ORIGINAL RESEARCH

Treatment of Localized Gingival Recession Using Gingival Unit Grafts: An 18-month Follow-up Study

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Abstract

Aim: The study aimed to longitudinally evaluate the efficacy of gingival unit grafts (GUGs), a modification of free gingival grafts, in the management of Miller's class I and class II recession defects in mandibular anterior region, over a period of 18 months.

Materials and methods: 17 subjects with 21 recession defects in mandibular anterior region were treated using GUG. Clinical parameters of recession depth (RD), clinical attachment levels (CALs), and keratinized tissue width (KTW) were recorded at baseline, 1, 6, and 18 months. Patient-centered outcomes were measured using a visual analog scale (VAS) for pain and discomfort on 14th postoperative day and for treatment satisfaction at the end of 18 months.

Results: There was a statistically significant improvement in RD, CAL, and KTW at 18 months when compared to baseline levels. A mean root coverage (MRC) percentage of 84.76 ± 11.79% was achieved at the end of 18 months. Patient-related outcomes for VAS for pain and discomfort as well as treatment satisfaction showed favorable results.

Conclusion: GUG can be used as a predictable treatment modality for Miller's class I and class II recession defects in mandibular anterior region. The results obtained can be well maintained over 18-month period with optimal maintenance care.

Clinical significance: The advantage of involving marginal gingiva in GUG results in a well-contoured graft, which increases the ease of adaptation and suturing. The biological characteristic of intact marginal vasculature results in early integration of graft into the recipient area and greater success in graft survival over denuded root surface, causing better long-term RC outcomes.

Keywords: Gingival recession, Gingival unit graft, Longitudinal studies.

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Introduction

Gingival recession is referred to the exposure of one or more root surfaces caused by the migration of the marginal periodontal tissues apical to the cementoenamel junction (CEJ).[1] This can result in root hypersensitivity,[2] root caries, plaque accumulation,[3] further periodontal attachment loss,[4] and tooth loss. Root coverage (RC) procedures are indicated to improve esthetic concerns of patients, decrease root sensitivity, and increase the keratinized gingiva. Various surgical techniques, such as pedicle grafts,[5] free gingival grafts (FGGs),[6] connective tissue grafts,[7] acellular dermal matrix grafting, and combinations of grafting techniques and flap designs along with regenerative approaches,[8] have shown promising results in achieving RC. However, due to variability in factors related to the defect, patient, and technique, little evidence supports superiority of any one technique to obtain predictable RC.[9,10]

FGG described by Bjorn et al. has been a common procedure for gingival augmentation due to its relative ease and high predictability for increasing width of keratinized tissue.[11] However, there are few limitations of this technique. As compared to soft tissue techniques for RC, the FGG results in an unpredictable color match between the grafted tissue and adjacent gingival tissues.[12] Also, FGG as a treatment modality offers less predictability when used as a RC procedure.[13]

The synergistic relationship between involved tissues and their vascular supply is an important factor in RC procedures. Critical changes at the recipient site involving nonsubmerged grafts such as root planing to reduce the prominence, "butt-joint" adaptation of the graft, and complex suturing techniques have been made to promote the adaptation of the graft tissue to the recipient site.[14] However, regarding the donor site modification, to make the procedure more predictable, increase in graft thickness was advocated by few authors.[13] Increasing the thickness of the grafts was more likely to increase its revascularization and survival on the avascular root surface, which often resulted in a large slow-healing palatal wound.[15,16]

More recently, site-specific donor tissues with special vascular configuration are believed to have possibly increased the potential for perfusion, survival, and function at the recipient site without increasing the graft thickness.[17] Gingival unit graft (GUG) was introduced by Allen and Cohen in 2004[17] as a modification of FGG, where the harvested palatal graft includes the marginal gingiva

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and interdental tissue. The vascular plexus of the gingiva is rich in horizontal anastomoses which perfuse the marginal zone or supracrestal tissues.[18] Hence, in GUG, the capillary buds from the recipient site anastomose with the severed vessels of the graft more rapidly, resulting in early graft integration and improved chances of graft survival.[17] The involvement of marginal gingiva and papillary tissue in the graft can accelerate healing, and improve recession defect coverage and color adaptation with adjacent tissues. There are only a few case reports and clinical trials regarding the use of GUG for RC, and all of these studies lack long-term follow-up data.[17,19–21] The results of all the studies comparing the GUG with FGG reported significantly superior clinical and esthetic results for GUG.[19–21] However, the reported data include isolated gingival recession defects, and the presence of multiple recession defects in the mandibular anterior region requires the use of longer grafts which might involve a greater morbidity to the donor site. Hence, the purpose of the study was to longitudinally evaluate, over an 18-month period, the reduction of gingival recession through GUG in isolated or two adjacent gingival recession defects in mandibular anterior region. Also, patient discomfort and treatment satisfaction were measured at the end of the follow-up period using a visual analog scale (VAS).

Materials and Methods

Study Design and Patient Population

This clinical trial was performed in 17 systemically healthy patients aged 18–39 years (mean age 27.29 years) from March 2020 to November 2021. The patients reported with a chief concern of gingival recession in mandibular anterior teeth region. They were selected for the study according to the following criteria:

Inclusion Criteria

1. Isolated or two adjacent Miller's class I/II gingival recession defects with a vertical depth ≥3 mm in mandibular anterior region. 2. Teeth with identifiable CEJ. 3. No active signs of periodontal disease with full-mouth plaque and full-mouth bleeding scores ≤15%, 4 weeks after Phase-1 therapy (measured at four sites per tooth).[22] 4. Nonsmoker, nontobacco user.

Exclusion Criteria

1. Teeth in labio-version or malocclusion which might require orthodontic treatment prior to RC procedures. 2. Presence of root caries or noncervical carious lesions. 3. Pregnant or breastfeeding patients. 4. Patients with systemic conditions or using drugs contraindicated for periodontal surgery.

About 4–8 weeks before the surgical procedure, patients received a professional prophylaxis and were given oral hygiene instructions which included modified Bass type of brushing technique using a soft toothbrush and fluoridated dentifrice twice daily. Occlusal adjustments were performed wherever necessary. Surgical procedure was not initiated until the subjects demonstrated an adequate standard of supragingival plaque control. The instructions were reinforced throughout the duration of study period at each of the postoperative visits.

Ethical Approval of Studies and Informed Consent

The entire treatment procedure was explained to the participants, and written informed consent was obtained from them. The investigation was conducted in accordance with the Helsinki Declaration revised in 1983, involving the experimentation of human subjects. The study protocol was reviewed and approved by the Institutional Ethical Committee. The trial was registered at ctri.nic.in (registration number CTRI/2020/06/025535).

Clinical Assessments

Clinical measurements were performed by a single periodontist during all phases of clinical examination. The clinical parameters were measured at baseline, 1st, 6th, and 18th month after the surgical procedures using a standard periodontal probe with 1-mm incremental markings and measured to the nearest 0.5 mm. Postsurgery, the patients were recalled once every 2 weeks for the first 2 months, once every month till 6 months, and once every 6 months thereafter for 18 months. Supragingival polishing at each of these visits was done as required. The clinical parameters measured were as follows:

- Vertical recession depth: Distance between the CEJ and the most apical part of the gingival margin.
- Recession width (RW): Width of exposed root at the level of CEJ.
- KTW: Distance between the most apical part of the gingival margin and mucogingival junction.
- Clinical attachment level (CAL): Distance between the CEJ and bottom of the pocket. CAL was measured at both recipient (rCAL) and donor (dCAL) sites.
- Probing depth (PD): Distance between the most apical part of the gingival margin and bottom of the gingival sulcus. PD was calculated at both recipient (rPD) and donor (dPD) sites.
- Percentage of RC was calculated by the following equation (RC%):

$$RC\% = \frac{(\text{Baseline RD} - \text{6 months RD})}{\text{Baseline RD}} \times 100$$

- Complete root coverage (CRC) was recorded when the postoperative gingival margin completely covered the CEJ.
- Patients were asked about postsurgical discomfort using a 10-point VAS on the 14th postoperative day (suture removal session), in which 0 indicated no pain and 10 represented the worst pain experienced.
- Patient satisfaction was assessed at 18 months after surgery using a 10-point VAS (0 indicated "dissatisfied" and 10 indicated "fully satisfied").

Sample Size Estimation

The sample size has been estimated using the GPower software v. 3.1.9.4 (Franz Faul, Universität Kiel, Germany). Considering the effect size to be measured (f) at 27% (based on the results from previous literature),[23] power of the study at 80%, and the alpha error at 5%, the sample size needed is 21. The study comprises 21 intervention sites.

Surgical Procedure

All surgical procedures were performed by a single periodontist.

Recipient Site Preparation

Upon induction of local anesthesia, the exposed root surfaces were carefully planed with currettes to obtain a smooth finish and irrigated using normal saline to flush away loose debris. The recipient site was outlined using no.15 blade. Two divergent incisions were placed outlining the recession defect at the line angles of the tooth/teeth involved, including the papillae of the involved tooth. The incision was carried apical to the mucogingival junction to a distance of 3–5 mm beyond the extent of recession.

The outlined area, including the papillae, was de-epithelialized to create a vascular bed for receiving the graft (Fig. 1B).

Donor Site Preparation

Palatal donor site was anesthetized. The graft was harvested from the first and/or second premolar region. The required length and width of the graft were measured using a periodontal probe, and bleeding points were marked at the donor area. A no.15 Bard Parker blade was used to trace the outline of the graft to a depth of approximately 1.5 mm (2 mm at the tip of the papilla) (Fig. 1C).[17] Graft papillae were first reflected by split dissection joined by a sulcular incision. The remaining portion of the graft was detached using no.15 blade. Once harvested, the under surface of the graft was trimmed to remove any loose tissue tags or adipose tissue (Fig. 1D). After harvesting, hemorrhage control was done by pressure pack for 5 minutes. A platelet-rich fibrin (PRF) bandage was placed at the harvested site to aid in healing (Fig. 1E), and a custom-made acrylic stent was placed to cover the wound.

Suturing

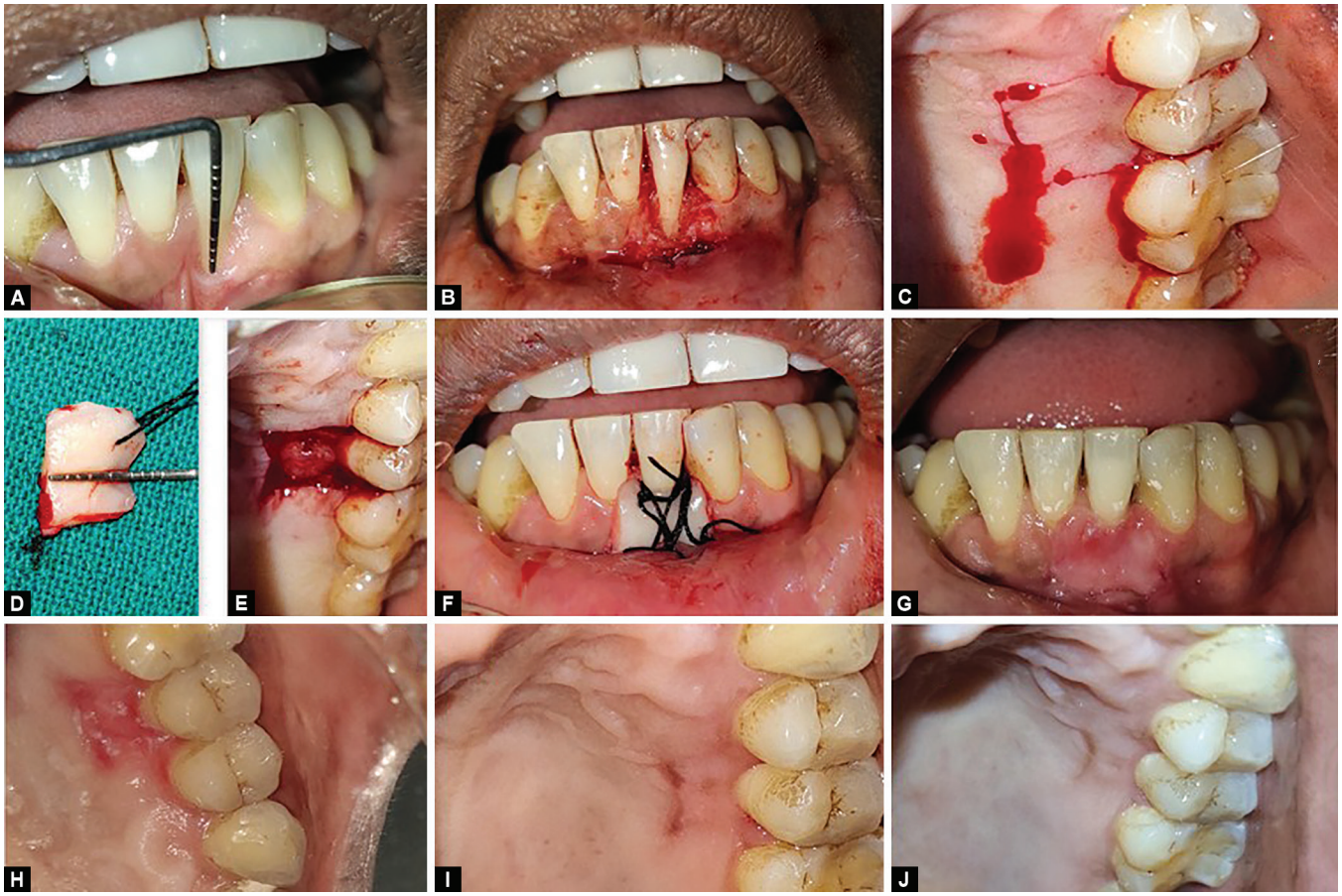
Suturing was done using 4-0 black silk suture (*Mersilk, Ethicon, Johnson, and Johnson*). The graft was secured to the recipient site using two interrupted sutures to the recipient papillae and stabilized using one or two compressive overlapping sutures to adapt the graft to the recipient site and reduce dead space. Two additional periosteal sutures were placed to hold the apical portion of the graft in place (Fig. 1F). Once the suturing was done, the area was gently pressed with moist gauze for approximately 2 minutes. The area was covered using periodontal dressing (*Coe-Pack, GC*). Patient was advised to take analgesics and antibiotics (500 mg amoxicillin every 8 hours for 7 days, and 600 mg ibuprofen every 12 hours for 3–4 days). Postsurgical instructions included brushing at all the areas other than the surgical site. During this period, plaque control was achieved using 0.2% chlorhexidine gluconate mouthrinse twice daily, for 4 weeks. Suture removal was done after 2 weeks (Fig. 1G); normal oral hygiene measures were resumed after 4 weeks. The oral hygiene instructions for the rest of the study period included twice daily brushing with a fluoridated toothpaste and soft toothbrush using modified Bass technique. At every recall interval, the instructions were reinforced, and supragingival polishing was done as required.

Statistical Analysis

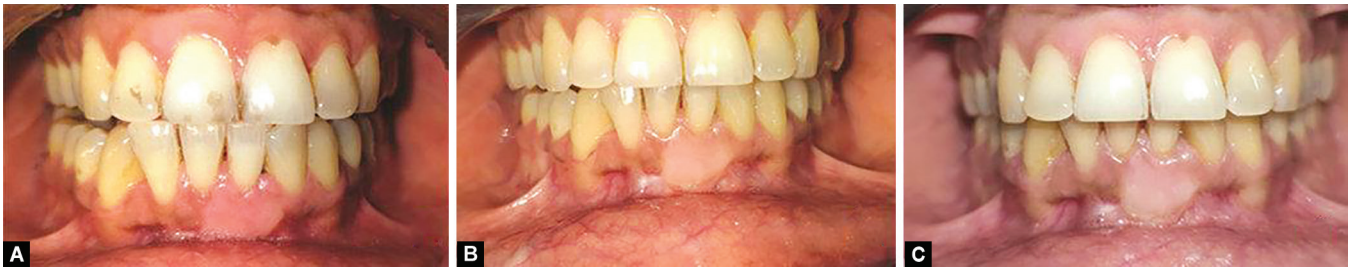
Statistical Package for Social Sciences (SPSS) for Windows, Version 22.0, released in 2013, Armonk, New York: IBM Corp., was used to perform statistical analyses.

Descriptive Statistics

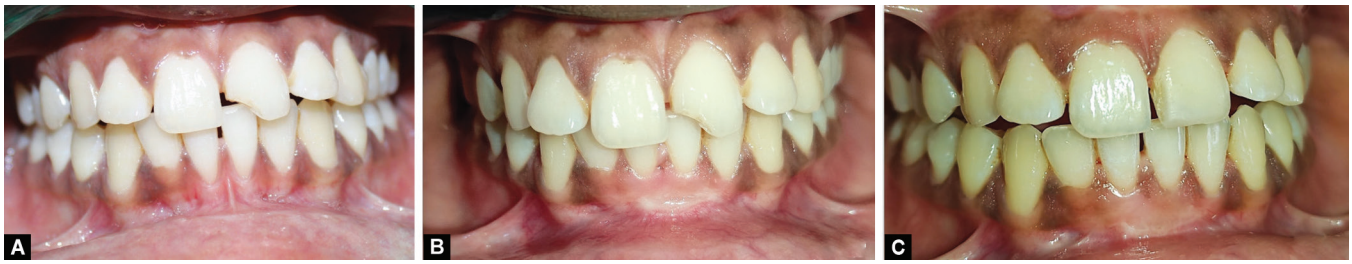
Descriptive analysis includes expression of all the explanatory and outcome variables in terms of frequency and proportions for categorical variables, whereas in terms of mean and standard deviation (SD) for continuous variables.



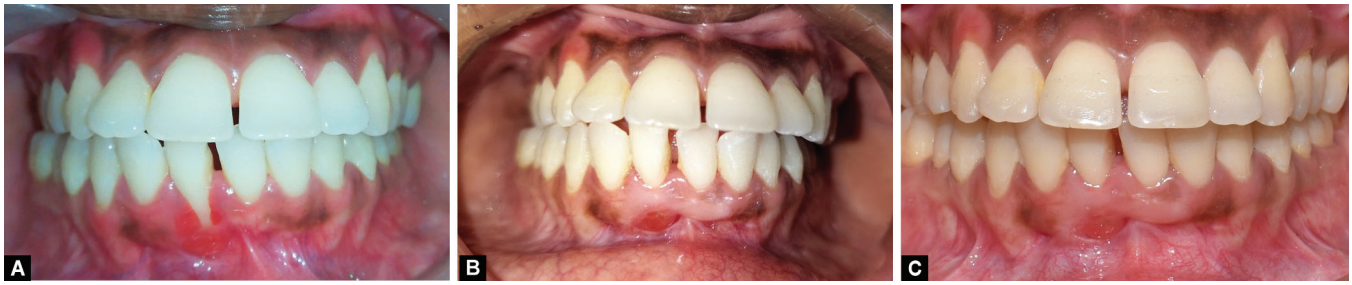
Figs 1A to J: Case 1: Clinical photographs of GUG procedure. (A) Preoperative depth of recession defect; (B) Recipient site preparation; (C) Incision outline of the graft; (D) Harvested GUG; (E) PRF placed after graft harvesting; (F) Graft sutured to the recipient site; (G) Recipient site 2 weeks postoperative; (H) Donor site 2 weeks postoperative; (I) Palatal site at 1 month; (J) Palatal site at 2 months



Figs 2A to C: Postoperative photograph. (A) 6 months; (B) 12 months; (C) 18 months



Figs 3A to C: Case 2: (A) Preoperative; (B) 6 months postoperative; (C) 18 months postoperative



Figs 4A to C: Case 3: (A) Preoperative; (B) 6 months postoperative; (C) 18 months postoperative

Inferential Statistics

Repeated measures of ANOVA test followed by Bonferroni's *post hoc* test were used to compare the mean RD, pocket depth, CAL, KTW values, and percentage of RC between different time intervals. Wilcoxon signed-rank test was used to compare the mean palatal PD (dPD) and CAL (dCAL) values between baseline and 2-month period. The level of significance (*p* value) was set at $p < 0.05$.

Results

About 17 subjects completed the study who contributed to 21 recession sites. The step-by-step clinical procedure and results of three representative cases are shown (Figs 1 to 4). Table 1 demonstrates the age, distribution of recession sites, and baseline clinical parameters of all the treated sites. Table 2 demonstrates the changes in RD during the observation period. There was a statistical significant decrease in RD from baseline to 1-, 6-, and 18-month period ($p < 0.001$). However, multiple comparisons of difference in mean RD between different time intervals using Bonferroni's *post hoc* test was statistically nonsignificant for 1 and 6 months ($p = 1.00$), 1 and 18 months ($p = 0.97$), and 6 and 18 months ($p = 1.00$). Similarly, the gain in KTW as well as change in CAL showed statistically significant improvement at all the postoperative periods ($p < 0.001$) when compared to the baseline levels (Table 3). KTW and CAL however remained stable after 1-month period, with no statistically significant change in their levels thereafter. The mean root coverage (MRC) was 84.76 ± 11.79% with 6 (28%) sites showing CRC at the end of 18 months. The change in the dPD and dCAL at the palatal site from baseline to 2 months was statistically not significant ($p = 0.07$, $p = 0.56$, respectively) (Table 4). The VAS score for discomfort at 14th day postoperative was 1.35 ± 1.17. The patient satisfaction score at the end of 18 months was 8.76 ± 0.90.

Table 1: Age, distribution of recession sites, and baseline clinical parameters

Number of subjects	*Male = 8*	*Female = 9*	
Age range	18–39 years	27.29 ± 5.82 years[†]	
Recession sites (total sites = 21)	Central incisors = 10	Lateral incisors = 6	Canines = 5
RD[‡]	4.17 ± 0.90		
RW[‡]	2.9 ± 0.34		
KTW[‡]	0.86 ± 0.55		
CAL[‡]	5.36 ± 0.94		
PD[‡]	1.19 ± 0.51		

Level of significance (*p* value) was set at $p < 0.05$; [†]Mean ± SD; [‡]Values in millimeters; RD, recession depth; RW, recession width; KTW, keratinized tissue width; CAL, clinical attachment level; PD, probing depth

Table 2: Changes in mean RD at different time intervals

	Baseline	*1 month*	*6 months*	*18 months*	*p value*
RD (mm)	4.17 ± 0.90	0.74 ± 0.60	0.67 ± 0.51	0.64 ± 0.50	0.001*
RD reduction from baseline (mm)		3.43 ± 0.88	3.50 ± 0.84	3.52 ± 0.84	0.18**
MRC (%)		82.97 ± 14.14	84.24 ± 11.83	84.76 ± 11.79	0.78**
Number of sites with CRC—*n* (%)		6 (28%)	6 (28%)	2 (28%)	

Level of significance (*p* value) was set at $p < 0.05$; *Statistically significant change when compared to baseline; **Statistically nonsignificant change between the three time intervals; RC, root coverage; CRC, complete root coverage

Table 3: Changes in CAL, KTW, and PD at different time intervals

	Baseline	*1 month*	*6 months*	*18 months*	*p value*
CAL (mm)	5.36 ± 0.94	1.79 ± 0.60	1.74 ± 0.56	1.74 ± 0.56	0.001*
Gain in CAL from baseline (mm)		3.57 ± 0.97	3.62 ± 1.00	3.62 ± 0.96	0.69**
KTW (mm)	0.86 ± 0.55	4.71 ± 0.87	4.38 ± 1.24	4.33 ± 1.29	0.001*
Gain in KTW from baseline (mm)		3.86 ± 1.31	3.52 ± 1.41	3.48 ± 1.45	0.19**
PD (mm)	1.19 ± 0.51	1.05 ± 0.15	1.07 ± 0.24	1.07 ± 0.24	0.83***
Reduction in PD from baseline (mm)		0.14 ± 0.45	0.12 ± 0.52	0.12 ± 0.52	0.67**

Level of significance (*p* value) was set at $p < 0.05$; *Statistically significant change when compared to baseline; **Statistically nonsignificant change between the three time intervals; ***Statistically nonsignificant change at all time intervals when compared to baseline

Table 4: Changes in donor site probing depth (dPD) and clinical attachment levels (dCALs) at baseline and 2-month period (mean ± SD)

	Baseline	*2 months*	*p value*
dPD (mm)	2.24 ± 0.41	2.14 ± 0.39	0.07*
dCAL (mm)	0.29 ± 0.30	0.31 ± 0.37	0.56*

Level of significance (*p* value) was set at $p < 0.05$; *Statistically nonsignificant change

Discussion

This 18-month longitudinal study was conducted to evaluate the long-term efficacy of GUGs in improving the soft tissue parameters in Miller's class I and class II recession defects. About 17 out of 20 patients completed the 18-month follow-up. The remaining three patients failed to attend their 12- and 18-month appointments. None of the patients reported any adverse events during the early or delayed healing period, both at the recipient or the donor sites.

The randomized control trials comparing the use of GUG and FGG reported superior clinical and esthetic results for GUG.[19–21] FGG has been studied extensively in several short-term and long-term studies and has proven to be stable gingival augmentation procedure in follow-up studies up to a period of 25 years.[22–24] Since the GUG is a relatively new technique, and no study evaluating its long-term follow-up has been reported till date in the literature, the authors aimed to evaluate the long-term stability of the clinical outcomes achieved, over a period of 18 months.

Defect site characteristics play a very important role in the outcome of RC procedures. The local anatomy of mandibular anterior region presents some unique challenges.[25–27] Due to poor mucogingival conditions present in the lower jaw (lack of keratinized gingiva, presence of frenal pull, shallow fornix), the technique most commonly proposed in literature for the treatment of recession defects is nonsubmerged grafts, such as FGG,[12,26] and its modifications like GUG. Nonsubmerged grafts facilitate deepening of the vestibule, eliminating the frena and creating a tensionless environment during healing. FGG utilizes the palatal masticatory mucosa to be used over the denuded root surface.[28] This keratinized palatal epithelium and dense connective tissue may be considered as "generic" tissue to be utilized for recession defect coverage.[17] Supracrestal gingiva is the only tissue naturally created and specifically designed to survive and function interproximally and over avascular root surfaces. GUG, which incorporates this supracrestal tissue along with masticatory mucosa, can be considered as more "site specific," physiologically oriented palatal donor tissue, with vasculature closely matching in size, number, and configuration with the recipient area. This aids in rapid and complete anastomosis of the vessels of the graft with those of the recipient area without the recommended increase in graft thickness as in case of thicker FGG.[17,19]

Apart from being site-specific, using marginal tissue provides numerous advantages over FGG technique, such as greater margin of safety from greater palatine artery, ease of harvesting, well-contoured tissue which is easily adaptable, and ease of suturing to the recipient site.

Success and predictability are commonly used to describe the outcome of RC procedures.[13] Success refers to the percentage of RC achieved, while predictability is the ability of a procedure to achieve CRC. In the present study, the MRC obtained at the end of 18 months postoperative period was 84.76 ± 11.79% from a group of 21 recession sites in 17 patients. CRC was obtained in six sites (28% of total sites). Various longitudinal studies for FGG have reported a wide range of success from 39 to 100%, with mean defect coverage of 69%.[28] A limited number of studies with predictability data showed that 90% of the defect covered 84% of the time.[28,29]

The efficacy of GUG, a relatively new technique first proposed by Allen in 2004 in a series of three cases, has not been documented in any longitudinal study. Apart from case reports and case series, GUG has been compared with FGG in only three randomized controlled trials, followed up for a period ranging from 6 to 9 months. The MRC percentage in the three comparative studies ranged from 60.52 ± 21.22 to 92.74 ± 8.81% which were greater than those of the control sites treated with FGG in a parallel or split mouth study design model.[19–21] The intact marginal vasculature of GUG is the key reason for the improved clinical parameters. Unlike the modification of increasing the

thickness of FGG to improve the clinical outcome, tissue thickness is not critical for GUG survival. A thinner and beveled GUG is more flexible, has greater capacity to integrate, and rapidly anastomoses with the recipient capillaries, thus increasing its survival and resultant better MRC.

A mean gain in KTW from 0.86 ± 0.55 to 4.33 ± 1.29 mm with a concomitant improvement in CAL 1.74 ± 0.56 mm was seen at the end of 18 months. RD, CAL, and KTW had the greatest improvement from baseline levels at 1-month period. Creeping, a mechanism first described by Goldman, refers to the postoperative coronal migration of the gingival margin. This phenomenon is particularly evident during the first postoperative year.[30] In the present study, the changes in RD measured after 1 month, during the 6 and 18 months postoperative period, were not statistically significant, indicating that the coverage of the root principally occurred by bridging (persistence of part of the graft over the denuded area by receiving the circulation from the capillaries in the vascular portion of recipient site). This finding further substantiates the theory of rapid anastomosis of the severed vessels contained in the GUG with that of the recipient site. No change in palatal CAL was found at the donor site tooth/teeth ($p = 0.56$). Careful sharp bevelled dissection of supracrestal gingiva without exposing the submucosal elements is one of the prerequisites to prevent undesirable recession at the donor site.

Patient-centered outcomes at the end of 14 days measured using VAS for discomfort showed a mean value of 1.35 ± 1.17. The secondary intention wound of the palate after harvesting GUG is more superficial as compared to FGG. The PRF bandage with its concentrated growth factors accelerates soft tissue healing by exerting a positive influence on mitogenesis.[31] The low mean value of VAS score indicates that the postoperative discomfort was well managed by PRF, acrylic stent, and postoperative care. Patient satisfaction measured using the 10-point VAS score at the end of 18 months was 8.76 ± 0.90, indicating that patients found the color blending of the grafted tissue with the surrounding area to be satisfactory.

The main focus of the authors was to evaluate long-term efficacy of relatively new technique like GUG and noninclusion of control group to compare its effectiveness which can be considered one of the main limitations of the present study. Additional long-term studies evaluating the clinical, esthetic as well as patient-centered outcomes comparing GUG with conventional techniques, like FGG, should be carried out. The biological advantages of GUG owing to the improved vasculature of marginal gingival tissues should be further substantiated using postoperative timing and blood flow characteristics during the healing stages of the graft.

Conclusion

In conclusion, GUG is a predictable method of RC for Miller's class I and class II recession defects in isolated single or two adjacent recession defects in mandibular anterior region. With adequate maintenance care, the results gained by the technique can be well maintained over an 18-month period.

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