

## Case Report

# Tunnel Technique With a Surgical Maneuver to Increase the Graft Extension: Case Report With a 3-Year Follow-Up

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**Background:** This article reports a clinical case with a 3-year follow-up in which a subepithelial connective tissue graft (SCTG) was used with the tunnel technique to treat multiple gingival recessions, and describes a technique used to enlarge the extension of the graft.

**Methods:** A 41-year-old female patient was referred for evaluation and treatment of maxillary multiple recessions. Following basic therapy, the plaque index was 23%, and the gingival index was 12%. Thus, SCTG with the tunnel technique was proposed to provide root coverage of Miller Class I recession on teeth #8 through #11 and a Miller Class III recession on tooth #12. After the donor area had been prepared, SCTG was removed and split cross-sectionally to lengthen it. The graft was placed through the tunnel and sutured.

**Results:** Two weeks after the surgical procedure, the tissue color was nearly homogeneous with some reddish regions where the connective tissue was left uncovered, and there were no signs of incisions or suture marks. After 3 years of follow-up, the mean coverage of the recessions was  $2.2 \pm 0.7$  mm (74.2%), which corresponded to the gain of keratinized tissue. In addition, a gain in tissue thickness was observed.

**Conclusion:** In a long-term evaluation, the tunnel technique with the elongated SCTG was used successfully for treatment of multiple gingival recessions with an increase of the soft tissue volume and gain of keratinized tissue. J Periodontol 2008;79:753-758.

### KEY WORDS

Case report; connective tissue; esthetics; gingival recession; grafts; surgery.

Gingival recession is characterized by apical displacement of the gingival margin with relation to the cemento-enamel junction.<sup>1</sup> Several factors may be related to this condition. Traumatic brushing<sup>2,3</sup> and inflammation caused by the presence of bacterial plaque<sup>4,5</sup> have been considered primary or triggering factors in gingival recession. Furthermore, tooth position in the arch,<sup>6</sup> bone dehiscences<sup>7</sup> and fenestrations, high insertion of the frenum,<sup>8</sup> thickness of the marginal gingiva, and iatrogenic factors (improper restorations<sup>9,10</sup> and uncontrolled orthodontic movement<sup>11,12</sup> related to force, direction, or dental tipping) are considered predisposing and may act in isolation or with other factors.

Overall, the indications to cover the root surface exposed by gingival recession include esthetics, root sensitivity, prevention and management of root caries, and prevention of periodontal disease progression in areas where oral hygiene cannot be maintained properly.<sup>13,14</sup>

Several surgical techniques have been used to achieve root coverage such as pedicle soft tissue graft<sup>15,16</sup> (flap positioned coronally, flap positioned laterally, and double-papillae flap), free gingival graft,<sup>17,18</sup> subepithelial connective tissue graft (SCTG),<sup>14,18-22</sup> acellular dermal matrix allograft (ADM),<sup>23,24</sup> guided tissue regeneration,<sup>22,25</sup> or a combination of these techniques. Among these procedures, the SCTG has been used the most frequently because of the final color achieved and the high predictability reported.<sup>13,14,19-22</sup> Nevertheless, the SCTG is used frequently with a coronally positioned flap that may retard the early esthetic result because of the need of releasing incisions on the buccal flap.<sup>26</sup> To avoid releasing incisions in the receptor site, the envelope technique was proposed.<sup>26</sup> In this technique, the SCTG is placed within an envelope created around the denuded root surface. The advantages are minimal surgical trauma at the recipient site, early esthetic result, and satisfactory healing.<sup>26,27</sup> Following these principles, Allen<sup>28,29</sup> modified this

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procedure to include adjacent areas of gingival recession on multiple teeth, which was defined as the “tunnel technique.”

Despite a number of publications<sup>14,20-22</sup> demonstrating the effect of the SCTG on the management of localized recessions, few articles have discussed its use for multiple recessions, especially when associated with the tunnel technique. In addition, no articles were found involving any maneuver to lengthen connective tissue grafts when the topic was searched in the MEDLINE database in April 2007. The following terms were used: “connective tissue graft” and “split” or “enlargement” or “increase” or “augmentation” or “stretch.” No limits were included.

The present article reports a clinical case after a 3-year follow-up in which SCTG was used with the tunnel technique to treat multiple gingival recessions and describes an approach used to enlarge the graft extension.

### CASE DESCRIPTION AND RESULTS

A 41-year-old female patient was referred to the Periodontology Clinic, São Paulo State University, in October 2003 by her orthodontist for evaluation and treatment of multiple recessions in the maxilla (Fig. 1). Her complaints were esthetics and dental sensitivity.

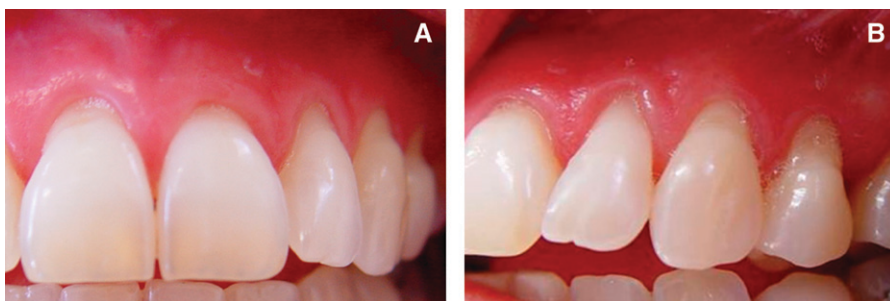
The patient reported she had undergone orthodontic therapy and orthognathic surgery. She was non-smoking, presented good systemic health, and brushed her teeth with a hard-bristle toothbrush using horizontal motions.

The clinical examination revealed a plaque index<sup>30</sup> (PI) of 43% and a gingival index<sup>30</sup> (GI) of 18%, with probing depth  $\leq 3$  mm. The lesions probably were caused by anatomic features associated with traumatic toothbrushing or orthodontic movement (buccal tipping).

The patient underwent complete root planing and scaling, teeth polishing, and oral hygiene instructions, and the use of a soft-bristle toothbrush was recommended. After 1 month, the PI was 23%, and the GI was 12%; thus, an SCTG was proposed in association with the tunnel technique, aiming for root coverage of teeth #8 through #12. These teeth presented Miller<sup>31</sup> Class I gingival recession, except for tooth #12, which presented proximal tissue loss in the distal aspect and was classified as Miller Class III recession.

#### Receptor Site Preparation

Initially, intra- and extraoral antiseptics were carried out using 0.12% chlorhexidine digluconate. Following



**Figure 1.**

Clinical aspect of the initial condition. Frontal (A) and lateral (B) views of the multiple recessions on teeth #8 through #12.

local anesthesia, the exposed root surfaces were submitted to root planing and scaling. After that, sulcular incisions were made through the buccal aspect with a #12 scalpel blade, preserving the integrity of the papillae. The incision was initiated in the distal aspect of the left first maxillary premolar (tooth #12) and extended to the distal aspect of the right central maxillary incisor (tooth #8). A vertical incision was performed in the distal aspect of the tunnel without reaching the gingival margin. Full-thickness dissection was carefully performed with a #5/6 Gracey curet to avoid crossing the mucogingival junction and was extended laterally up to the vertical incision performed previously in the distal aspect of the tunnel.

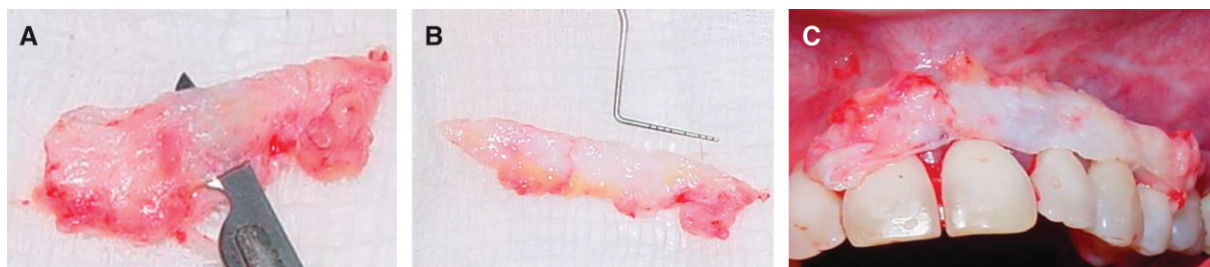
#### Donor Site Preparation

The second step was to harvest an SCTG from the palatal mucosa that would be large enough to completely cover the tunnel area. The selected area extended from the distal aspect of the cuspid to the distal aspect of the left first molar. The single-incision technique was used to remove the graft. Because the area to be managed was large, a maneuver was performed to enlarge the extension of the graft. The graft was removed with the maximum thickness so that it could be split. The graft was then positioned on a sterilized glass plate and immobilized with a sterile wooden spatula. The graft was split cross-sectionally with a #15 scalpel blade; however, it was not divided completely into two parts (Fig. 2). After this procedure, the graft had almost twice the length of the initial graft and a thickness of 1.5 mm.

#### Graft Positioning

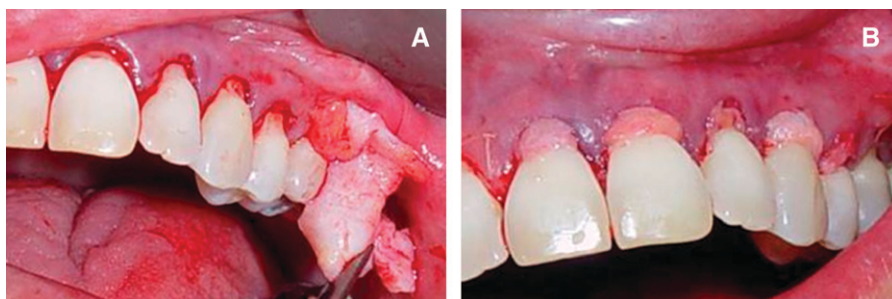
The graft was positioned over the receptor site with a bioabsorbable polyglactin 910 5-0 suture.<sup>||</sup> The needle was introduced through the flap in the distal aspect of tooth #8, and the suture was guided inside the

<sup>||</sup> Vicryl, Johnson & Johnson, São José dos Campos, SP, Brazil.



**Figure 2.**

The graft was split cross-sectionally (A), but it was not separated into two parts (B). C The final extension of the graft was evaluated after the surgical maneuver.



**Figure 3.**

The graft was introduced into the tunnel (A), and sutured in position (B).

tunnel; then, the suture exited the tunnel through the vertical incision made in its distal aspect. The suture was guided through the graft and was introduced into the tunnel again, leaving it next to the point of initial penetration. Then the graft was pulled by the suture, penetrating into the tunnel toward the initial point (Fig. 3), where it was fixed using a single suture. The vertical incision was closed along with the graft using a single suture, which kept the graft in the position desired. Finally, the palate suture was carried out with X-shaped suspensory sutures, and periodontal dressing<sup>¶</sup> was applied over the donor site and on the receptor areas.

#### Postoperative Instructions

The patient was instructed to take analgesic medication (paracetamol, 750 mg, three times a day for 4 days) and to use mouthrinse with 0.12% chlorhexidine digluconate (twice a day for 15 days). The periodontal dressing and all sutures were removed after 7 days. The patient was followed up weekly during the first month, monthly up to the third month, and annually up to the third year.

#### Clinical Evaluation

The healing process was uneventful, and the patient did not report pain or discomfort during the overall postoperative period.

The patient presented a thick palate at baseline; thus, it was possible to obtain a thick graft, and a satisfactory wound closure was achieved. During the surgical procedure, bleeding was within normal limits. During the postoperative follow-up, no sign of necrosis or hemorrhage was observed in the donor area, and no pain or discomfort was reported.

The color of the tissues was nearly homogeneous 2 weeks following the surgical procedure, with

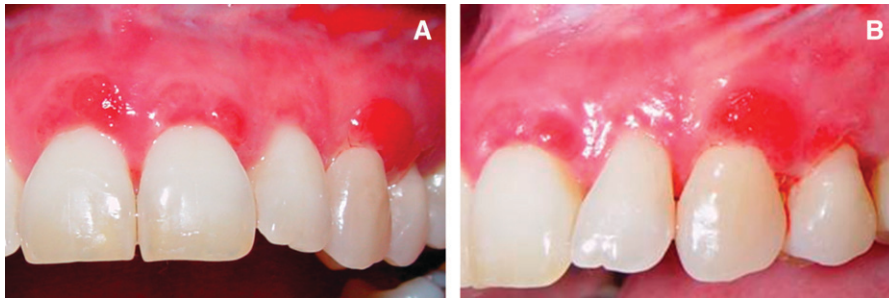
some reddish regions in the sites where the connective tissue was left exposed, and there were no signs of incisions or suture marks (Fig. 4). Because releasing incisions were not made in the receptor area, healing was achieved at a very early stage and without the presence of scars. Esthetic improvements were observed 3 months postoperatively (Fig. 5) and were maintained during 3 years of follow-up (Fig. 6).

The clinical measurements made at baseline and after 3 years of follow-up are shown in Table 1. The mean coverage of the recessions was  $2.2 \pm 0.7$  mm (74.2%); this value corresponded to the gain of keratinized tissue. In addition, an increase in the tissue thickness was observed.

#### DISCUSSION

In the present article, a clinical case was reported in which the SCTG was used with the tunnel technique to treat multiple recessions, resulting in a satisfactory coverage. One of the difficulties in obtaining coverage of multiple recessions with SCTG is obtaining a graft of adequate size because of anatomic limitations in the donor area. The graft usually is removed from the palate in the region of the premolars and first molar. If this length is respected, three teeth is the maximum area of coverage. If the coverage area involves a larger

<sup>¶</sup> Coe-Pak, GC America, Alsip, IL.



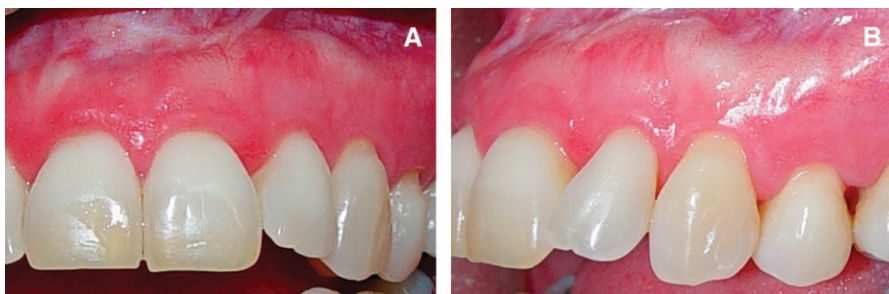
**Figure 4.**

Clinical aspect 2 weeks after surgery: frontal (A) and lateral (B) views. Several reddish regions were observed in the sites where the connective tissue was left exposed.



**Figure 5.**

Clinical aspect 3 months after surgery. There were no signs of incisions or suture marks.



**Figure 6.**

Clinical aspect 3 years after surgery: frontal (A) and lateral (B) views. The esthetic improvements were maintained.

number of teeth or a curved area of the dental arch, a graft with a larger extension is necessary.

The use of ADM, available in several sizes, is an alternative. The great advantage of this technique is that there is no need for a second surgical area, which makes the surgical procedure easier and reduces the surgery time and the postoperative discomfort of the patient.<sup>23,24</sup> However, although ADM interacts

perfectly with the organism by the cellular repopulation and revascularization of the matrix from the circumjacent tissues, these procedures imply the need for a more extensive blood supply for the allogenic graft compared to the SCTG, which features a preserved vascular and cellular net.<sup>32</sup>

In a non-randomized clinical study in 2004, Harris<sup>33</sup> evaluated the root coverage obtained with ADM compared to SCTG in both short- and long-term evaluation.

In the short-term (12.3 to 13.2 weeks) analysis, both techniques provided similar root coverage (93.4% for ADM and 96.6% for SCTG). In the long-term (48.1 to 49.2 months) evaluation, the ADM coverage was only 65.8%, whereas that obtained with SCTG was 97.0%. The short-term SCTG results were maintained in the long-term evaluation; this did not occur with the ADM. It was concluded that the SCTG provides a more predictable and stable long-term root coverage. For this reason and because of the thin biotype of the patient, SCTG was chosen in the present clinical case, which was associated with the tunnel technique.

To use the SCTG, a surgical approach was necessary to enlarge it. In this case, the cross-sectional split of the graft resulted in almost twice the initial length, enabling it to encompass the curved area of the dental arch involving five adjacent teeth with a thickness of 1.5 mm.

The tunnel technique can be used to manage multiple gingival recessions in a single-stage surgery and is indicated for deep or shallow Miller Class I and II recessions; however, it should be avoided in wide recessions to prevent excessive graft exposure. Considering the periodontal biotype, as with the other techniques, the thicker the periodontium and the thicker and wider the papillary areas, the better. Its main advantages are maintenance of the papillae integrity and the absence

of releasing incisions that interrupt the vascularization of the connective tissue and the periosteum. Instead of performing a releasing incision in the distal aspect of tooth #12, we made a vertical incision in the distal aspect of the tunnel, without reaching the gingival margin. This window facilitates the insertion and sliding of the graft and allows the preservation of the papilla integrity, which minimizes the surgical trauma and the

**Table 1.**  
**Initial and 3-Year Recession Measurements**

Tooth	Initial Recession (mm)	Final Recession (mm)	Recession Reduction (mm)	Recession Reduction (%)
8	3.0	0.0	3.0	100.0
9	2.0	0.5	1.5	75.0
10	3.0	0.5	2.5	83.3
11	3.0	1.5	1.5	50.0
12	4.0	1.5	2.5	62.5
Mean ± SD	3.0 ± 0.7	0.8 ± 0.7	2.2 ± 0.7	74.2 ± 19.2

need for additional sutures. As a result, the postoperative period is less painful, the healing process is faster, an esthetic result is obtained earlier, and scars are avoided. Conversely, the disadvantages are the difficulty in preparing the receptor site with maximum care taken not to perforate the flap or disrupt the papillae, as well as the delicate placement of the graft.

The maneuver to increase the graft extension is performed easily, and the final thickness obtained should be ~1.5 mm, considered adequate in root-coverage procedures.<sup>34</sup> Specifically for the tunnel technique, thicker grafts may be difficult to place and have a risk for papillae disruption.

If, after preparing the recipient site, the surgeon is unable to gain one continuous graft of adequate length, some alternatives are available: removal of another graft to complete the length; position the flap coronally to cover the denuded area; or release, raise, and rotate the flap in this area using the multipapillary technique. However, the best course is to verify the available thickness and length of the graft donor area before surgery to ensure proper planning.

The graft stabilization is another relevant aspect to be considered; to achieve it, the receptor site was prepared, avoiding extending it apically because extending the tunnel beyond the mucogingival junction would favor dislodgement of the graft. When this occurs, the apical region must be delimited by periosteal sutures or additional vertical sutures fixing the graft to the interdental papillae. In addition, in this case, we opted not to position the flap coronally to keep the graft in a more stable position, thus decreasing the number of sutures, which facilitates the surgical technique and the healing process.

In the present case report, the mean percentage of recession coverage was 74.2%, whereas values range from 74% to 91.6% in the literature.<sup>34</sup> Several factors may have prevented the average from reaching the

higher values. First, a Miller Class III recession was identified in tooth #12, which decreased the mean root coverage. Second, the patient had a thin periodontal biotype, probably related to the buccal position of teeth in the arch, as a consequence of previous orthodontic therapy. Third, except for tooth #10, the width of the defects was  $\geq 3$  mm, which may have compromised the supply of the graft's central portion and worsened the root coverage prognosis according to Sullivan and Atkins.<sup>17</sup>

With relation to the stability of the root coverage result, the values obtained 1.5 months after the

surgery remained the same after the 3-year follow-up, which agree with the Harris study.<sup>33</sup>

The increase in keratinized tissue is related to the magnitude of root coverage because the flap was not displaced coronally during the surgical procedure. Thus, the portion of the graft that was left exposed seems to have been submitted to a keratinization process, resulting in root coverage as well as an increase in the keratinized tissue strip. Therefore, the mean gain of keratinized tissue was ~2.2 mm in the present study, which corroborates the average of 2.3 mm reported in the literature.<sup>34</sup>

## CONCLUSIONS

Overall, the result obtained with the use of the SCTG by the tunnel technique was rather favorable. There was a considerable reduction in the multiple gingival recessions with an increase in the volume of soft tissue and gain of keratinized tissue, and the patient was quite satisfied with the final esthetic outcome. Furthermore, after a 3-year follow-up, the results were stable.

## ACKNOWLEDGMENT

The authors report no conflicts of interest related to this case report.

## REFERENCES

1. American Academy of Periodontology. *Glossary of Periodontal Terms*, 4th ed. Chicago: American Academy of Periodontology; 2001:44.
2. Løe H, Anerud A, Boysen H. The natural history of periodontal disease in man: Prevalence, severity and extent of gingival recession. *J Periodontol* 1992;63:489-495.
3. Serino G, Wennstrom JL, Lindhe J, Eneroth L. The prevalence and distribution of gingival recession in subjects with a high standard of oral hygiene. *J Clin Periodontol* 1994;21:57-63.

4. Agudio G, Pini Prato G, Cortellini P, Parma Benfenati S. Gingival lesions caused by improper oral hygiene measures. *Int J Periodontics Restorative Dent* 1987;7(1):52-65.
5. Khocht A, Simon G, Person P, Denepitiya JL. Gingival recession in relation to history of hard toothbrush use. *J Periodontol* 1993;64:900-905.
6. Gorman WJ. Prevalence and etiology of gingival recessions. *J Periodontol* 1967;38:316-322.
7. Lost C. Depth of alveolar bone dehiscences in relation to gingival recessions. *J Clin Periodontol* 1984;11:583-589.
8. Trott JR, Love B. An analysis of localized gingival recession in 766 Winnipeg High School students. *Dent Pract Dent Rec* 1966;16:209-213.
9. Lindhe J, Socransky SS, Nyman S, Westfelt E. Dimensional alteration of the periodontal tissues following therapy. *Int J Periodontics Restorative Dent* 1987;7(2):9-21.
10. Turner CH. A retrospective study of the fit of jacket crowns placed around gold posts and cores, and the associated gingival health. *J Oral Rehabil* 1982;9:427-434.
11. Boyd RL. Mucogingival considerations and their relationship to orthodontics. *J Periodontol* 1978;49:67-76.
12. Coatoam GW, Behrents RG, Bissada NF. The width of keratinized gingiva during orthodontic treatment: Its significance and impact on periodontal status. *J Periodontol* 1981;52:307-313.
13. Bouchard P, Malet J, Borghetti A. Decision-making in aesthetics: Root coverage revisited. *Periodontol* 2000 2001;27:97-120.
14. Harris RJ. The connective tissue and partial thickness double pedicle graft: A predictable method of obtaining root coverage. *J Periodontol* 1992;63:477-486.
15. Caffesse RG, Guinard EA. Treatment of localized gingival recessions. Part IV. Results after three years. *J Periodontol* 1980;51:167-170.
16. Zucchelli G, Cesari C, Amore C, Montebugnoli L, De Sanctis M. Laterally moved, coronally advanced flap: A modified surgical approach for isolated recession type defects. *J Periodontol* 2004;75:1734-1741.
17. Sullivan HC, Atkins JH. Free autogenous gingival grafts. III. Utilization of grafts in the treatment of gingival recessions. *Periodontics* 1968;6:152-160.
18. Paolantonio M, di Murro C, Cattabriga A, Cattabriga M. Subpedicle connective tissue graft versus free gingival graft in the coverage of exposed root surfaces. *J Clin Periodontol* 1997;24:51-56.
19. Bruno JF. Connective tissue graft technique assuring wide root coverage. *Int J Periodontics Restorative Dent* 1994;14:126-137.
20. Langer B, Langer L. Subepithelial connective graft technique for root coverage. *J Periodontol* 1985;56:715-720.
21. Nelson SW. The subpedicle connective tissue graft: A bilaminar reconstructive procedure for the coverage of denuded root surfaces. *J Periodontol* 1987;58:95-102.
22. Rosetti EP, Marcantonio RA, Rossa C Jr., Chaves ES, Goissis G, Marcantonio E Jr. Treatment of gingival recession: Comparative study between subepithelial connective tissue graft and guided tissue regeneration. *J Periodontol* 2000;71:1441-1447.
23. Henderson RD, Greenwell H, Drisko C, et al. Predictable multiple site root coverage using an acellular dermal matrix allograft. *J Periodontol* 2001;72:571-582.
24. Tal H. Subgingival acellular dermal matrix allograft for the treatment of gingival recession: A case report. *J Periodontol* 1999;70:1118-1124.
25. Pini Prato GP, Tinti C, Vincenzi G, Magnani C, Cortellini P, Clauser C. Guided tissue regeneration versus mucogingival surgery in the treatment of human buccal gingival recession. *J Periodontol* 1992;63:919-928.
26. Raetzke PB. Covering localized areas of root exposure employing the "envelope" technique. *J Periodontol* 1985;56:397-402.
27. Tözüm TF, Dini FM. Treatment of adjacent gingival recessions with subepithelial connective tissue grafts and the modified tunnel technique. *Quintessence Int* 2003;34:7-13.
28. Allen AL. Use of the supraperiosteal envelope in soft tissue grafting for root coverage. I. Rationale and technique. *Int J Periodontics Restorative Dent* 1994;14:216-227.
29. Allen AL. Use of the supraperiosteal envelope in soft tissue grafting for root coverage. II. Clinical results. *Int J Periodontics Restorative Dent* 1994;14:302-315.
30. Ainamo J, Bay I. Problems and proposal for recording gingivitis and plaque. *Int Dent J* 1975;25:229-235.
31. Miller PD Jr. A classification of marginal tissue recession. *Int J Periodontics Restorative Dent* 1985;5(2):8-13.
32. Aichelmann-Reidy ME, Yukna RA, Evans GH, Nasr HF, Mayer ET. Clinical evaluation of acellular allograft dermis for the treatment of human gingival recession. *J Periodontol* 2001;72:998-1005.
33. Harris RJ. A short-term and long-term comparison of root coverage with an acellular dermal matrix and a subepithelial graft. *J Periodontol* 2004;75:734-743.
34. Glise JM, Monnet-Corti V. Connective tissue graft using the envelope technique. In: Borghetti A, Monnet-Corti V, eds. *Periodontal Plastic Surgery* (in Portuguese). Porto Alegre, Brazil: Artmed; 2002:238-245.

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