Original Article

Periosteum eversion technique versus subpedicle connective tissue graft technique for root coverage of gingival recessions: A randomized split-mouth study

ABSTRACT

Introduction: The connective tissue graft (CTG) with pedicle flap as subpedicle CTG technique (SPCTGT) is considered the gold standard technique in the treatment of gingival recessions. The aim of this study was to compare periosteum eversion technique (PET) with SPCTGT for root coverage of gingival recessions.

Materials and Methods: Ten patients having bilateral gingival recessions of Miller class I and II were selected. The left or right side was randomly assigned into PET group and SPCTGT group. Before and after 1 year of surgery, depth of gingival recession (DGR), width of keratinized gingiva (WKG), width of attached gingiva (WAG), and probing depth (PD) were measured and compared. Pre- and post-groups were compared by paired *t*-test. Two independent groups were compared by independent Student's *t*-test. A two-tailed (α =2) $P < 0.05$ was considered statistically significant.

Results: Comparing the pre to post mean of PET and SPCTGT showed decrease (net improvement) in DGR (−5.80 ± 0.42 vs. −4.65 ± 0.39, mean difference = −1.15 ± 0.57, $t = 2.02$, $P = 0.058$) and in PD (−1.05 ± 0.12 vs. − 0.60 ± 0.12, mean difference = −0.45 ± 0.17, $t = 2.64$, $P = 0.017$); and increase (net improvement) in WKG (5.80 ± 0.42 vs. 4.80 ± 0.41, mean difference = 1.00 ± 0.58, $t = 1.71$, $P = 0.104$) and in WAG (5.60 ± 0.32 vs. 4.90 ± 0.24, mean difference = 0.70 ± 0.41, $t = 1.73$, $P = 0.101$). PET showed 19.8% and 42.9% higher decrease in DGR and PD; and 17.2% and 12.5% higher increase in WKG and WAG, respectively, than SPCTGT.

Conclusions: The study found that both the modalities were effective in the management of root coverage of gingival recessions. However, PET was found more effective than SPCTGT.

Keywords: Bilaminar reconstructive procedure, mucogingival surgery, periodontal plastic surgery, periosteoplasty

INTRODUCTION

Gingival recession is defined as the exposure of root surface in the oral cavity, resulting from the detachment and migration of junctional epithelium toward the apex of the root.[1] Plaque-induced inflammation and toothbrush trauma have been proposed as etiologic factors[2,3] even though this point still needs elucidation.[4] Different surgical techniques have been proposed for the treatment of the gingival recessions. A systematic review of literature showed that the connective tissue graft (CTG) is considered the gold standard technique in the treatment of gingival recessions.[5,6] A possible hypothesis to explain the clinical efficacy of CTG may be related with the specific healing model of the procedure. In fact, the high stability of the wound over CTG is associated with graft vascularization originated from both the periodontal plexus and the overlying flap leading to a complete blood supply for the graft after 2 weeks.[7] However,

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CTG has a number of disadvantages: a secondary harvesting surgery for donor tissue is required; increased morbidity may be associated with the donor surgery; and a limited amount of donor tissue is available, limiting the number of defect sites treated per patient visit.[8,9] To overcome such limitations, and to increase the effectiveness of root coverage techniques, periosteum eversion technique (PET) has been proposed. The aim of this study was to compare PET with subpedicle CTG technique (SPCTGT) for root coverage of gingival recessions.

MATERIALS AND METHODS

Ten patients recruited from the outpatient department of periodontology having bilateral gingival recessions of Miller Class I and II [Figure 1]. Patients having unilateral Miller Class I, II, III, and IV; and bilateral gingival recessions of Miller Class III and IV were excluded from the study. On split-mouth basis, each side either left or right was randomly assigned into PET group and SPCTGT group. Before start of surgery and after 1 year, clinical parameters as depth of gingival recession (DGR), width of keratinized gingiva (WKG), width of attached gingiva (WAG), and probing depth (PD) were measured.

The patients underwent Phase I therapy including scaling, root planing, and instructions for proper oral hygiene measures. A coronally directed "roll" technique was advised for tooth with gingival recession to minimize toothbrushing trauma of gingival margin. Surgical treatment of gingival recession was not schedule until the patient could able to maintain full-mouth bleeding score[10] of ≤20% and full mouth plaque score[11] of ≤20% along with absence of plaque, i.e., "plaque-free" (area where plaque could not be removed with a manual probe) and bleeding on probing at the surgical tooth site.

At the time of surgery, informed written consent was taken from the patients. This study was approved by the institutional ethical committee for human subjects and was also conducted in accordance with the Helsinki Declaration of 1975, as revised in 2000. The patient was instructed to do presurgical rinse by 0.2% chlorhexidine solution. The facial skin all around the oral cavity was cleaned with spirit and scrubbed by 7.5% povidone-iodine solution. The intraoral surgical site was painted with 5% povidone-iodine solution.[12]

After proper part preparation, 2% lignocaine HCL with 1:80,000 adrenaline was administered to anesthetize respective nerve of surgical site. The PET was done according to Singh and Kiran.[12] After local anesthesia, marginal incision was given all along the soft-tissue margin of the recession defect. Two lateral vertical incisions along the proximal side of recession defect were made, and a mucoperiosteal flap was reflected [Figure 2]. The exposed root surface was cleaned thoroughly by scaling and root planing to remove any root surface deposits. An attempt was made to flatten the root in the area of the root prominence. A basal incision was given at the baseline to incise the periosteum, and then it was separated from the submucous connective tissue up to the borderline of the attached gingiva. The crestly pedicle periosteum was everted [Figure 3] and transposed coronally, where it was sutured with 5-0 absorbable suture [Figure 4]. After that, a coronal transposition of mucoperiosteal flap was done, and it was also sutured [Figure 5].

The SPCTGT was done according to Nelson.[13] Two vertical incisions were made from the distal crest of the bordering interdental papillae to the base of the vestibule. These incisions were horizontally connected on the proximal to a sulcular incision that was made on the exposed root. As much of the interdental papilla was retained as possible without affecting the adjacent teeth. Full-thickness mucogingival flaps were reflected to allow repositioning of the pedicles to the cementoenamel junction of the affected tooth [Figure 6]. Any sulcular epithelium that remained on the borders of the denuded root surface was removed with curettes, and the root was reinspected to assure that all roughness had been removed. A CTG was obtained from the palate using a "trap door" approach.[13] The CTG was then placed on the recipient bed at the level of the cementoenamel junction and sutured [Figure 7]. The pedicles were then sutured together with interrupted sutures [Figure 8]. A sling suture was used to position the pedicles directly over the free CTG and denuded root surface to the height of the cementoenamel junction [Figure 9].

Figure 1: Bilateral gingival recessions

Figure 2: Mucoperiosteal flap reflected

Figure 3: Crestly pedicle everted periosteum

Figure 4: Periosteum sutured on the root surface

Figure 5: Mucoperiosteal flap sutured

Figure 6: Full-thickness mucogingival flaps

Figure 7: Connective tissue graft sutured

Antibiotic (amoxicillin 500 mg, 1 tablet every 8 h, for 7 days) and analgesic (nimesulide 100 mg, 1 tablet every 12 h, for 3 days) were prescribed. The patient was instructed to be extremely cautious during mastication at meals and not to brush the teeth in the treated area for 2 weeks but to use 0.2% chlorhexidine mouthwash twice daily for 1 min. After this period, the patient was advised to mechanical cleaning of treated tooth region using an extra soft toothbrush by coronally directed "roll" technique, together with 0.2% chlorhexidine mouthwash twice daily, 1 min for more 4 weeks. After this period, routine oral hygiene procedures could be reintroduced.[12]

Clinical follow-up was performed once a week in the 1st postoperative month, every 2 weeks in the 2nd postoperative months and once a month after that up to 1 year. At each

visit, recall programs, including professional tooth cleaning and reinforcement of daily oral hygiene measures, were done. Healing was uneventful. The patient was satisfied with the treatment outcome [Figures 10 and 11]. As the postoperative time increased, the progressive adaptation and morphologic resemblance were observed.[12]

Statistical analysis

Data were summarized as Mean ± standard error of the mean. Pre- and postgroups were compared by paired *t*-test. Two independent groups were compared by independent Student's *t*-test. A two-tailed($\alpha = 2$) $P < 0.05$ was considered statistically significant. Analyses were performed on Statistical Package for Social Sciences (SPSS) software windows version 17.0 (SPSS Inc., Chicago, Illinois, USA).

RESULTS

The outcome measures of the study were DGR, WKG, WAG, and PD. The DGR, WKG, and PD were assessed at pretreatment (pre) and after 1 year posttreatment (post) whereas WAG was assessed at final evaluation (i.e., after 1 year posttreatment).

Outcome measures

The pre- and postoutcome measures (DGR, WKG, and PD) of two groups (PET and SPCTGT) are summarized in Table 1 and also depicted in Graphs 1-3, respectively. In both groups, the mean DGR and PD decreased (improved) comparatively at post as compared to pre and the decrease (improvement) was evidently higher in PET than SPCTGT. In contrast, the mean WKG in both groups increased (improved) comparatively at post as compared to pre and the increase (improvement) was evidently higher in PET than SPCTGT.

For each group, comparing the pre and post mean DGR, paired *t*-test showed significant decrease in DGR of both PET (94.3%) (6.15 ± 0.48 vs. 0.35 ± 0.11, mean difference = −5.80 ± 0.42, $t = 13.93$, $P < 0.001$) and SPCTGT (86.1%) (5.40 ± 0.35 vs. 0.75 ± 0.15, mean

Figure 8: Pedicles sutured together

Figure 9: Pedicles sutured around the tooth

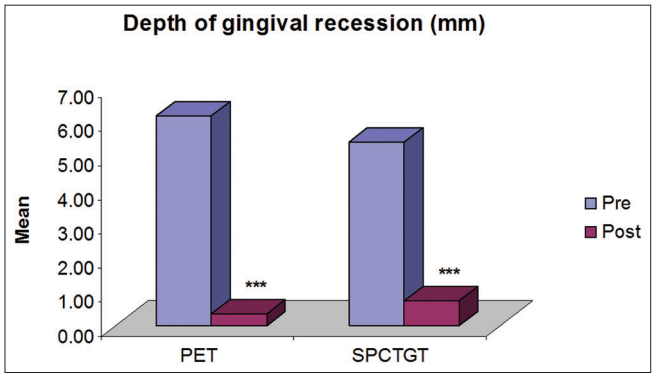
Figure 10: Root coverage by periosteum eversion technique after 1 year

Figure 11: Root coverage by subpedicle connective tissue graft technique after 1 year

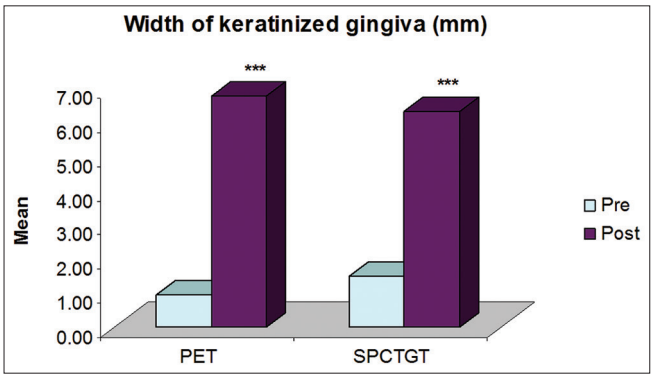
Table 1: Pre- and post-outcome measure of two groups

Outcome measures (mm)	Group	Pre (n=10)	Post (n=10)	Mean change (post-pre)	t	P
DGR	PET	6.15±0.48	0.35±0.11	−5.80±0.42	13.93	<0.001
	SPCTGT	5.40±0.35	0.75±0.15	−4.65±0.39	12.00	<0.001
WKG	PET	0.95±0.23	6.75±0.42	5.80±0.42	13.93	<0.001
	SPCTGT	1.50±0.26	6.30±0.26	4.80±0.41	11.72	<0.001
PD	PET	2.20±0.08	1.15±0.15	−1.05±0.12	9.00	<0.001
	SPCTGT	2.00±0.11	1.40±0.12	−0.60±0.12	4.81	0.001

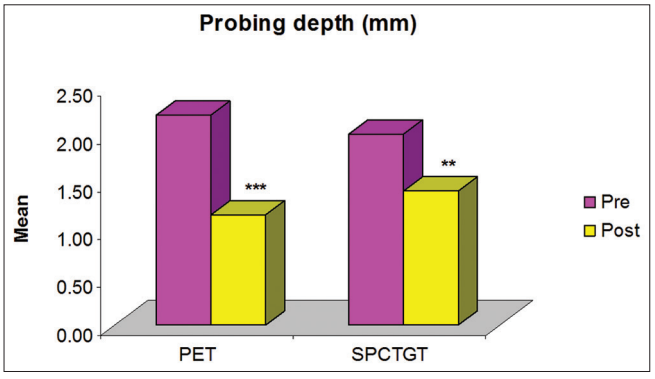
Pre- and post-outcome measures of two groups were summarized in mean±SE and compared by paired t-test. SE: Standard error, DGR: Depth of gingival recession, WKG: Width of keratinized gingiva, PD: Probing depth, PET: Periosteum eversion technique, SPCTGT: Subpedicle connective tissue graft technique



Graph 1: For each group, comparison of mean depth of gingival recession between periods. ***P < 0.001 - as compared to pre



Graph 2: For each group, comparison of mean width of keratinized gingiva between periods. ***P < 0.001 - as compared to pre



Graph 3: For each group, comparison of mean probing depth between periods. **P < 0.01 or ***P < 0.001 - as compared to pre

difference = −4.65 ± 0.39, t = 12.00, P < 0.001) at post as compared to pre [Table 1 and Graph 1].

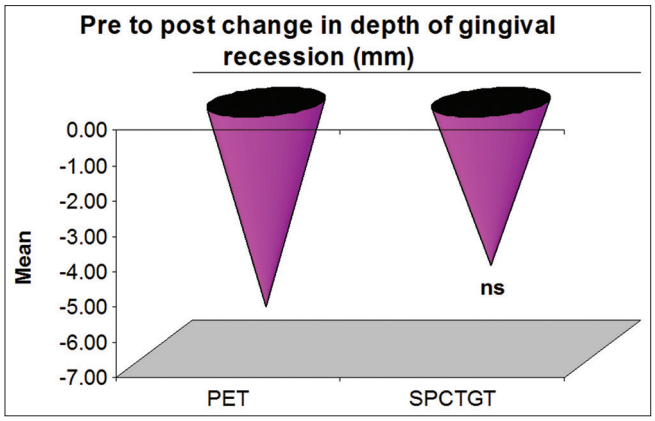
Similarly, comparing the pre and post mean WKG, paired t-test showed significant increase in WKG of both PET (85.9%) (0.95 ± 0.23 vs. 6.75 ± 0.42, mean difference = 5.80 ± 0.42, t = 13.93, P < 0.001) and SPCTGT (76.2%) (1.50 ± 0.26 vs. 6.30 ± 0.26, mean difference = 4.80 ± 0.41, t = 11.72, P < 0.001) at post as compared to pre [Table 1 and Graph 2].

Further, comparing the pre and post mean PD, paired t-test showed significant decrease in PD of both PET (47.7%) (2.20 ± 0.08 vs. 1.15 ± 0.15, mean difference = −1.05 ± 0.12, t = 9.00, P < 0.001) and SPCTGT (30.0%) (2.00 ± 0.11 vs. 1.40 ± 0.12, mean difference = −0.60 ± 0.12, t = 4.81, P = 0.001) at post as compared to pre [Table 1 and Graph 3].

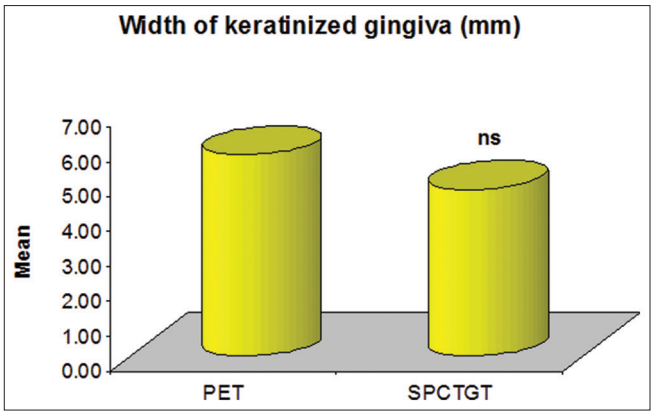
To find out efficacy of one treatment over other, the net improvement (i.e., mean change from pre to post) in outcome measures (DGR, WKG, and PD) of two groups were compared by Student's t-test and summarized in Table 2 and also shown in Graphs 4-6, respectively.

Comparing the pre to post mean decrease (net improvement) in DGR of two groups (treatments), Student's t-test showed similar decrease between the two groups (−5.80 ± 0.42 vs. −4.65 ± 0.39, mean difference = −1.15 ± 0.57, t = 2.02, P = 0.058) though the decrease (improvement) was 19.8% higher in PET as compared to SPCTGT [Table 2 and Graph 4].

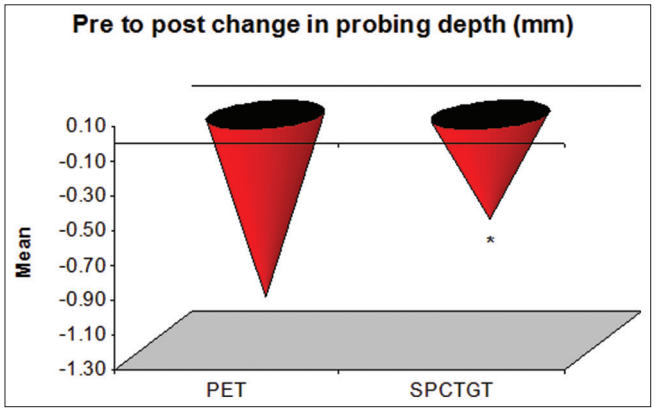
Similarly, comparing the pre to post mean increase (net improvement) in WKG of two groups (treatments), Student's t-test showed similar increase between the two groups (5.80 ± 0.42 vs. 4.80 ± 0.41, mean difference = 1.00 ± 0.58, t = 1.71, P = 0.104) though the increase (improvement) was 17.2% higher in PET as compared to SPCTGT [Table 2 and Graph 5].



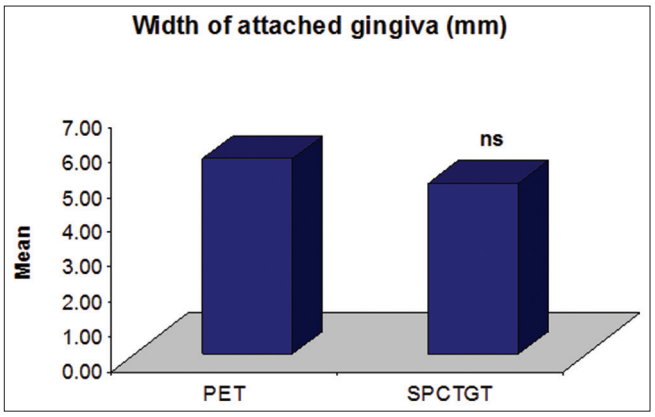
Graph 4: Comparison of pre to post mean change in depth of gingival recession between two groups. $^{ns}P > 0.05$ - as compared to periosteum eversion techniqu



Graph 5: Comparison of pre to post mean change in the width of keratinized gingiva between two groups. $^{ns}P > 0.05$ - as compared to periosteum eversion technique



Graph 6: Comparison of pre to post mean change in probing depth between two groups. $^{*}P < 0.05$ - as compared to periosteum eversion technique



Graph 7: Comparisons of posttreatment mean width of attached gingiva between two groups. $^{ns}P > 0.05$ - as compared to periosteum eversion technique

Table 2: Comparison of the net improvement in outcome measures between two groups

Outcome measures (mm)	PET ($n=10$)	SPCTGT ($n=10$)	Mean difference	t	P
DGR	−5.80±0.42	−4.65±0.39	−1.15±0.57	2.02	0.058
WKG	5.80±0.42	4.80±0.41	1.00±0.58	1.71	0.104
PD	−1.05±0.12	−0.60±0.12	−0.45±0.17	2.64	0.017

Improvement (i.e., pre to post change) in outcome measures of two groups were summarized in mean±SE and compared by Student's *t*-test. PET: Periosteum eversion technique, SPCTGT: Subpedicle connective tissue graft technique, SE: Standard error, DGR: Depth of gingival recession, WKG: Width of keratinized gingiva, PD: Probing depth

Further, comparing the pre to post mean decrease (net improvement) in PD of two groups (treatments), Student's *t*-test showed significantly different and lower (42.9%) decrease in SPCTGT as compared to PET (-1.05 ± 0.12 vs. -0.60 ± 0.12, mean difference $= -0.45 \pm 0.17$, $t = 2.64$, $P = 0.017$) [Table 2 and Graph 6].

The WAG of two groups at the final evaluation (i.e., after 1 year posttreatment) is summarized in Table 3 and also shown in Figure 7. At the final evaluation, the mean WAG of PET was slightly higher than SPCTGT. Comparing the mean

Table 3: Comparison of posttreatment width of attached gingiva between two groups

PET ($n=10$)	SPCTGT ($n=10$)	Mean difference	t	P
5.60±0.32	4.90±0.24	0.70±0.41	1.73	0.101

Posttreatment WAG of two groups was summarized in mean±SE and compared by Student's *t*-test. WAG: Width of attached gingiva, PET: Periosteum eversion technique, SPCTGT: Subpedicle connective tissue graft technique, SE: Standard error

WAG of two groups, Student's *t*-test showed similar WAG between the two groups (5.60 ± 0.32 vs. 4.90 ± 0.24, mean difference $= 0.70 \pm 0.41$, $t = 1.73$, $P = 0.101$) though it was 12.5% higher in PET as compared to SPCTGT [Table 3 and Graph 7].

DISCUSSION

In the prevention and correction of gingival recession, a choice of four possibilities exists: no treatment at all; place a graft to prevent gingival recession; stabilize an existing recession; or attempt the root coverage of the gingival recession. Patients with gingival recession who complain of root hypersensitivity or esthetic concerns are

candidates for root coverage. In addition, the therapist may recommend root coverage procedures to improve plaque control in localized areas of gingival recession, to reduce the chance of root caries, to satisfy esthetic requirements of restorations, and to prevent a further gingival recession, particularly if prosthetic or orthodontic treatment is planned. When the therapeutic objective is the correction of gingival recession, a procedure should be selected that will most predictably result in root coverage.[13]

The ultimate goal of any therapeutic intervention aimed at root coverage should be to restore the tissue margin at the CEJ and to achieve an attachment of the tissues to the root surface so that a normal healthy gingival sulcus with no bleeding on probing and a minimal PD is present.[14]

Various surgical procedures have been described to treat gingival recessions, but these have been demonstrated to heal with a long junctional epithelium, and regeneration has been observed only in the most apical portion of the lesion. Although the bilaminar technique using subepithelial CTGs still holds the most promising results in root coverage, histological studies show unpredictable healing.[15] The use of PET in this study to attain root coverage may alleviate the need for donor site procurement of connective tissue.

The periosteum is widely used in dentistry. Singh and Gautam evaluated the periosteal pedicle graft (PPG) induced by platelet-rich fibrin (PRF) with vestibular incision subperiosteal tunnel access (VISTA) technique to cover denuded root surface area. A patient with Miller Class II gingival recession of 6.5 mm was treated by PRF reinforced with VISTA technique. PRF was prepared from whole blood and applied to the root surface. After 6 months, 5.5 mm, that is, 84.6% root coverage was obtained. They concluded PRF reinforced PPG with VISTA technique had successful results in the treatment of gingival defects.[1] The PET was reported by Singh and Kiran for the coverage of denuded root surface. In the PET, the periosteum is separated from the mucoperiosteal flap after baseline incision, so that the basal part of periosteum is used for eversion on denuded root surface for root coverage. The periosteum remains pedicle in the crestal part of the mucoperiosteal flap and can be elongated and coronally transposed over the denuded root surface without retraction forces. They found 100% root coverage after 6 months.[12] The periosteum inversion technique was reported by Singh, where periosteum is pedicle at the crestal/marginal part of the alveolar bone. The periosteum thereby retains blood supply and will survive on avascular root surface or even if exposed after surgery. He found 100% root coverage after 12 months.[16] Kumar Singh and Saxena described the usefulness of PPG as a barrier membrane and demineralized freeze-dried bone allograft (DFDBA) for bone regeneration in periradicular bone defect. A patient with intraoral discharging sinus due to carious exposed pulp involvement was treated by PPG and DFDBA. Clinical and radiological evaluations were done immediately prior to surgery, 3 months, 6 months, and 1 year after surgery. The patient was treated using split-thickness flap, PPG, apicoectomy, defect fill with DFDBA, and lateral displacement along with suturing of the PPG prior to suturing the flap, to close the communication between the oral and the periapical surroundings through sinus tract opening. After 1 year, successful healing of periradicular bone defect was achieved. They concluded that that PPG as a barrier membrane and DFDBA have been shown to have the potential to stimulate bone formation when used in periradicular bone defect.[17] Singh *et al*. designed the periosteum transposition technique for coverage of exposed root surface. A patient with an isolated Miller Class I labial gingival recession at lower left central incisor of 6.0 mm was treated by this technique. In this technique, a partial-thickness flap was reflected and underlying periosteum was elevated and transposed on exposed root surface and sutured. The partial-thickness flap was sutured at its original position. After 1 year, complete root coverage was obtained. Thus, the periosteum transposition technique is an assuring technique that has the potential for complete coverage of exposed root surface.[18]

In the present study, 19.8% higher decrease in depth of gingival recession was found by PET versus SPCTGT. This is due to well-vascularized periosteum has the possibility to react to bacterial contamination like any other vital tissue. A study showed that periosteal cells release vascular endothelial growth factor.[19] Periostin is a protein that is termed so because it was initially identified in the periosteum. It is secreted cell adhesion protein that is 90 kDa in size. Structurally, it is a disulfide-linked protein that favors osteoblast attachment and spreading. Osteoblast attachment is mediated through the presence of $\alpha_v\beta_3$ and $\alpha_v\beta_5$ integrins that are upregulated in the presence of periostin. Osteoblasts produce Type I collagen, noncollagenous proteins (osteocalcin, osteopontin, and osteonectin) and various glycoproteins. They also produce cytokines and growth factors such as bone morphogenetic proteins (BMPs) as BMP-2 and BMP-7, transforming growth factor-β, insulin-like growth factor, and platelet-derived growth factor that take part in the regeneration.[12] The success of SPCTGT is due to a bilaminar graft that is composed of a free CTG and an overlying pedicle graft. By

overlaying grafted free connective tissue with a pedicle, the otherwise compromised section of free graft which covers a denuded root surface is supplied by plasmatic circulation from capillaries in the vascular portion of the pedicle allowing it to survive.[13]

CONCLUSIONS

The study found both the modalities were effective in the management of root coverage of gingival recessions. However, PET was found more effective than SPCTGT.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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