A mucogingival technique for the treatment of multiple recession defects in the mandibular anterior region: a case series with two-year follow-up.

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ABSTRACT

In the lower anterior area gingival recessions are frequently associated with minimal amount or lack of attached gingiva and high frenum insertion that make the free gingival graft the treatment of choice. However, it shows low predictability in terms of complete root coverage. This case series describes a bilaminar technique with flap incision in the fornix for the treatment of adjacent gingival recession defects. It achieved high predictability in complete root coverage without decreasing the vestibular depth. At 24 months the treatment resulted in $90.6 \pm 16.8\%$ root coverage and 11 out of the 15 treated teeth were completely covered.

INTRODUCTION

Gingival recession is a widespread clinical manifestation affecting single or multiple root surfaces at all teeth types.[1] Root hypersensitivity, aesthetic problem and abrasion may accompany gingival recession and lead patients to seek treatment.[2] When multiple Miller Class I and II recessions are present, an approach to address all adjacent defects in one surgical time is the first choice.[3] The ultimate goal of the root coverage procedures is to achieve complete and predictable coronal displacement of the gingival margin on all root surfaces.

In the last years several surgical techniques have been offered with variable clinical outcomes.[4] A recent systematic review reported the best predictability in complete root coverage when adjacent Miller class I and II recession defects were treated by the coronally advanced flap with or without the connective tissue graft.[5] The absence of an adequate dimension of keratinized tissue apical to the recession defects may be a limitation for these procedures.[6]

In the lower anterior area gingival recessions are frequently associated with shallow vestibule or coronal frenum insertion.[7] These poor mucogingival conditions may influence the passive surgical shift of the coronally advanced flap towards the cemento-enamel junction and further decrease the vestibular depth.[8] In all cases in which there is lack of keratinized tissue adjacent to the recession defect the free gingival graft is the treatment of choice. It is effective in extending the fornix and in increasing both width and thickness of the keratinized tissue.[9,10] However, it does not achieve predictable results in terms of complete root coverage with consequent impaired recovery from root sensitivity.[11] In addition, it is associated with poor aesthetic appearance due to the unsatisfactory chromatic and texture tissue integration and the apical misalignment of the alveolar mucosa.[12]

The present clinical investigation proposed a bilaminar technique with flap incision in the fornix for the treatment of adjacent Miller class I and II recession defects at lower anterior

area in patients with shallow vestibule. Background foundations were the surgical techniques proposed by Marggraf and Azzi et al.[13,14] Marggraf described a coronally positioned pedicle flap with horizontal incisions in the vestibule, scalloped intrasulcular incisions and dissection of the inter-dental papillae associated with the recession defect.[13] Azzi et al. proposed the reconstruction of the inter-dental papillae in Miller class IV recessions using the bilaminar technique and horizontal incisions in the attached gingiva to preserve the integrity of the papillae.[14]

MATERIALS AND METHODS

Seven subjects (2 males and 5 females), aged between 20 and 40 years (mean age 32.6 ±7.8 years) were selected on consecutive basis among individuals referred at the Section of Periodontology, C.I.R. Dental School, Department of Surgical Sciences, University of Turin (Italy) between March and November 2010 for multiple recession defects. All subjects complained dentinal discomfort caused by hypersensitivity that persisted after topical applications of antihypersensitivity agents. The patients agreed to participate in the study and gave their written consent. The protocol of the study was approved by the institutional ethical committee.

All patients met the study inclusion criteria: 1) periodontal and systemic health; 2) multiple (at least two) adjacent Miller class I or II[15] recessions ≥ 2 mm deep at mandibular anterior teeth; 3) detectable cemento-enamel junction (CEJ); 4) presence of ≤ 1 mm-high keratinized tissue apical to the root exposures; 5) no restorations or caries in the area to be treated; 6) shallow vestibule; 7) no previous periodontal surgery at the experimental sites; 8) no contraindications for surgical root coverage procedures and no taking medications known to interfere with periodontal health and healing; 9) no smoking habits.

Pre-treatment procedures

After the screening examination all patients were enrolled in a strict non-surgical periodontal treatment to establish adequate supragingival plaque control (full mouth plaque score, FMPS

<20%)[16] and gingival health conditions (full mouth bleeding score, FMBS, <20%)[17]. They received proper oral hygiene instructions to avoid possible habits related to the etiology of the recessions. The surgical procedure was not scheduled until the recession defects did not display either plaque deposits or bleeding on probing (fig. 1a).

Clinical measurements

All clinical examinations were performed by a single experienced periodontist immediately before the surgical treatment and at 24 months post-surgery. The examiner did not perform the surgeries and was calibrated prior to the study to reduce intra-examiner variability (kappa index >0.90). All measurements were taken using a calibrated periodontal probe (PCP UNC-15, Hu-Friedy, Chicago, IL) at the mid-buccal aspect of the study teeth and rounded to the nearest millimeter. The height of the recession defect (REC) was measured from the cemento-enamel junction (CEJ) to the most apical point of the gingival margin (GM); the probing depth (PD) was measured from the gingival margin to the bottom of the gingival sulcus; the clinical attachment level (CAL) was the algebraic sum of PD and REC. The width of keratinized tissue (KT) apical to the recession defects was recorded from the most apical point of the gingival margin (GM). At baseline it was calculated as the distance between GM and the mucogingival junction (MGJ), with the MGJ location determined visually. At 2-year follow-up it was recorded as the amount of keratinized tissue coronal to the horizontal incision in the fornix. The apico-coronal dimension of the vestibule was measured as the distance in mm from the CEJ to the bottom of the fornix. The bottom of the vestibule was determined by pulling the lip and by moving apically the periodontal probe kept horizontally to the mucosal surface so that the muscle insertions could be detected. The percentage of root coverage was calculated according to the following formula: ([preoperative REC-postoperative REC] / preoperative REC) x 100.

Surgical protocol

All surgeries were performed by the same experienced periodontist (NB). Local anesthesia was administered to donor and recipient sites. Gracey curettes were gently used to only treat the areas of the exposed root surfaces with loss of clinical attachment. Root planing was achieved when a clean and smooth surface was obtained. Care was taken in not tearing the gingival margin.

An initial horizontal incision was made in the alveolar mucosa 7 mm apically to the gingival margin, keeping the blade perpendicular to the external mucosal surface. The incision was extended laterally to the neighboring teeth (Fig. 1b). Afterwards an intrasulcular incision was made through each recession and in the buccal aspect of one tooth on each side of the area to be covered without any external incisions, thus, without severing the gingival papillae (fig. 1 c).

A partial thickness flap was raised in the apical-coronal direction starting from the horizontal incision . In the areas where the tissue was too thin to allow for a split-thickness dissection a full-thickness approach was performed. The mesial, distal and intermediate papillae were gently undermined using small elevators. The full thickness dissection was limited to the buccal portion of the papillary tissue (fig. 1 d). As result, the flap could be coronally advanced without tension.

The connective tissue graft was harvested from the palate by means of the single incision technique or the trap-door technique.[18] The graft dimensions were determined to allow the coverage of the surgically exposed root surfaces. The height of the graft was as greater as possible depending on the anatomic features of the palatal vault and the width was adequate to cover all recessions plus 3 mm mesially and distally.[19]

The connective graft was placed under the flap. It was repositioned at the level of the CEJ using a suspended sling 5-0 suture (Vycril, Ethicon) (Fig. 1e). The suture was applied to two interdental spaces, starting mesial or distal to the connective graft. The needle passed through the interdental space from the lingual to the buccal aspect, pierced the coronal part of the free

connective graft and was taken backward through the interdental space. It turned around the convexity of the anatomic crown, passed through the other interdental space, and proceeded as previously described. The suture was closed with a single knot on the lingual aspect (fig. 1 f). In cases in which the convexity of the anatomical crown did not allow for a suspended suture technique the suture was anchored to the lingual attached gingiva. The sling suture allowed for the coronal displacement of the graft under the flap, resulting in complete coverage of the recession defects.

Next, horizontal mattress e-PTFE 5-0 sutures anchored to the periosteum at the level of the initial horizontal incision and hanging each experimental tooth were also positioned to provide intimate contact between the flap and the underlying connective tissue bed. The sutures were closed with a knot on the lingual aspect. The threads of the sutures were aligned with the perpendicular of the interdental papillae in order to minimize any suture-induced trauma and to ensure adequate stability of both the flap and the connective tissue graft (Fig.1g). No suture was placed along the horizontal incision in the vestibule to allow for secondary wound healing. Finally, the donor area was sutured using interrupted sutures. No periodontal dressing was used to protect the grafted area.

Post-surgical care

Postoperative pain was controlled by ibuprofen 600 mg twice a day for 2 days. Patients were instructed not to brush their teeth in the treated area and to rinse with 0.12% chlorhexidine digluconate for 1 minute two times a day for 3 weeks for plaque control. Sutures were removed after 2 weeks. Patients resumed tooth brushing 3 weeks after surgery using a roll technique[19] with an ultrasoft toothbrush. Recall appointments were scheduled weekly for the first month, every 2 months over the first year postoperatively and every 6 months thereafter. At every follow-up visit subjects received oral hygiene reinforcement, professional supragingival debridement and tooth polishing.

Data analysis

A computer program was used for all statistical analysis (SAS, version 9.0, SAS Institute, Cary, NC). A subject-level analysis was performed for each parameter. Descriptive statistics were performed using mean ± standard deviation for quantitative variables and percentage for qualitative variables.

The primary outcomes were REC reduction from baseline to 2-year examination and complete of root coverage (i.e. number of experimental units completely covered). Secondary variables were changes in the other clinical parameters. The Shapiro-Wilk test was used to determine the normal distribution of the studied parameters and the paired Wilcoxon signed rank test to compare the baseline and 2-year measurements. A p-value < 0.05 was considered statistically significant.

A power calculation was done after the completion of the study, assuming the mean REC reduction from baseline to 24 months as a primary outcome variable. This analysis indicated that the study had a >98% power to detect a 1 mm difference in REC, adopting an alpha= 0.05.

RESULTS

The periodontal parameters at baseline together with the 24-month outcomes are summarized in Tables 1 and 2. Table 1 presents data for each treated recession at baseline and 24 months postoperatively and Table 2 shows the results for each clinical parameter studied.

Among 7 patients, 15 recessions were treated, 2 of them were classified as Miller class I and 13 as class II. The treated teeth were 8 central incisors, 3 lateral incisors, 2 canines and 2 first premolars.

All patients completed the study and attended all recall visits. Postoperative healing was uneventful in all cases (Fig. 1h). Plaque and bleeding scores remained below 15% during the experimental period, indicating a good standard of supragingival plaque control.

At baseline, the average REC was 2.9 ± 0.5 mm (range 2.5-3.5 mm) with a mean CAL amounting to 4.1 ± 0.4 mm (range 3.5-4.5 mm).

Two years following the root coverage procedure, the mean residual REC was 0.4 ±0.6 mm (range 0.0-1.5 mm) that accounted for 90.6 ± 16.8% root coverage (p<0.0001). Complete root coverage was obtained in 11 out of the 15 treated recessions (73.3%) and in 5 out of the 7 patients (71.4%). No recession had <50% root coverage (Fig 2).

Compared with the conditions prior to the surgical treatment PD values remained almost unchanged over time and CAL gain was 2.6 ± 0.4 mm (p< 0.0001).

At 2-year examination the most coronal portion of the epithelial tissue was keratinized in all treated defects. The epithelium which was not keratinized covered a thick and no movable connective tissue. The width of KT increased on average from 0.5 ± 0.4 mm (range 0.0-1.0 mm) preoperatively to 3.5 ± 1.1 mm (range 1.5-4.5 mm) postoperatively and this difference was statistically significant (p<0.0001).

When the baseline vestibular depth was compared to 24-month values it was found a statistically significant difference of 0.9 ± 0.6 mm (p= 0.011). The vestibular height increased by 1-2 mm in 10 out of the 15 (66.7%) recession defects. In the remaining 5 defects no difference was detected with respect to the baseline values.

In 5 out of 7 (71.4%) patients healing resulted in a scar in the fornix detectable only at an intraoral inspection. When patient satisfaction was evaluated, there was no evidence of residual sensitivity in 6 patients and one patient expressed improvement in root sensitivity. None declared dissatisfaction concerning esthetics or pointed out a painful palate healing. The final color and tissue blend of the grafted area were appreciated by the patients as well.

DISCUSSION

The mucogingival technique was effective in the treatment of multiple recession-type defects associated with shallow fornix and minimal amount or lack of keratinized tissue at the mandibular anterior area. The successful outcomes were maintained over the 2-year observation period. In fact 73.3% of the root surfaces initially exposed due to gingival recession showed complete root coverage. Furthermore, 71.4% of the patients enrolled in the

study had the soft tissue margin at the level of the CEJ of all teeth. In all treated cases the deepening of the fornix was achieved.

In the lower anterior area recession defects are frequently associated with mucogingival problems due to the lack of adequate vestibule depth and coronal frenum attachment. These anatomic features are of particular importance if they interfere with the patient's ability to perform proper home plaque control procedures.[7] For most patients it is uncomfortable to brush non-keratinized tissue such as alveolar mucosa. Nevertheless, recession is of major concern for patients because it is readable visible manifestation of periodontal damage and may create dentine discomfort due to hypersensitivity. In such clinical situations a mucogingival intervention is required to achieve in one surgical time coverage of the exposed root surfaces and increase in the amount of keratinized gingiva.[21]

The bilaminar technique with the coronally advanced flap is the most predictable procedure in achieving complete root coverage. Thus, it is considered as the gold standard treatment to improve esthetics at single and multiple recession-type defects.[5,22] However, a prerequisite for using this procedure is the presence of an adequate amount of keratinized tissue adjacent to the root exposure.

The free gingival graft (FGG) represents the best treatment option in areas where gingival recession defect are combined with reduced or missing amount of keratinized gingiva.[23,24] The use of FGG for increasing the width of the KT had shown predictable results.[9,10] Nevertheless, less favorable results have been obtained in root coverage. Data from two meta-analyses reported mean defect coverage ranging from 43% to 85.3%[25] and percentage of sites completely covered between 9% and 73%[11]. Sometimes the creeping attachment led to complete root coverage at shallow gingival recessions.[26] When incomplete root coverage is achieved patients may complain residual root sensitivity. The coronal millimeters of the still-uncovered root surfaces are the most susceptible to hypersensitivity.[27]

The present prospective case series presented a mucogingival technique in which a connective tissue graft was harvested from the palate, placed under an partial thickness flap with horizontal incision in the fornix and repositioned over the CEJ. Such bilaminar surgical procedure offered the advantage to combine the outcomes of the FGG in terms of increased depth of the vestibular fornix with the predictability in root coverage of bilaminar technique. In 6 out of 15 recessions it provided an increased amount of KT. In the remaining 9 sites the alveolar mucosa changed from a movable to an adherent tissue in relation to the underlying bone, but without complete keratinization.

The percentage of complete root coverage was in the range achieved by means of bilaminar procedures in the treatment of multiple adjacent recession defects. In a recent systematic review the obtained complete root coverage ranged between 50% and 93.1% for the coronally advanced flap combined with different types of soft tissue grafts.[5]

The most critical aspect of the surgical approach was the vascularization. Blood supply in flap operations has to come from the areas bordering the recession and from the pedicle. In the present technique we interrupted the blood supply to the flap from the fornix, but we maintained the integrity of the interdental papillae and we avoided vertical releasing incisions. It should be underlined that none of the treated recessions experienced suffering of the flap or any episode of tissue necrosis. The postoperative course of the surgical sites well compared with that for other mucogingival techniques.

From an esthetic standpoint, there was a nice chromatic and tissue integration of the grafted area with the adjacent soft tissues. Esthetic outcomes were better than those previously described for the FGC.[11,12] Limitation of the present procedure was the formation of a thin white scar in the fornix. In 5 out of 7 cases healing resulted in a single scar but it did not impair esthetics because it was undetectable without an intraoral inspection.

An important aspect to be considered when interpreting the present results is the careful patient selection. None of the included patients was a smoker and all displayed an adequate

level of oral hygiene (FMPS <15%). It is well known that these aspects are essential for short- and long-term results after root coverage procedures.[28]

CONCLUSIONS

Although only a few cases were treated using the present technique, the results were encouraging. This mucogingival procedure was an efficient and predictable modality of treatment to achieve in one surgical time complete root coverage and increase of the apico-coronal dimension of the fornix. The main indication for this technique is the mandibular anterior region where the anatomical features often preclude the use of traditional surgical procedures. The procedure holds promise for the successful management of complex mucogingival problems, although further studies are warranted.

REFERENCES

1. Kassab MM, Cohen RE. The etiology and prevalence of gingival recession. J Am Dent Assoc 2003;134:220-225.

2. Hugoson A, Sjöin B, Norderyd O. Trends over 30 years (1973–2003), in the prevalence and severity of periodontal disease.J Clin Periodontol 2008;35:405–414.

3. Zucchelli, G, De Sanctis M. Treatment of multiple recession type defects in patients with aesthetic demands. J Periodontol 2000;71:1506–1514.

4. Rasperini G, Acunzo R, Limiroli E. Decision making in gingival recession: scientific evidence and clinical experience. Clin Adv Periodontics 2011;1:41-52.

5. Hofmänner P, Alessandri R, Laugisch O, Aroca S, Salvi GE, Stavropuolos A, Sculean A. Predictability of surgical techniques used for coverage of multiple adjacent recessions. A systematic review. Quintessence Int 2012;43:545-554.

6. Cortellini GP, Pini Prato GP. Coronally advanced flap and combination therapy for root coverage. Clinical strategies based on scientific evidence and clinical experience. Periodontol 2000 2012;59:158-184.

7. Wennström JL, Zucchelli G, Pini Prato G. Mucogingival therapy – Periodontal plastic surgery. In: Lindhe J, Lang NP, Karring T. Clinical periodontology and implant dentistry, ed 5. Oxford: Blackwell Munksgaard:955–1028.

8. Pini Prato G, Pagliaro U, Baldi C, Nieri M, SalettaD, Cairo F, Cortellini P. Coronally advanced flap procedure for root coverage. Flap with tension versus flap without tension: a randomized controlled clinical study. J Periodontol 2000;71:188-201.

9. Ward VJ. A clinical assessment of the use of the free gingival graft for correcting localized recession associated with frenal pull. J Periodontol 1974;45:78–83.

10. Agudio G, Nieri M, Rotundo R, Cortellini P, Pini Prato G. Free gingival grafts to increase keratinized tissue: a retrospective long-term evaluation (10 to 25 years) of outcomes. J Periodontol 2008;79:587–594.

11. Clauser C, Nieri M, Franceschi, D, Pagliaro U, Pini Prato G P. Evidence-based mucogingival therapy. Part 2: ordinary and individual patient data meta-analyses of surgical treatment of recession using complete root coverage as the outcome variable. J Periodontol 2003;74:741–756.

12. Kerner S, Sarfati A, Katsahian S, Jaumet V, Micheau C, Mora F, Monnet-Corti V, Bouchard P. Qualitative cosmetic evaluation after root-coverage procedures. J Periodontol 2009;80:41–47.

13. Marggraf E. A direct technique with a double lateral bridging flap for coverage of denuded root surface and gingiva extension. J Clin Periodontol 1985;12: 69-76.

14. Azzi R, Etienne D, Sauvan JL, Miller PD. Root coverage and papilla reconstruction in Class IV recession: a case report. Int J Periodontics Restorative Dent 1999;19:449-455.

15. Miller PD Jr. A classification of marginal tissue recession. Int J Periodontics Restorative Dent 1985;5:8-13.

16. O'Leary TJ, Drake RB, Naylor JE. The plaque control record. J Periodontol 1972;43:38.

17. Ainamo J, Bay I. Problems and proposals for recording gingivitis and plaque. Int Dent J 1975;25:229-235.

18. Harris RJ. A comparison of two techniques for obtaining a connective tissue graft from the palate. Int J Periodontics Restorative Dent 1997;17:260-271.

19. Benninger B, Andrews K, Carter W. Clinical measurements of hard palate and implications for subepithelial connective tissue grafts with suggestions for palatal nomenclature. J Oral Maxillofac Surg 2012;70:149-153.

20. Litonjua LA, Andreana S, Bush PJ, Cohen RE. Toothbrushing and gingival recession. Int Dent J 2003;53:67-72.

21. Hall WB. The current status of mucogingival problem and their therapy. J Periodontol 1981;52:569-575.

22. Buti J, Baccini M, Nieri M, La Marca M, Pini-Prato GP. Bayesian network meta-analysis of root coverage procedures: ranking efficacy and identification of best treatment. J Clin Periodontol 2013;40:372-386.

23. Camargo PM, Melnick PR, Kenney BE. The use of free gingival graft for aesthetic purposes. Periodontol 2000 2001;27:72-96.

24. Holbrook T, Ochsenbein C. Complete root coverage of the denuded root surfaces with a one-stage gingival graft. Int J Periodontics Rest Dent 1983;3:9-27.

25. Roccuzzo M, Bunino M, Needleman I, Sanz M. Periodontal plastic surgery for treatmnent of localized gingival recession: a systematic review. J Clin Periodontol 2002;29 (Suppl 3):178-194.

26. Matter J. Creeping attachment of free gingival grafts: a five-year follow up study. J Periodontol 1980;51:681-685.

27. Bouchard P, Malet J, Borghetti A. Decision-making in aesthetics: Root coverage revisited. Periodontol 2000 2001;27:97-120

28. Chambrone L, Chambrone D, Pustiglione FE, Chambrone LA, Lima LA. The influence of tobacco smoking on the outcomes achieved by root-coverage procedures: a systematic review. J Am Dent Assoc 2009;140:294-306.

Table 1. Gingival recession characteristics at baseline and 24 months postoperatively

		BASELINE					24 MONTHS					
PATIENT	TOOTH #	REC (mm)	PD (mm)	CAL (mm)	KT (mm)	VESTIBULE (mm)	REC (mm)	PD (mm)	CAL (mm)	KT (mm)	VESTIBULE (mm)	% ROOT COV.
1	31	2	1	3	1	4	0	1	1	3	6	100
	41	3	1	4	0	5	0	1	1	4	6	100
2	41	3	1	4	0	5	1	1	2	1	5	67
	31	4	1	5	0	6	1	1	2	2	6	75
3	41	3	1	4	0	5	1	1	2	2	5	67
	31	4	1	5	1	5	2	1	3	2	5	50
4	31	2	2	4	0	3	0	2	2	2	5	100
	41	3	1	4	0	4	0	1	1	1	5	100
5	33	3	1	4	1	5	0	1	1	1	5	100
	34	2	1	3	1	3	0	1	1	2	5	100
6	32	3	2	5	1	5	0	1	1	2	6	100
	33	2	1	3	1	4	0	1	1	1	5	100
	34	3	2	5	1	5	0	1	1	2	6	100
7	42	3	1	4	1	5	0	1	1	3	6	100
	43	3	1	4	1	5	0	1	1	2	6	100

REC = recession depth; PD = probing depth; CAL= clinical attachment level; KT= width of eratinized tissue; VESTIBULE = distance between CEJ and bottom of the fornix; % root cov. = % of root coverage

Table 2. Baseline and 24-month clinical outcomes

Parameters	Mean ±SD	Median (Range)	P-value
REC (mm)			
Baseline	2.9 ± 0.5	2.7 (2.5-3.5)	
24 months	0.4 ± 0.6	0.0 (0.0-1.5)	
Difference	2.5 ± 0.3	2.5 (2.0-3.0)	< 0.0001
PD (mm)			
Baseline	1.2 ± 0.3	1.0 (1.0-1.7)	
24 months	1.1 ± 0.2	1.0 (1.0-1.5)	
Difference	0.1 ± 0.3	0.0 (0.0-0.7)	>0.05
CAL (mm)			
Baseline	4.1 ± 0.4	4.0 (3.5-4.5)	
24 months	1.5 ± 0.6	1.0 (1.0-2.5)	
Difference	2.6 ± 0.4	2.5 (2.0-3.4)	<0.0001
KT (mm)			
Baseline	0.6 ± 0.4	0.5 (0.0-1.0)	
24 months	2.0 ± 0.8	1.7 (1.5-3.5)	
Difference	1.4 ± 0.8	1.5 (0.5-3.0)	0.003
Vestibule depth (mm)			
Baseline	4.6 ± 0.7	4.7 (3.5-5.0)	
24 months	5.5 ± 0.5	5.5 (5.0-6.0)	
Difference	0.9 ± 0.6	1.0 (0.0-1.5)	0.011

REC = recession depth; PD = probing depth; CAL= clinical attachment level; KT= width of keratinized tissue; Vestibule depth = distance between CEJ and bottom of the fornix.

Legends

Fig. 1. A representative case illustrating the surgical procedure.

A: Before surgery, gingival recession defects are present on the lower central incisors. Note the shallow vestibule and the narrow band of keratinized tissue.

B: Preparation of the recipient site. An horizontal incision is made perpendicular to the external mucosal surface 7 mm from the gingival margin. The incision is extended laterally to involve one tooth on each side of the area to be covered.

C: An intrasulcular incision is performed at the buccal aspect of the central and lateral lower incisors. No vertical releasing incisions are made.

D: A partial thickness flap is raised in the apical-coronal direction starting from the horizontal incision. A full-thickness dissection is made by undermining the mesial, distal and interdental papillae using small periosteal elevators. The dissection is limited to the buccal portion of the papillary area.

E: After preparing the recipient site the connective graft is removed from the palate. The graft is placed over the root surfaces beneath the flap.

F: Schematic drawing of the connective graft suturing technique. It allows for both the coronal displacement of the graft under the flap and the coronal repositioning of the flap . The sling suspended suture is applied to two interdental spaces, starting mesially or distally to the connective tissue graft. The needle passes through the interdental space from the lingual to the buccal aspect, exite underneath the flap, pierces the coronal portion of the free connective graft and is taken backward through the interdental space. It turns around the convexity of the anatomic crown, passes through the other interdental space, and proceeded as previously described. The suture is closed with a single knot on the lingual aspect.

G: Stabilizing horizontal mattress sutures are anchored to the periosteum at the level of the initial horizontal incision and turn around each experimental tooth. The sutures are closed with a knot on the lingual aspect. The horizontal incision in the vestibule is not sutured.

H: Postsurgical wound healing at 2 months. The recipient site has acceptable contour and color blending. Chlorexhidine stains are still detectable on the buccal surface of the treated teeth. Note the scar in the fornix.

Fig. 2. Presentation of a clinical case.

A: Preoperative clinical view. Recession defects at left lower canine and first premolar.

B: Two-year outcomes showing complete root coverage and good match of the grafted tissue.

C: Note the increase in the vestibular depth.
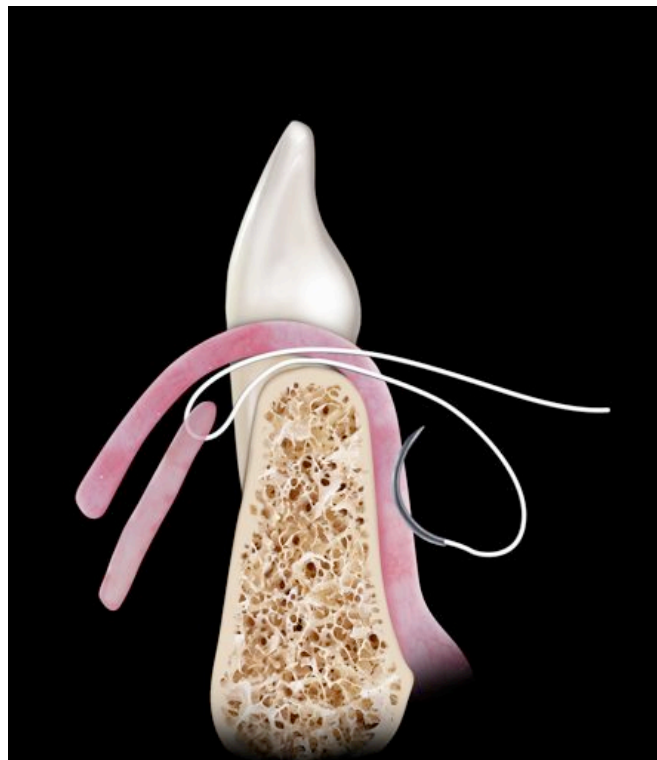
Fig. 1A

Fig. 1 B

Fig. 1 C

Fig. 1 D

Fig. 1 E

Fig. 1 F

Fig. 1 G

Fig. 1 H

Fig. 2 A

Fig. 2 B

Fig. 2 C