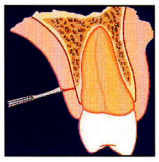
The Single-Incision Palatal Harvest Technique: A Strategy for Esthetics and Patient Comfort



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The use of connective tissue grafts for root coverage and ridge augmentation is a proven, effective treatment modality. Complications associated with the palatal donor site can arise because of incomplete primary closure of the palatal wound or sloughing of the overlying tissue. This article presents a new technique for the atraumatic harvesting of connective tissue grafts from palatal donor sites. The main advantage of this single-incision technique is the primary closure of the palatal flap, resulting in less pain and sensitivity and fewer postoperative complications. A review of the technique and its indications, rationale, and limitations is presented. (Int J Periodontics Restorative Dent 2000;20:297–305.)

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Periodontal plastic surgery comprises a number of techniques for the management of soft tissue deficits and deformities.[1] Among these are insufficient clinical crown length, asymmetric gingival margins, improper gingival margin relationship, localized alveolar ridge deficiencies, the exposure of unerupted teeth, and localized marginal tissue recession.[2]

Of these, gingival recession is a long-recognized condition that has been addressed in the literature via a variety of surgical techniques. The primary concerns regarding the presence of gingival recession include marginal tissue irritation, root surface sensitivity, root caries, esthetic concerns, and tooth loss. Recent advances in techniques and materials have resulted in significant improvements in both predictability and esthetics.

Grupe and Warren[3] first reported the treatment of gingival recessions using a lateral sliding flap procedure. This procedure, however, was limited by the amount and thickness of adjacent donor tissue. Bjorn[4] was the first to report the transplantation of epithelialized palatal grafts

for the purpose of augmenting the zone of keratinized gingiva. Coverage of denuded root surfaces with free soft tissue autografts was not considered possible with any degree of predictability until a series of articles published by Miller[5,6] reported that complete root coverage was possible in 90% of Class I and II recessions using a citric acid root biomodification technique and free soft tissue autografts.

The principal shortcomings of the epithelialized graft, however, were the presence of a painful, open palatal wound and a "tire-patch" appearance of the grafted sites. Edel[7] was the first to address these concerns by obtaining connective tissue for the augmentation of keratinized gingiva. The use of connective tissue grafts for root coverage was first mentioned by Langer and Calagna in 1982,[8] with the chief advantages being the presence of a bilaminar blood supply, a minimal palatal wound, and improved esthetics.[8,9] The first clinical study using connective tissue grafts for root coverage was reported in 12 cases published by Raetzke[10] in which 80% mean root coverage was obtained. Since then, the predictability and consistent esthetics of connective tissue grafts have been well documented.[11–15] Comprehensive review of the literature indicates that greater mean root coverage has been reported with connective tissue grafts than with any other root coverage technique.[16]

Since the introduction of the connective tissue graft, numerous techniques have been reported for the harvesting of donor tissue. A popular method has been the use of a partial-thickness trapezoidal palatal flap followed by connective tissue harvesting and suturing of the donor site.[7,9,17] This type of palatal flap design has been prone to sloughing and delayed healing.[7,17]

Raetzke[10] described the use of a semilunar incision design for the harvest of a connective tissue graft "wedge" together with a small band of palatal epithelium. Others have used specialized blade instruments to similarly obtain connective tissue via parallel incisions.[12] Both techniques require substantial palatal thickness to avoid sloughing of the overlying palatal tissue, and complete primary closure of the wound cannot predictably be obtained.

Recently, a new technique was described for the harvesting of a full-thickness periosteal connective tissue graft from the palate.[18] In this technique, an incision is made perpendicular to the long axis of the teeth, followed by a second incision parallel to the long axis of the teeth and 1 to 2 mm apical to the first incision. A small periosteal elevator is then used to obtain the graft. This technique decreases the chances of sloughing of the palatal flap, but may result in a significant void at the donor site, often requiring long periods to repair secondarily. The purpose of this article is to describe a modification of this technique that employs only a single incision for the harvest of a full-thickness connective tissue graft.[19] In addition, the indications, rationale, and benefits of this technique in clinical practice are discussed.

Method and materials

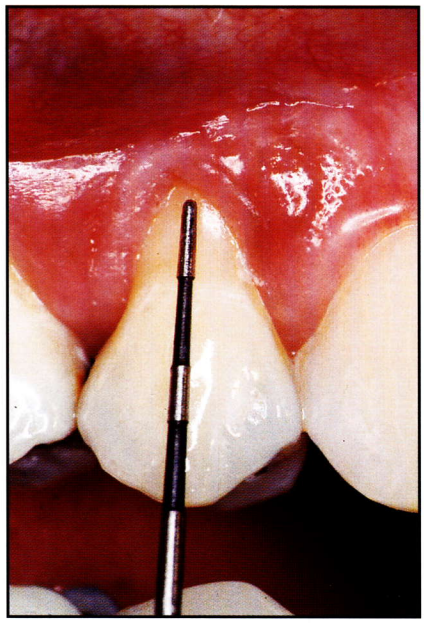
Case 1

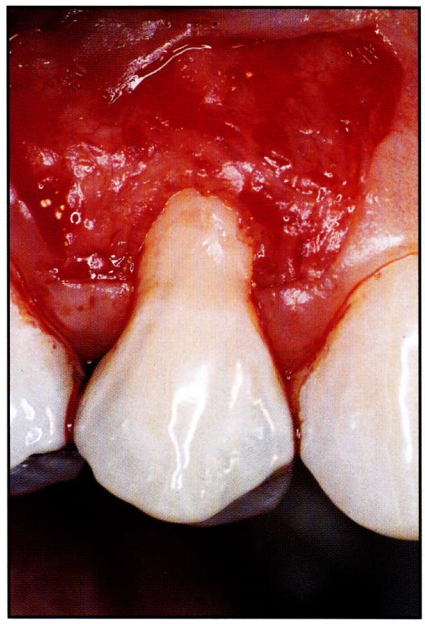
A 51-year-old Latin American woman presented to the Baylor College of Dentistry Department of Periodontics for the evaluation of recession on the maxillary right second premolar. A review of her medical history revealed that she had been diagnosed with Wolff-Parkinson-White syndrome, for which she required daily verapamil (Isoptin, Knoll). Her other medications included hormone-replacement therapy (Premarin [Wyeth-Ayerst] and Provera [Upjohn]), loratadine (Claritin, Schering) for seasonal allergies, and calcium supplements.

The initial examination revealed a 4-mm Miller Class I recession[20] on the buccal aspect of the maxillary second premolar (Fig 1) that was sensitive to thermal variation and was of significant esthetic concern. There were minimal probing depths and approximately 2 mm of attached gingiva apical to the recession. The exposed root surface was carefully planed and burnished with citric acid for 30 seconds. The recipient site was prepared in the manner previously described by Allen.[21] Briefly, partial-thickness flap dissection is extended well into the vestibule to allow passive coronal positioning of the flap. The amount of tissue excised coronally is equal to the

Fig 1 (left) *Case 1. Maxillary right second premolar with a 4-mm Miller Class I recession.*

Fig 2 (right) *Split-thickness recipient bed preparations.*





amount of coronal positioning of the flap desired.

The single-incision palatal harvest technique

Following preparation of the recipient bed (Fig 2), the connective tissue graft can be harvested. The first step involves the careful evaluation of the dimensions of tissue required for root coverage as well as the availability of donor tissue. Following administration of local anesthesia, a # 15 blade is oriented perpendicular to the palatal tissue surface. A single incision is made to the bone in a horizontal direction approximately 2 to 3 mm apical to the gingival margin of the maxillary teeth (Figs 3 and 4). The length of the incision is determined by the dimensions of the graft required, as well as extension for the elevation and removal of the donor tissue.

A partial-thickness dissection is then made within the single incision, leaving an adequate thickness of the palatal flap intact to minimize the chance of sloughing of the overlying tissue (Figs 5 and 6). The dissection is carried out as far apical as necessary to obtain the desired dimensions of the graft. The connective tissue with underlying periosteum is then carefully elevated from the palate with the use of a small Molt or Buser elevator (Hu-Friedy) (Fig 7). Careful manipulation of the graft with Corn suture pliers (Hu-Friedy) or other delicate tissue forceps may be required, but care must be taken to prevent compression or tearing of the graft. In the present case, primary closure was obtained using # 5.0 chromic gut suture with a PS-5 needle (Ethicon/Johnson & Johnson) (Fig 8). The use of sutures for closure of the palatal wound is optional but recommended.[19]

Once the graft is harvested, it must be maintained in a moist environment to prevent desiccation prior to transplantation. The connective tissue and periosteal surfaces should

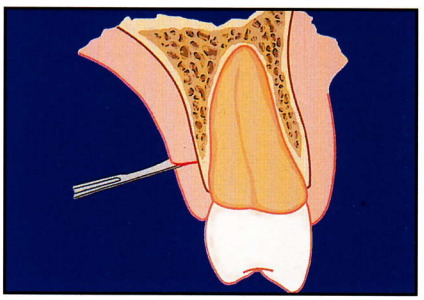


Fig 3 *Initial incision is made with # 15 blade oriented perpendicular to the tissue surface.*

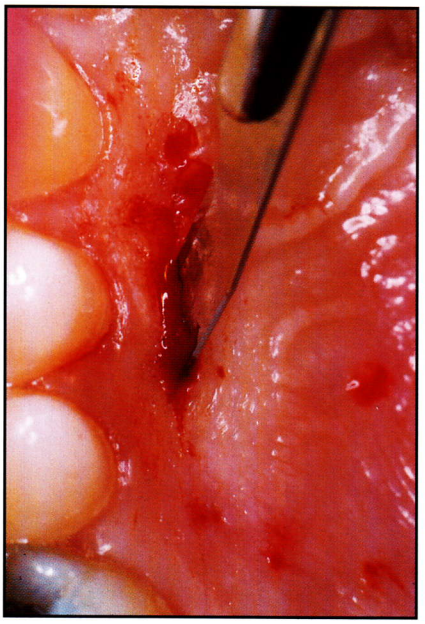


Fig 4 (right) *Single palatal incision.*

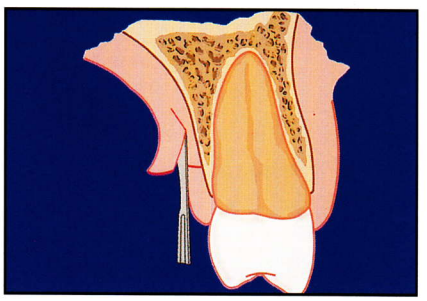


Fig 5 *Split-thickness dissection is made parallel to the long axis of the teeth, leaving the graft attached to the underlying bone with adequate thickness of the overlying palatal flap.*

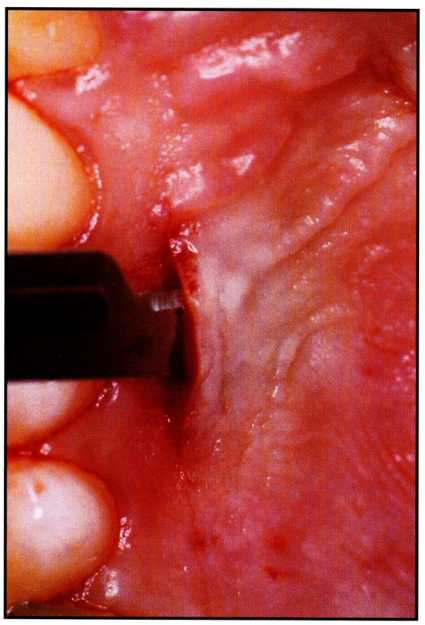


Fig 6 *Split-thickness dissection.*

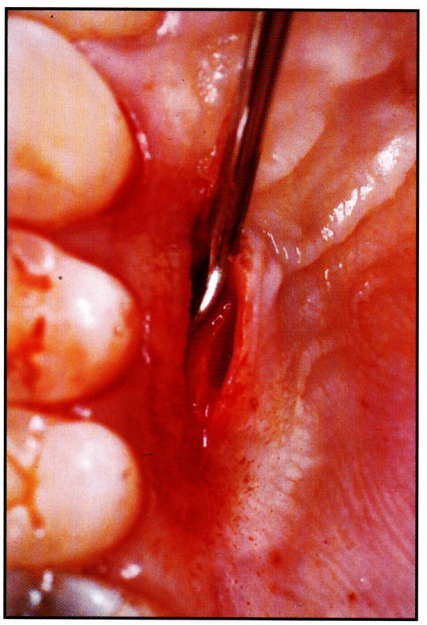


Fig 7 *Atraumatic graft elevation using a Molt periosteal elevator.*

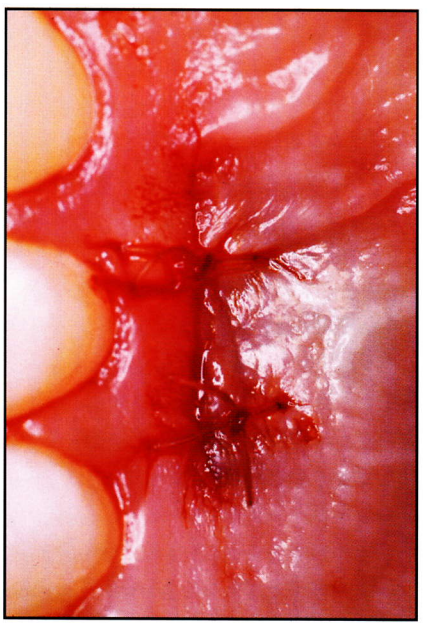


Fig 8 *Primary closure of donor site is achieved with # 5.0 chromic gut sutures.*

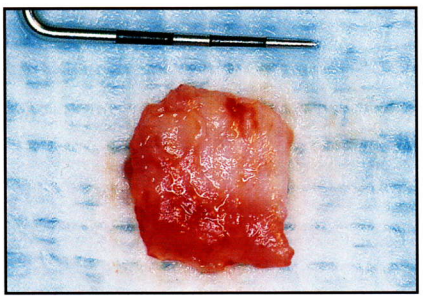


Fig 9 *Harvested connective tissue graft (periosteum side).*

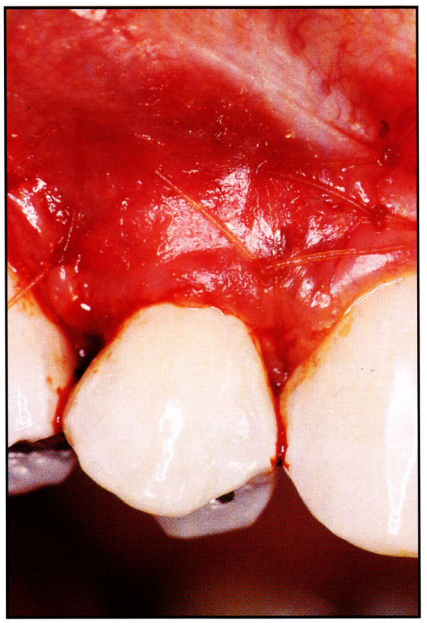


Fig 10 (right) *Final suturing of grafted site.*

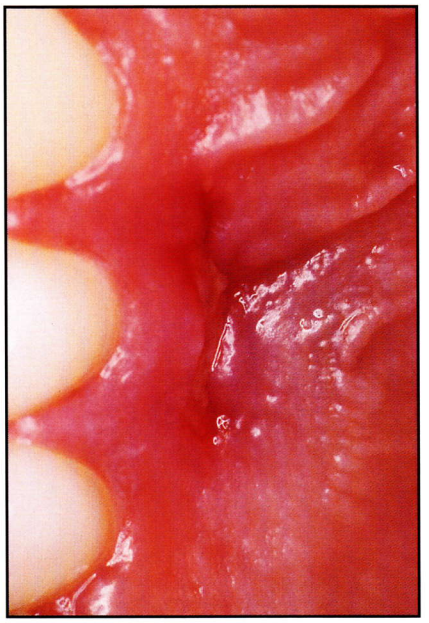


Fig 11 (far right) *Healing at 5 days following graft harvesting.*

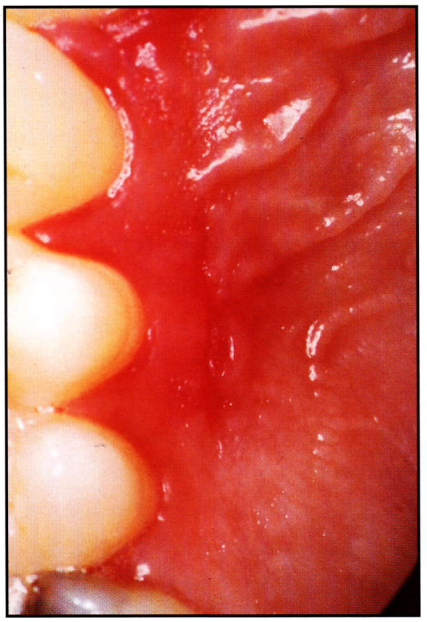


Fig 12 (left) *Healing at 2 weeks. Note accelerated healing response of the palatal wound.*

Fig 13 (right) *After 15 months, 100% root coverage is maintained.*

be readily identifiable (Fig 9). Final contouring of the graft may be accomplished at this time. The graft is sutured to the recipient bed, again using # 5.0 chromic gut suture, and the flap is coronally positioned and secured with # 5.0 chromic gut suture (Fig 10).

At 5 days postsurgery, palatal healing had proceeded uneventfully, with primary wound closure (Fig 11). At 2 weeks, palatal healing was nearly complete (Fig 12). At 15 months postsurgery, root coverage approximating 100% was evident, with no inflammation or sensitivity, minimal probing depths, and a favorable esthetic result (Fig 13).

Case 2

A 48-year-old Asian woman presented with multiple Miller Class I recessions from the maxillary right canine to the left first premolar that were primarily of esthetic concern to the patient. Her past medical history was noncontributory. Examination revealed minimal probing depths and approximately 2 to 3 mm of attached gingiva apical to the recessions throughout the sextant.

At the time of surgery, the recipient sites were prepared by tunneling the papillae using a split-thickness dissection; the connective tissue grafts were harvested bilaterally using the single-incision technique. At 10 days, healing was nearly complete, with minimal postoperative discomfort to the patient. At 9 months postoperative, root coverage was nearly 100% at all sites, with minimal probing depths, no inflammation, and a favorable esthetic result.

Discussion

This article describes the modification of a technique previously reported by Bruno,[18] in which blunt dissection was used to obtain connective tissue with periosteum. In this report, the use of parallel incisions, which results in a graft with an epithelial collar, is replaced with a single-incision technique that results in dense connective tissue without an epithelial collar and primary closure of the palatal wound.

Bouchard et al[15] compared the use of connective tissue grafts with and without epithelial collars in Class I and II recessions. While they found no significant differences in mean root coverage with either graft, they did report that by eliminating the epithelial collar, better esthetic results were consistently achieved. On the other hand, they concluded that if large augmentation of keratinized gingiva is required, retention of the epithelial collar may be desired.[15] Use of the single-incision technique in the present report resulted in grafts without an epithelial collar with excellent functional and esthetic results. In addition, large amounts of connective tissue can be harvested from the palate with rapid healing and minimal discomfort to the patient, as shown by case 2.

The use of a single-incision connective tissue harvesting technique is intended to be a natural progression from previously reported donor tissue harvesting techniques. Edel[7] first reported the use of a "trapdoor" palatal flap design using vertical incisions to gain access to the

underlying connective tissue. While this flap design has gained widespread use because of the relative ease of graft procurement, it is not without complications. Among these are the interruption of vascular supply to the overlying tissue as a result of the use of vertical incisions as well as over-thinning of the flap, which also predisposes palatal sloughing.[7,17]

The use of parallel incisions and wedge techniques eschews the use of vertical incisions, which eliminates the possible interruption of the vascular supply.[10–12] However, over-thinning of the palatal flap as well as the inability to obtain primary closure of the wound are still disadvantages associated with these techniques. The technique reported by Bruno[18] is essentially a modified wedge technique. To review briefly, a horizontal incision is made to the bone, followed by a second incision that takes an epithelial collar with the desired graft thickness. The incisions meet at the periphery of the wound, and the graft is obtained via blunt elevation with underlying periosteum.[18] This technique improves on previous reports by not only avoiding vertical incisions, but also by ensuring a more consistent thickness of the palatal flap. This further reduces the possibility of adverse postoperative sequelae.

Finally, the use of the single-incision technique facilitates the predictability of primary closure of the palatal wound. This maximizes patient comfort during the early stages of healing, accelerates the healing response at the donor site, and significantly decreases the likelihood of postoperative complications from the donor site, even when harvesting large amounts of donor tissue.

Another possible advantage of this technique and Bruno's[18] technique is the ability to obtain new attachment and/or bone formation over the previously denuded root surface. The presence of osteogenic substances in periosteum, such as bone morphogenic proteins (BMP), may induce new bone formation by stimulating the differentiation of mesenchymal cells into osteoprogenitor cells.[22,23] The presence of BMP in periosteum has been verified in studies using immunohistochemical staining; specifically, BMP-2 derived from free periosteal grafts in rabbits has been implicated in the differentiation of osteoblasts from mesenchymal cells.[24,25]

Periosteum has been shown in both human and animal models to have the capability to stimulate bone formation in a variety of tissues. Ritsila et al[26] reported that free periosteal grafts from the tibia of rabbits were able to induce bone and cartilage formation in the eye and kidney. Cohen and Lacroix[27] found bone formation when periosteal grafts were placed in midline sutures of rabbit mandibles. Free periosteal grafts from the tibia were placed into the maxillary clefts of 11 human patients with resulting bone formation.[28] Smukler et al[29] used free grafts of stimulated periosteum to induce bone formation in intrabony defects. Recently, Lekovic and coworkers[30,31] used periosteal grafts obtained via a "window flap" to treat

mandibular grade II furcations. Reentry revealed significant increases in bone fill when compared to either repositioned or coronally positioned flaps. Kwan et al[32] compared periosteal grafts to open-flap debridement in intrabony defects and found significant gain in clinical attachment and bone fill in sites where periosteal grafts were used as barriers.

Previously, new attachment and bone formation in recession defects have been predictably achieved only with the use of guided tissue regeneration procedures.[33] However, a case report by Pasquinelli[34] found new cementum and bone formation in conjunction with the placement of a thick free soft tissue autograft. It is therefore reasonable to hypothesize that new cementum and bone formation may be possible with the use of a known osteogenic tissue such as periosteum. Further research into this aspect of wound healing of the periosteal graft is needed.

The technique presented is not without certain limitations. Since no vertical incisions are used, adequate extension of the first horizontal incision is necessary to obtain the desired graft dimensions. The amount of graft material that can be obtained is limited by individual variation of the palatal vault. A recent study carefully measured the thickness of masticatory mucosa in the palate and tuberosity to determine optimal donor sites.[35] It was concluded that the palatal root of the first molar and the canine area formed the posterior and anterior anatomic barriers, respectively, for the harvest of connective tissue. Furthermore, if augmentation of keratinized tissue is desired in conjunction with connective tissue grafting, the technique described by Bruno[18] may be the next logical choice instead of the single-incision technique.

A technique that maximizes functional and esthetic aspects of connective tissue grafting and ensures patient comfort during the postoperative healing period has been presented. Its advantages include primary closure and accelerated healing of the palatal wound, a decreased likelihood of postoperative complications, improved postoperative patient comfort, and predictable root coverage and esthetics.

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References

1. Miller PD Jr. Regenerative and reconstructive periodontal plastic surgery. Mucogingival surgery. Dent Clin North Am 1988;32:287–306.
2. Allen EP. Use of mucogingival surgical procedures to enhance esthetics. Dent Clin North Am 1988;32:307–330.
3. Grupe J, Warren R. Repair of gingival defects by a sliding flap operation. J Periodontol 1956;27:290–295.
4. Bjorn H. Free transplantation of gingiva propia. Swed Dent J 1963;22:684–689.
5. Miller PD Jr. Root coverage using a free soft tissue autograft following citric acid application. Part I: Technique. Int J Periodontics Restorative Dent 1982;2(1): 65–70.
6. Miller PD Jr. Root coverage using a free soft tissue autograft following citric acid application. III. A successful and predictable procedure in areas of deep-wide recession. Int J Periodontics Restorative Dent 1985;5(2):15–37.
7. Edel A. Clinical evaluation of free connective tissue grafts used to increase the width of keratinized gingiva. J Clin Periodontol 1974;1:185–196.
8. 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.
9. Langer B, Langer L. Subepithelial connective tissue graft technique for root coverage. J Periodontol 1985;56:715–720.
10. Raetzke PB. Covering localized areas of root exposure employing the "envelope" technique. J Periodontol 1985;56:397–402.
11. Nelson SW. The subpedicle connective tissue graft. A bilaminar procedure for the coverage of denuded root surfaces. J Periodontol 1987;58:95–102.
12. Harris RJ. The connective tissue and partial thickness double pedicle graft: A predictable method of obtaining root coverage. J Periodontol 1992;63:477–486.
13. Harris RJ. The connective tissue with partial thickness double pedicle graft: The results of 100 consecutively-treated defects. J Periodontol 1994;65:448–461.
14. Allen AL. The use of the supraperiosteal envelope in soft tissue grafting for root coverage. II. Clinical results. Int J Periodontics Restorative Dent 1994;14: 303–315.
15. Bouchard P, Etienne D, Ouhayoun J-P, Nilvéus R. Subepithelial connective tissue grafts in the treatment of gingival recessions. A comparative study of 2 procedures. J Periodontol 1994;65:929–936.
16. Wennström JL. Mucogingival therapy. Ann Periodontol 1996;1:671–701.
17. Broome WC, Taggart EJ. Free autogenous connective tissue grafting. Report of two cases. J Periodontol 1976;47:580–585.
18. Bruno JF. Connective tissue graft technique assuring wide coverage. Int J Periodontics Restorative Dent 1994;14: 127–137.
19. Miller PD Jr. Periodontal plastic surgery, Esthetic and restorative considerations. Presented at the Summer Meeting of the Southwest Society of Periodontology, Santa Fe, NM, 20–22 June 1997.
20. Miller PD Jr. A classification of marginal tissue recession. Int J Periodontics Restorative Dent 1985;5(2):9–13.
21. Allen EP. Pedicle flaps, gingival grafts, and connective tissue grafts in aesthetic treatment of gingival recession. Pract Periodontics Aesthet Dent 1993;5:29–38.
22. Urist MR, Strates BS. Bone morphogenic protein. J Dent Res 1971;50:1392–1406.
23. Lee MB. Bone morphogenic proteins: Background and implications for oral reconstruction. A review. J Clin Periodontol 1997;24:355–365.
24. Lianjia Y, Yan J. Immunohistochemical observations on bone morphogenic protein in normal and abnormal conditions. Clin Orthop 1990;257:249–256.
25. Nishimura T, Simmons DJ, Mainous EG. The origin of bone formed by heterotopic periosteal autografts. J Oral Maxillofac Surg 1997;55:1265–1268.
26. Ritsila V, Alhopuro S, Rintala A. Bone formation with free periosteum from tibia. Scand J Plast Reconstr Surg 1972;6: 51–56.
27. Cohen J, Lacroix P. Bone and cartilage formation by periosteum. Assay of experimental autogenous grafts. J Bone Joint Surg Am 1955;37:717–730.
28. Ritsila V, Alhopuro S, Gulling U, Rintala A. The use of free periosteum for bone formation in congenital clefts of the maxilla. Scand J Plast Reconstr Surg 1972;6:57–60.
29. Smukler H, Goldman HM, Castelucci G. Grafting intraosseous defects with stimulated free osteoperiosteal grafts. Periodontal Case Rep 1985;7:11–16.
30. Lekovic V, Kenney EB, Carranza FA, Martignoni M. The use of autogenous periosteal grafts as barriers for the treatment of Class II furcation involvements in lower molars. J Periodontol 1991;61: 775–780.
31. Lekovic V, Klokkevold PR, Camargo PM, Kenney EB, Nedic M, Weinlaender M. Evaluation of periosteal membranes and coronally positioned flaps in the treatment of Class II furcation defects: A comparative clinical study in humans. J Periodontol 1998;69:1050–1055.
32. Kwan SK, Lekovic V, Camargo PM, Klokkevold PR, Kenney EB, Nedic M, Dimitrijevic B. The use of autogenous periosteal grafts as barriers for the treatment of intrabony defects in humans. J Periodontol 1998;69:1203–1209.
33. Cortellini P, Clauser C, Pini Prato GP. Histologic assessment of new attachment following the treatment of a human buccal recession by means of a guided tissue regeneration procedure. J Periodontol 1993;64:387–391.
34. Pasquinelli KL. The histology of new attachment utilizing a thick autogenous soft tissue graft in an area of deep recession: A case report. Int J Periodontics Restorative Dent 1995;15:248–257.
35. Studer SP, Allen EP, Rees TD, 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.