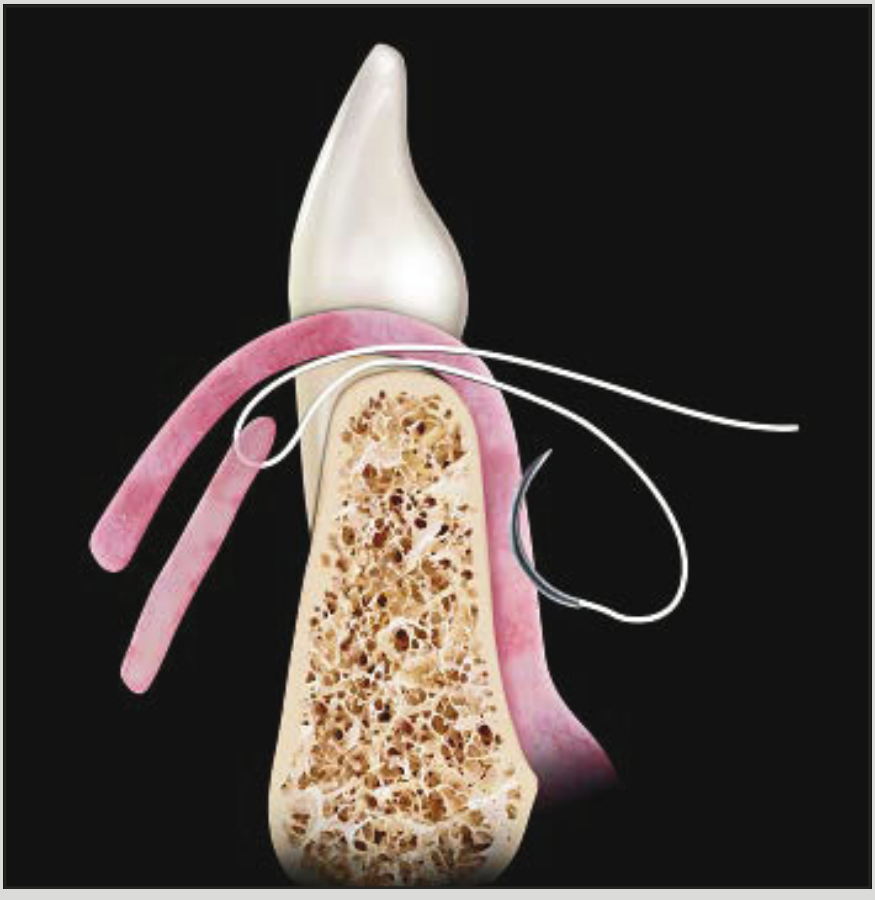

A Mucogingival Technique for the Treatment of Multiple Recession Defects in the Mandibular Anterior Region: A Case Series with a 2-Year Follow-Up

Nicola Bethaz, DDS[1]
Federica Romano, DDS[2]
Francesco Ferrarotti, DDS[1]
Giulia Maria Mariani, DDS[1]
Mario Aimetti, MD, DDS[3]

In the mandibular anterior area, gingival recession can be associated with a minimal amount or lack of attached gingiva, a shallow vestibule, and high frenum insertion. These anatomical features may preclude the use of traditional root coverage procedures. This case series describes a a bilaminar technique with flap incision in the fornix for the treatment of adjacent gingival recession defects in patients with a shallow vestibule. It achieved high predictability in complete root coverage without decreasing the vestibular depth. At 24 months, the treatment resulted in 90.6% ± 16.8% root coverage, and 11 of the 15 treated teeth (73.3%) were completely covered. (Int J Periodontics Restorative Dent 2014;34:345–352. doi: 10.11607/prd.1920)

[1]Clinical Instructor, Department of Surgical Sciences, C.I.R. Dental School, University of Turin, Turin, Italy.
[2]Researcher, Department of Surgical Sciences, C.I.R. Dental School, University of Turin, Turin, Italy.
[3]Associate Professor, Department of Surgical Sciences, C.I.R. Dental School, University of Turin, Turin, Italy.

Correspondence to: Prof Mario Aimetti, C.I.R. Dental School, University of Turin, Via Nizza 230-10126 Turin, Italy; fax: +390116708389; email: mario.aimetti@unito.it.

Gingival recession is a widespread clinical manifestation affecting single or multiple root surfaces at all tooth types.[1] Root hypersensitivity, esthetic problems, 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 surgery is the first choice.[3] The ultimate goal of root coverage procedures is to achieve complete and predictable coronal displacement of the gingival margin on all root surfaces.

In the last few 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 with a coronally advanced flap with or without connective tissue graft.[5]

In the mandibular anterior area, gingival recessions are frequently associated with shallow vestibule or coronal frenum insertion.[6] These poor mucogingival conditions may influence the passive surgical shift

of the coronally advanced flap toward the cementoenamel junction (CEJ) and further decrease the vestibular depth.[7–9] The absence of an adequate dimension of keratinized tissue close to the recession defects may be a limitation for coronally and even laterally sliding flap procedures.[7–9] Thus, in most cases in which there is a 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.[10,11] However, it does not achieve predictable results in terms of complete root coverage with consequent impaired recovery from root sensitivity and esthetics.[12] In addition, it is associated with poor esthetic appearance due to the unsatisfactory chromatic and texture tissue integration and the apical misalignment of the alveolar mucosa.[13]

This 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 mandibular anterior areas in patients with a shallow vestibule. Background foundations were the surgical techniques proposed by Marggraf and Azzi et al.[14,15] Marggraf described a coronally positioned pedicle flap with horizontal incisions in the vestibule and scalloped intrasulcular incisions and dissection of the interdental papillae associated with the recession defect.[14] Azzi et al proposed the reconstruction of the interdental papillae in Miller Class IV recessions, using the bilaminar technique and horizontal incisions in the attached gingiva to preserve the integrity of the papillae.[15]

Method and materials

Seven subjects (two men and five women), aged from 20 to 40 years (mean age, 32.6 ± 7.8 years) were selected on consecutive basis among individuals referred to the Section of Periodontology, C.I.R. Dental School, Department of Surgical Sciences, University of Turin, Italy, from March to November 2010 for multiple recession defects. All subjects complained of 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[16] recessions ≥ 2 mm deep at mandibular anterior teeth, *(3)* detectable 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 not taking any medications known to interfere with periodontal health and healing, and *(9)* no smoking habits.

Pretreatment procedures

After the screening examination, all patients were enrolled in a strict nonsurgical periodontal treatment to establish adequate supragingival plaque control (full-mouth plaque score [FMPS] < 20%)[17] and gingival health conditions (full-mouth bleeding score [FMBS] < 20%).[18] 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 were free of both plaque deposits and bleeding on probing (Fig 1a).

Clinical measurements

All clinical examinations were performed by a single experienced clinician (FF) immediately before the surgical treatment and at 24 months postsurgery. The examiner did not perform the surgeries and was calibrated prior to the study to reduce intraexaminer variability (kappa index > 0.90). All measurements were taken using a graded periodontal probe (PCP UNC-15, Hu-Friedy) at the midbuccal aspect of the study teeth and rounded to the nearest millimeter. The height of the recession defect (REC) was measured from the CEJ to the most apical point of the gingival margin (GM); the probing depth (PD) was measured from GM 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) was

recorded from the most apical point of the GM to the line between the attached gingiva and the alveolar mucosa. The line was identified with Lugol staining. The apicocoronal dimension of the vestibule was measured as the distance in mm from the CEJ, as a fixed reference point, to the bottom of the fornix. The bottom of the vestibule was identified by stretching the lip and simultaneously moving the periodontal probe in a apicocoronal direction, kept horizontal 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) × 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 treat only the areas of the exposed root surfaces with clinical attachment loss. Root planing was achieved when a clean and smooth surface was obtained. Care was taken to avoid tearing the gingival margin.

An initial horizontal incision was made in the alveolar mucosa 7 mm apical to the gingival margin, keeping the blade perpendicular to the external mucosal surface. The incision was extended one tooth-width lateral to the recession defects (Fig 1b). Afterward, an intrasulcular incision was made through each recession and extended to one tooth on each side of the area to be covered without severing the gingival papillae. Vertical releasing incisions were not performed (Fig 1c).

A split-thickness primary flap was raised in the apicocoronal 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 (Fig 1d). 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.[19] The graft dimensions were determined to allow the coverage of the surgically exposed root surfaces. The height of the graft was as high as possible depending on the anatomical features of the palatal vault, and the width was adequate to cover all recessions plus 3 mm mesially and distally.[20]

The connective graft was placed under the primary flap according to a bilaminar procedure. It was repositioned at the level of the CEJ using a suspended sling 5-0 suture (Vycril, Ethicon, Johnson & Johnson) (Fig 1e). The needle passed through the interdental space from the lingual to the buccal aspect, pierced the coronal part of the connective graft, and was taken backward through the same interdental space. It wrapped around the anatomical 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 1f). The sling suture allowed for the coronal displacement of the graft under the primary flap, resulting in complete coverage of the adjacent recession defects.

Next, horizontal mattress e-PTFE 5-0 sutures anchored to the periosteum at the level of the initial horizontal incision and hanging from each tooth were also positioned over the primary flap. They provided intimate contact between the flap and the underlying tissues. The sutures were always closed with a knot on the lingual aspect. The threads of the sutures were aligned perpendicular to the interdental papillae, and the knot tension was calibrated 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 and this area healed by secondary intention. Finally, the donor area was sutured using interrupted sutures. No periodontal dressing was used to protect the grafted area.

Postsurgical care

Postoperative pain was controlled with 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.

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

Fig 1a *Presurgery, gingival recession defects are present on the mandibular central incisors. Note the shallow vestibule and the narrow band of keratinized tissue.*

Fig 1b *Horizontal incision in the fornix.*

Fig 1c *An intrasulcular incision is performed at the buccal aspect of the mandibular central and lateral incisors. No vertical releasing incisions are made.*

Fig 1d *A partial-thickness flap is raised in the apicocoronal 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.*

Fig 1e *After preparing the recipient site, the connective tissue graft is removed from the palate. The graft is placed over root surfaces beneath the flap.*

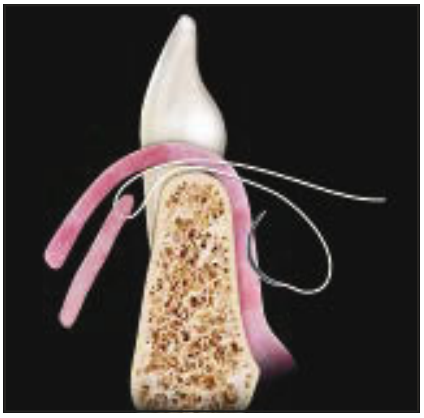

Fig 1f *Schematic drawing of the connective tissue graft suturing technique. It allows for both the coronal displacement of the graft under the flap and the coronal repositioning of the flap. The sling suspended suture is applied to two interdental spaces, starting mesially or distally to the connective tissue graft. The needle passes through the interdental space from the lingual to the buccal aspect, exits underneath the flap, pierces the coronal portion of the free connective tissue graft, and is taken backward through the interdental space. It wraps around the convexity of the anatomical crown, passes through the interdental space, and proceeds as previously described. The suture is closed with a single knot on the lingual aspect.*

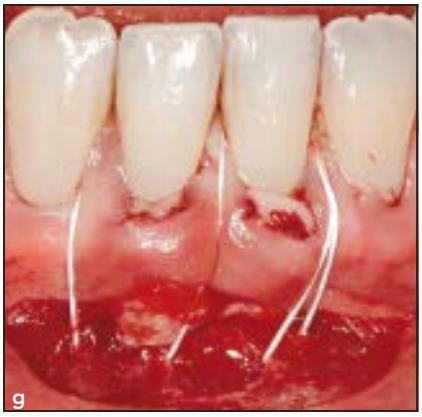

Fig 1g *Stabilizing horizontal mattress sutures are anchored to the periosteum at the level of the initial horizontal incision and wrap around each experimental tooth. The sutures are closed with a knot on the lingual aspect. The horizontal incision in the vestibule is not sutured.*

Fig 1h *Postsurgical wound healing at 3 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.*

Sutures were removed after 2 weeks. Patients resumed tooth brushing 3 weeks after surgery, using a roll technique[21] 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). A subject-level analysis was performed for each parameter. Descriptive statistics were performed using mean ± SD for quantitative variables and percentage for qualitative variables.

The primary outcomes were REC reduction from baseline to 2-year examination and completion of root coverage (ie, 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 of < .05 was considered statistically significant.

A power calculation was done after 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 value = .05.

Table 1 Baseline and 24-mo clinical outcomes

Parameters	Mean ±SD	Median (Range)	P
REC (mm)			
Baseline	2.9 ± 0.5	2.7 (2.5–3.5)	
24 mo	0.4 ± 0.6	0.0 (0.0–1.5)	
Difference	2.5 ± 0.3	2.5 (2.0–3.0)	< .0001
PD (mm)			
Baseline	1.2 ± 0.4	1.0 (1.0–2.0)	
24 mo	1.1 ± 0.2	1.0 (1.0–1.5)	
Difference	0.1 ± 0.3	0.0 (0.0–0.7)	> .05
CAL (mm)			
Baseline	4.1 ± 0.4	4.0 (3.5–4.5)	
24 mo	1.5 ± 0.6	1.0 (1.0–2.5)	
Difference	2.6 ± 0.4	2.5 (2.0–3.4)	< .0001
KT (mm)			
Baseline	0.6 ± 0.4	0.5 (0.0–1.0)	
24 mo	2.0 ± 0.8	1.7 (1.5–3.5)	
Difference	1.4 ± 0.8	1.5 (0.5–3.0)	.003
Vestibule depth (mm)			
Baseline	4.6 ± 0.7	4.7 (3.5–5.0)	
24 mo	5.5 ± 0.5	5.7 (5.0–6.0)	
Difference	0.9 ± 0.5	1.0 (0.0–1.5)	.004

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

Results

The periodontal parameters at baseline together with the 24-month outcomes are summarized in Table 1. Among 7 patients, 15 recessions were treated, 2 were classified as Miller Class I, and 13 were classified as Class II. The mean number of recessions treated on each patient was 2.2 ± 0.4 (range 2 to 3). 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 mean REC was 2.9 ± 0.5 mm (range, 2.5 to 3.5 mm) with a mean CAL amounting to 4.1 ± 0.4 mm (range, 3.5 to 4.5 mm).

Two years following the root coverage procedure, the mean residual REC was 0.4 ± 0.6 mm (range, 0 to 1.5 mm), accounting for 90.6% ± 16.8% root coverage (*P* < .0001). Complete root coverage was obtained in 11 of 15 treated recessions (73.3%) and in 5 of

Fig 2 *Presentation of clinical case.*

Fig 2a *Preoperative view. Baseline gingival recession defects.*

Fig 2b *Two-year outcome showing complete root coverage and good matching of the grafted tissue.*

Fig 2c *Note the increase in the attached gingiva.*

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 ($P < .0001$).

The width of KT increased on average from 0.6 ± 0.4 mm (range, 0.0 to 1.0 mm) preoperatively to 2.0 ± 0.8 mm (range, 1.5 to 3.5 mm) at the 24-month examination, and this difference was statistically significant ($P = .003$).

When the baseline vestibular depth values were compared to 24-month measurements, a mean statistically significant difference of 0.9 ± 0.5 mm was observed ($P = .004$). The vestibular height increased by 1 to 2 mm in 11 of 15 (73.3%) recession defects. In the remaining 4 defects, no differences were found with respect to the baseline values. Three of these defects experienced incomplete root coverage.

In 5 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 1 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 also appreciated by the patients.

Discussion

The mucogingival technique was effective in the treatment of multiple recession-type defects associated with a shallow fornix and little or no keratinized tissue at mandibular anterior areas. 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 patients enrolled in the study had the soft tissue margin at the level of the CEJ of all teeth.

In the mandibular anterior area, recession defects are frequently associated with mucogingival problems due to the lack of attached gingiva, inadequate vestibule depth, and coronal frenum attachment, which make it difficult for plaque control to be performed.[6] For most patients it is uncomfortable to brush nonkeratinized tissue such as alveolar mucosa. In addition, dentin discomfort due to hypersensitivity is another patient complaint. In such clinical situations, a mucogingival intervention is required to achieve in one surgery coverage of the exposed root surfaces and an increase in the amount of keratinized gingiva.[22]

The selection of one instead of another surgical technique depends

on the local anatomic characteristics of the sites to be treated and on the patient's demands. The bilaminar technique with the coronally advanced flap is the most predictable procedure in achieving complete root coverage. Thus, it is considered the gold standard to improve esthetics at single and multiple recession-type defects.[5,23] However, a prerequisite for using this procedure is the presence of an adequate vestibular depth and amount of keratinized tissue adjacent to the root exposure.[7] In sites presenting with unfavorable anatomic conditions, the clinician should take the soft tissue located laterally to the recession defect into consideration to perform a laterally sliding flap. Zucchelli et al reported a statistically significant inverse relationship between the baseline amount of keratinized tissue lateral to the gingival recession and root coverage.[9] The percentage of complete root coverage amounted to 40% when the keratinized tissue included in the flap was about 1 mm.

The free gingival graft (FGG) represents the best treatment option in areas where gingival recession defects are combined with reduced or missing amounts of keratinized gingival tissue close to the root exposure.[24,25] The use of FGG for increasing the width of the KT has shown predictable results.[10,11] However, less-favorable results have been obtained in root coverage. Data from two meta-analyses reported mean defect coverage ranging from 43% to 85.3%[26] and percentage of sites completely covered between 9% and 73%.[12] Sometimes the creeping attachment led to complete root coverage at shallow gingival recessions.[27] When incomplete root coverage is achieved, patients may complain of residual root sensitivity. The coronal millimeters of the still-uncovered root surfaces are the most susceptible to hypersensitivity.[28]

This prospective case series presented a mucogingival technique in which a connective tissue graft was harvested from the palate, placed under a partial-thickness flap with horizontal incision in the fornix and repositioned at the level of the CEJ. Such surgical procedures offer the advantage of combining the predictability in root coverage of the bilaminar technique with deepening of the fornix. In 11 of 15 treated recessions, the vestibular depth increased by 1 to 2 mm. The remaining 4 sites did not show any dimensional changes. 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 from 50.0% to 93.1% for the coronally advanced flap combined with different types of soft tissue grafts.[5]

Furthermore, a clinically and statistically significant increase in the width of marginal KT was observed on the buccal aspect of treated teeth. The height of KT changed from the baseline mean value of 0.6 ± 0.4 mm to the 2-year value of 1.4 ± 0.8 mm. When looking at each defect separately, apart from 4 sites it increased by 2 to 4 mm. The present data agree with those reported in the literature for bilaminar procedures.

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, the blood supply to the flap from the fornix was interrupted, but the integrity of the interdental papillae was maintained and vertical releasing incisions were avoided. 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 fared well compared with other mucogingival techniques.

From an esthetic standpoint, there was nice chromatic and tissue integration of the grafted area with the adjacent soft tissues. Esthetic outcomes were better than those previously described for the FGG.[12,13] A limitation of the present procedure was the formation of a thin white scar in the fornix. In five of seven cases, healing resulted in a single scar but did not impair esthetics because the scar 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.[29]

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 surgery complete root coverage and to increase the apicocoronal 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.

Acknowledgments

The authors reported no conflicts of interest related to this study.

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, et al. Predictability of surgical techniques used for coverage of multiple adjacent recessions. A systematic review. Quintessence Int 2012;43:545–554.
6. Wennström JL, Zucchelli G, Pini Prato G. Mucogingival therapy–Periodontal plastic surgery. In: Lindhe J, Lang NP, Karring T (eds). Clinical Periodontology and Implant Dentistry, ed 5. Oxford: Blackwell Munksgaard, 2008:955–1028.
7. 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.
8. Pini Prato G, Pagliaro U, Baldi C, et al. 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. 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.
10. 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.
11. 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.
12. Clauser C, Nieri M, Franceschi D, Pagliaro U, Pini Prato GP. 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.
13. Kerner S, Sarfati A, Katsahian S, et al. Qualitative cosmetic evaluation after root-coverage procedures. J Periodontol 2009;80:41–47.
14. 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.
15. 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.
16. Miller PD Jr. A classification of marginal tissue recession. Int J Periodontics Restorative Dent 1985;5:8–13.
17. O'Leary TJ, Drake RB, Naylor JE. The plaque control record. J Periodontol 1972; 43:38.
18. Ainamo J, Bay I. Problems and proposals for recording gingivitis and plaque. Int Dent J 1975;25:229–235.
19. 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.
20. 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.
21. Litonjua LA, Andreana S, Bush PJ, Cohen RE. Toothbrushing and gingival recession. Int Dent J 2003;53:67–72.
22. Hall WB. The current status of mucogingival problem and their therapy. J Periodontol 1981;52:569–575.
23. 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.
24. Camargo PM, Melnick PR, Kenney BE. The use of free gingival graft for aesthetic purposes. Periodontol 2000 2001;27:72–96.
25. Holbrook T, Ochsenbein C. Complete root coverage of the denuded root surfaces with a one-stage gingival graft. Int J Periodontics Restorative Dent 1983;3:9–27.
26. 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.
27. Matter J. Creeping attachment of free gingival grafts: A five-year follow up study. J Periodontol 1980;51:681–685.
28. Bouchard P, Malet J, Borghetti A. Decision-making in aesthetics: Root coverage revisited. Periodontol 2000 2001;27: 97–120
29. 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.