I type A incision design is used at a donor site without epithelium.*

Fig 4c *At 10 months, note complete root coverage.*

- Shallow palate: The average distance from the CEJ to the neurovascular bundle is 7 mm.

For example, in the shallow palate situation, a 10 mm × 5 mm × 2 mm connective tissue graft is planned for harvesting. With the subclass type B incision, it is possible to cut the neurovascular bundle, so a subclass type A incision will be the choice in this situation.

The third concern is the possibility of an exostosis at the palatal site, especially in the molar area. If the "sounding" reveals an exostosis and there is not enough tissue thickness, the type A incision design is the better choice to gain more tissue (Fig 3).

Clinical Case Reports

Case 1

This 36-year-old man had gingival recession on the facial surfaces of the maxillary right canine and first premolar (Fig 4a). The premolar had endodontic treatment previously completed. A complete crown was to be fabricated in the future. The gingival margin of the right first premolar was at the same level as that of the left first premolar. Root coverage was planned to be attempted on the canine. A Class I type A incision design was applied at the donor site without epithelium (Fig 4b). The supraperiosteal envelope technique[13,14] was applied to achieve root coverage. At 10 months, there was complete root coverage (Fig 4c).

Case 2

This 32-year-old woman had the maxillary right central incisor missing. She was not satisfied with her restorative dentistry. After removing the old restorations, the pontic area revealed a Class I ridge defect[15,16] (buccolingual loss of tissue; Fig 5a). The Class I type B incision design was applied at the donor site with epithelium on the outer layer of the connective tissue graft (Fig 5b). The pouch procedure[17,18] was used at the recipient site. The connective tissue graft was sutured beneath the flap with epithelium exposed.[4] At 5 months, a depression was created in the edentulous area for an ovate pontic.[19] The occlusal view showed the success of the soft tissue augmentation (Fig 5c).

COPYRIGHT © 2002 BY QUINTESSENCE PUBLISHING CO, INC. PRINTING OF THIS DOCUMENT IS RESTRICTED TO PERSONAL USE ONLY. NO PART OF THIS ARTICLE MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM WITHOUT WRITTEN PERMISSION FROM THE PUBLISHER.

Fig 5a *Pontic area (maxillary right central incisor) reveals a Class I ridge defect (buccolingual loss of tissue).*

Fig 5b *Class I type B incision design is used at the donor site, with epithelium on the outer layer of the connective tissue graft.*

Fig 5c *At 5 months, a depression is created in the edentulous area for an ovate pontic. Occlusal view shows the success of the soft tissue augmentation.*

Fig 6a *This 45-year-old man had lost the maxillary right central and lateral incisors. A Class III ridge defect is noted.*

Fig 6b *Class II type A incision design is used at the donor site, without epithelium on the outer surface of the connective tissue graft.*

Fig 6c *At 3 months, the ridge defect is significantly improved.*

Case 3

This 45-year-old man had lost the maxillary right central and lateral incisors (Fig 6a). A Class III ridge defect[20] was noted. A connective tissue graft with a coronally positioned flap[21] was to be attempted before the final fixed restoration. The Class II type A incision design was applied at the donor site without epithelium on the outer aspect of the connective tissue graft (Fig 6b). A crestal incision was made at the edentulous area, and a sulcular incision was made around the right first premolar and left central incisor. The connective tissue graft was placed underneath the flap. A coronally positioned flap was used to cover the graft. At 3 months, the ridge defect was improved a great deal (Fig 6c).

Conclusions

The Liu classification of incision design from the palatal site should aid clinicians to decide which kind of incision design is best for the patient and to achieve the most effective incision/flap design to harvest the donor tissue. According to this classification, clinicians can harvest properly sized connective tissue grafts, thus avoiding larger wounds. The following factors should be evaluated:

- The graft size required by the recipient site
- The anatomy of the palatal vault
- The possibility of an exostosis
- Wound healing from the donor site (primary or secondary intention)
- Blood supply for the overlying flap
- Postoperative patient discomfort
- Whether sutures, stents, or hemostatic agents are required
- Visibility of the procedure

COPYRIGHT © 2002 BY QUINTESSENCE PUBLISHING CO, INC. PRINTING OF THIS DOCUMENT IS RESTRICTED TO PERSONAL USE ONLY. NO PART OF THIS ARTICLE MAY BE REPRODUCED OR TRANSMITTED IN ANY FORM WITHOUT WRITTEN PERMISSION FROM THE PUBLISHER.

References

1. Langer B, Langer L. Subepithelial connective tissue graft technique for root coverage. J Periodontol 1985;56:715–720.
2. Raetzke PB. Covering localized areas of root exposure employing the "envelope" technique. J Periodontol 1985;56: 397–402.
3. Harris RJ. The connective tissue and partial thickness double pedicle graft: A predictable method of obtaining root coverage. J Periodontol 1992;63:477–486.
4. Cohen ES. Ridge augmentation utilizing the subepithelial connective tissue graft: Case reports. Pract Periodontics Aesthet Dent 1994;6:47–53.
5. Cohen ES. Ridge enhancement and socket preservation utilizing the subepithelial connective tissue graft: A case report. Pract Periodontics Aesthet Dent 1995;7: 53–58.
6. Arnoux JP, Weisgold AS, Lu J. Single-tooth anterior implant: A word of caution. Part II. J Esthet Dent 1997;9:285–294.
7. Langer B, Calagna LJ. The subepithelial connective tissue graft. A new approach to the enhancement of anterior cosmetics. Int J Periodontics Restorative Dent 1982;2(2):23–33.
8. Reiser GM, Bruno JF, Mahan PE, Larkin LH. The subepithelial connective tissue graft palatal donor site: Anatomic considerations for surgeons. Int J Periodontics Restorative Dent 1996;16:131–137.
9. Nery EB, Corn H, Eisenstein IL. Palatal exostosis in the molar region. J Periodontol 1977;48:663–666.
10. Harris RJ. A comparison of two techniques for obtaining a connective tissue graft from the palate. Int J Periodontics Restorative Dent 1997;17:261–271.
11. Hürzeler MB, Weng D. A single-incision technique to harvest subepithelial connective tissue grafts from the palate. Int J Periodontics Restorative Dent 1999;19: 279–287.
12. Studer SP, Allen EP, Rees TC, Kouba A. The thickness of masticatory mucosa in the human hard palate and tuberosity as potential donor sites for ridge augmentation procedures. J Periodontol 1997;68: 145–151.
13. Allen AL. Use of the supraperiosteal envelope in soft tissue grafting for root coverage. I. Rationale and technique. Int J Periodontics Restorative Dent 1994;14: 217–227.
14. Zabalegui I, Sicilia A, Cambra J, Gil J, Sanz M. Treatment of multiple adjacent gingival recessions with the tunnel subepithelial connective tissue graft: A clinical report. Int J Periodontics Restorative Dent 1999;19:199–206.
15. Seibert JS. Reconstruction of deformed, partially edentulous ridges, using full thickness onlay grafts. Part I. Technique and wound healing. Compend Contin Educ Dent 1983;4:437–453.
16. Seibert JS. Reconstruction of deformed, partially edentulous ridges, using full thickness onlay grafts. Part II. Prosthetic/periodontal interrelationships. Compend Contin Educ Dent 1983;4:549–562.
17. Langer B, Calagna L. The subepithelial connective tissue graft. J Prosthet Dent 1980;44:363–367.
18. Garber DA, Rosenberg ES. The edentulous ridge in fixed prosthodontics. Compend Contin Educ Dent 1981;2: 212–223.
19. Abrams L. Augmentation of deformed residual edentulous ridge for fixed prosthesis. Compend Contin Educ Gen Dent 1980;1:205–214.
20. Orth CF. A modification of the connective tissue graft procedure for the treatment of type II and type III ridge deformities. Int J Periodontics Restorative Dent 1996;16: 267–277.
21. Harvey P. Management of advanced periodontitis. I. Preliminary report of a method of surgical reconstruction. NZ Dent J 1965;61:180–187.