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Clinical Case Study

Comparison of Perioseum Eversion Technique and Subepithelial Connective Tissue Graft Technique for Root Coverage of Miller's Class I and Class II Gingival Recessions: A One-Year Follow-Up Prospective Clinical Study

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Abstract

The aim of this study was to compare periosteum eversion technique (PET) with SPCTGT for root coverage of gingival recessions.

Keywords: *Periosteum Eversion Technique (PET); SPCTGT; Root Coverage; Gingival Recessions*

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]. 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 [2]. The aim of this study was to compare periosteum eversion technique (PET) with SPCTGT for root coverage of gingival recessions.

Materials and Methods

Twenty patients having Miller class I and II gingival recessions > 3 mm in upper and/or lower anterior teeth; the involved tooth was well aligned in the dental arch and free of periapical pathology. Exclusion criteria will: smokers and chewers of tobacco; endodontically

treated test or control sites; root surface restorations on test or control sites; pregnant and lactating women; use of fixed orthodontic or removable appliances; and a previous root coverage procedure. Also, patients having gingival recessions of Miller Class III and Class IV will excluded from the study. 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 Patients will be randomly assigned into PET group and SCTGT group. All clinical measurements were taken using a standard UNC15 periodontal probe, with an accuracy of 0.5 mm.

In all patient which are selected for study phase I therapy was done consisting of scaling, root planing, polishing and occlusal adjustment (if necessary), antimicrobial therapy and oral hygiene instructions given to all patients. Four weeks later, study models were created and the patient's oral hygiene was examined. Pre-and post-groups were compared by independent t-test. Four independent groups were compared by independent t-test.

Periosteum eversion surgical technique

Local anesthesia and infiltration with 2% lignocaine hydrochloride containing adrenaline at a dosage of 1:80,000 were used to complete the surgical procedure. Marginal incision was given at surgical site followed by two divergent vertical incisions were performed on the facial surface of the affected tooth, one mesial and one distal, precisely next to the defect, extending beyond the mucogingival junctionn. Care was taken to see that the papilla was intact. The Glickman periosteal elevator was used to raise a trapezoidal mucoperiosteal flap.

Following root surface preparation, the periosteum was cut at the baseline and lateral portion, and it was separated from the submucous connective tissue all the way to the gingival boundary. Using 4-0 bio-absorbable suture material (Braided coated polyglactin 910 violet, Supercryl), the crestally pedicled periosteum was everted and transferred coronally to the cemento-enamel junction, where it was secured with interdental suture. After positioning the flap coronally to fully cover the periosteum, no. 4-0 bio absorbable suture was used to fix it with a sling suture. Direct interrupted sutures were then used on both sides to close the vertical wounds. Post-operative instructions, medication was given and patient was recalled for follow-up regimen (once every two weeks for the first month in second post-operative month and once a month after that). All of the study participants underwent the same surgical procedure. After three months all the clinical parameters were measured and compared to preoperative values.

Figure 1: *a) Preoperative photograph showed exposed root surface at tooth no # 31; b) Preoperative photograph showed no bone loss.*

Figure 2: *a) After internal bevel incision; b) After vertical and horizontal incisions.*

Figure 3: *a) After partial-thickness flap reflection; b) After the periosteum reflection.*

Figure 4: *a) Root conditioning with 24% EDTA; b) After washing with normal saline.*

Figure 5: *a) Transposition of the periosteum on exposed root surface; b) After suturing of transposed periosteum on exposed root surface; c) After suturing of partial-thickness flap on its original position; d) Periodontal dressing applied on surgical area.*

Figure 6: *One year postoperative showed complete root coverage.*

Subepithelial connective tissue graft surgical technique

Preparation of the recipient bed

2% lignocaine hydrochloride containing 1: 2,00,000 epinephrine was used to anesthetize the operative site. A full-thickness flap was raised, featuring two vertical incisions 1 to 2 mm apical to the gingival margin of the neighboring teeth and a horizontal incision 2 mm apical to the tip of the papilla. Without any holes that could compromise the blood supply, the flap was extended all the way to the muco-buccal fold. To facilitate coronal movement, the periosteum was released at the flap's base. Using an airotor with a tapered fissure bur and careful root planing, the root's convexity was decreased.

From the donor site, obtaining a graft

A "trap door" flap design was used to remove the connective tissue graft from the palate. About 3 mm apical to the gingival margin of the first premolar, extending towards the first molar, a partial thickness horizontal incision with a bevel was made using a no. 15 blade. Mesiodistally, two vertical incisions were performed.

The prepared edge of the palatal flap was lifted using tissue forceps. It was reflected into the palate's center, revealing the connective tissue underneath.

To enable the connective tissue's reflection from the bone, an incision was made around its edge perpendicular to the bone. The connective tissue was harvested and reflected using a Kirkland knife and a tiny periosteal elevator. Following graft harvesting, 4-0 black silk sutures were used to seal the incision.

Transfer and immobilizing the graft

The denuded root was covered with the extracted connective tissue graft, which was secured with 4-0 polyglactin 910 resorbable sutures. Using 4-0 black silk sutures, the overlaying flap was sutured interdentally after being dragged coronally to cover the graft as much as feasible.

Coe-pack was used to cover both the donor and recipient sites. For two weeks, all patients were given analgesics and a mouthwash containing 0.2% chlorhexidine digluconate twice a day. Post-operative instructions were explained to the patients.

Figure 7: *Preoperative clinical situation showing gingival recession.*

Figure 8: *Connective tissue graft sutured.*

Figure 9: *Pedicles sutured around the tooth.*

Figure 10: *Root coverage by subpedicle connective tissue graft technique after 1 year.*

Post-operative care

Antibiotics (amoxicillin 500 mg + potassium clavulanate 125 mg for 7 days TDS), Analgesics (Ibuprofen 400 mg for five days, a non-steroidal anti-inflammatory medicine TDS), multivitamin (Becosules once daily for 14 days) along with 2% povidine iodine rinses BD for 7 days to control post-operative discomfort were prescribed.

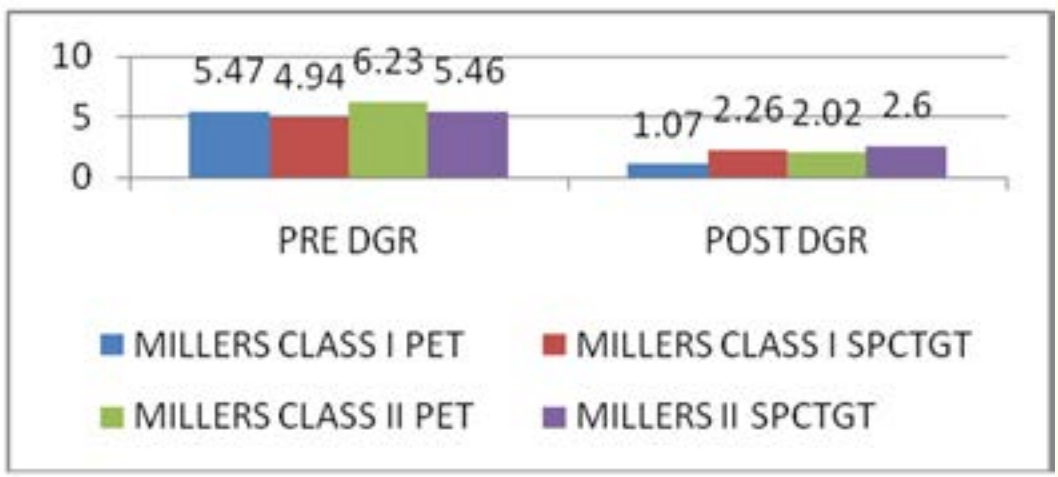
Statistical analysis

Data will be summarized as Mean ± standard error of the mean. Pre- and post-groups will be compared by paired *t*-test. Four independent groups were compared by independent Student's t- test. A two-tailed ($\alpha = 2$) $P < 0.05$ will considered statistically significant. Comparison of the groups based on the pre and post variables of Millers class II group based on PET and SPCTGT. Analyses will be performed on Statistical Package for Social Sciences (SPSS) software windows version 17.0 (SPSS Inc., Chicago, Illinois, USA).

Results

Comparing the PET and SPCTGT, the periosteum eversion technique (PET) exhibited 25.8% greater reduction in the depth of gingival recession as compared to subepithelial connective tissue graft technique (SCTG) in Miller's class I cases and in Miller's class II cases the reduction of depth of gingival recession was similar, i.e. exhibited 15.2% greater reduction as compared to SPCTG.

Outcome measures: The results shows that statistically significant difference was seen at pre DGR, post DGR, pre WKG, post WKG, pre WAG, post WAG and post PD ($p < 0.05$), whereas non-significant difference was seen in the PRE PD ($p > 0.05$). Table 1 and graph 1 shows the comparison of the groups based on the pre and post DGR, the results shows statistically significant ($p < 0.05$) difference at pre DGR but statistically non-significant difference at post DGR ($p > 0.05$).



Graph 1

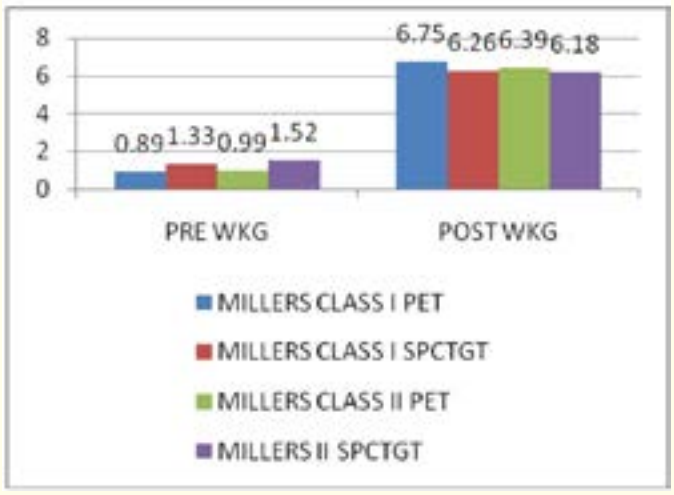
Group		Pre DGR	Post DGR
Group-A	Mean	5.47	1.07
	SD	0.38	0.16
Group-C	Mean	4.94	2.26
	SD	0.18	0.35
Group-B	Mean	6.23	2.02
	SD	0.13	0.16
Group-D	Mean	5.46	2.60
	SD	0.25	0.48
P-Value		0.003	0.023

Table 1

Table 2 and graph 2 shows the comparison of the groups based on the pre and post WKG, the results statistically non-significant difference at pre and post WKG ($p > 0.05$).

Group		Pre WKG	Post WKG
Group-A	Mean	0.89	6.75
	SD	0.14	0.37
Group-C	Mean	1.33	6.26
	SD	0.07	0.10
Group-B	Mean	0.99	6.39
	SD	0.10	0.18
Group-D	Mean	1.52	6.18
	SD	0.08	0.16
P-Value		0.253	0.110

Table 2

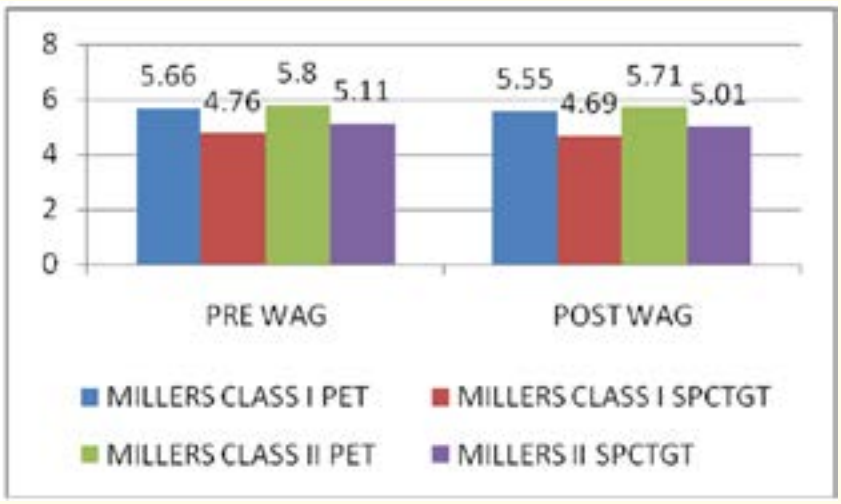


Graph 2

Table 3 and graph 3 shows the comparison of the groups based on the pre and post WAG, the results statistically non-significant difference at pre and post WAG ($p > 0.05$).

Group		Pre WAG	Post WAG
Group-A	Mean	5.66	5.55
	SD	0.10	0.20
Group-C	Mean	4.76	4.69
	SD	0.12	0.12
Group-B	Mean	5.80	5.71
	SD	0.06	0.06
Group-D	Mean	5.11	5.01
	SD	0.11	0.14
P-Value		0.225	0.227

Table 3

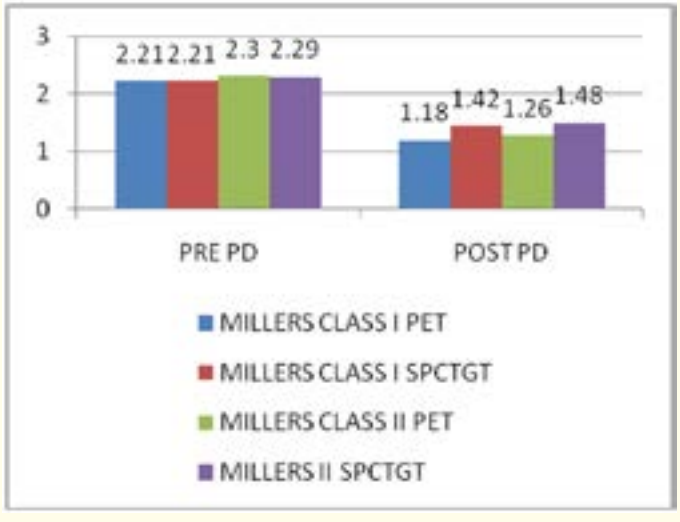


Graph 3

Table 4 and graph 4 shows the comparison of the groups based on the pre and post PD, the results shows statistically significant ($p < 0.05$) difference at pre PD but statistically non-significant difference at post PD ($p > 0.05$).

Group		Pre PD	Post PD
Group-A	Mean	2.21	1.18
	SD	0.07	0.06
Group-C	Mean	2.21	1.42
	SD	0.07	0.08
Group-B	Mean	2.30	1.26
	SD	0.03	0.05
Group-D	Mean	2.29	1.48
	SD	0.05	0.04
P-Value		0.003	0.268

Table 4

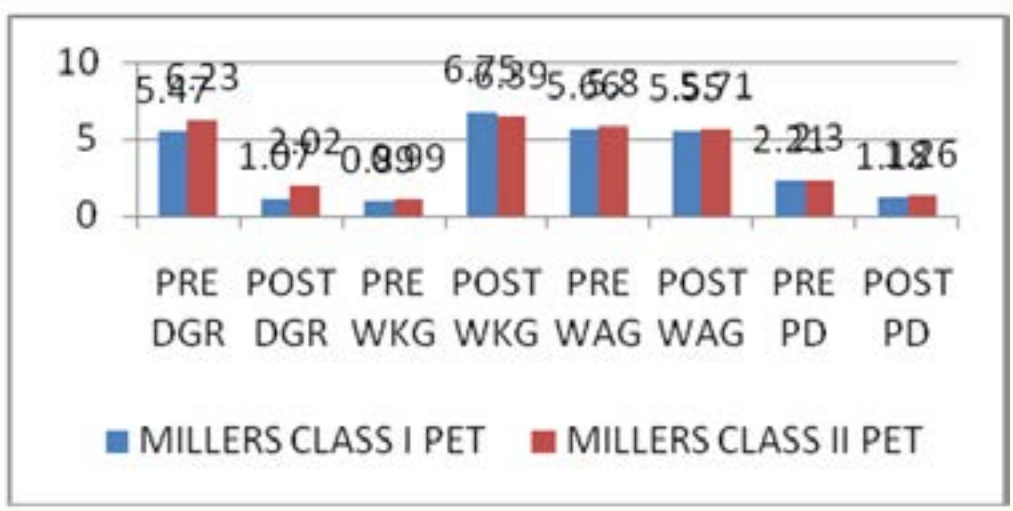


Graph 4

Table 5 and graph 5 shows the comparison of the groups based on the pre and post variables of PET group based on Millers class I and class II. The results shows that statistically significant difference was seen at pre DGR and pre PD ($p < 0.05$), whereas non-significant difference was seen in the remaining variables ($p > 0.05$).

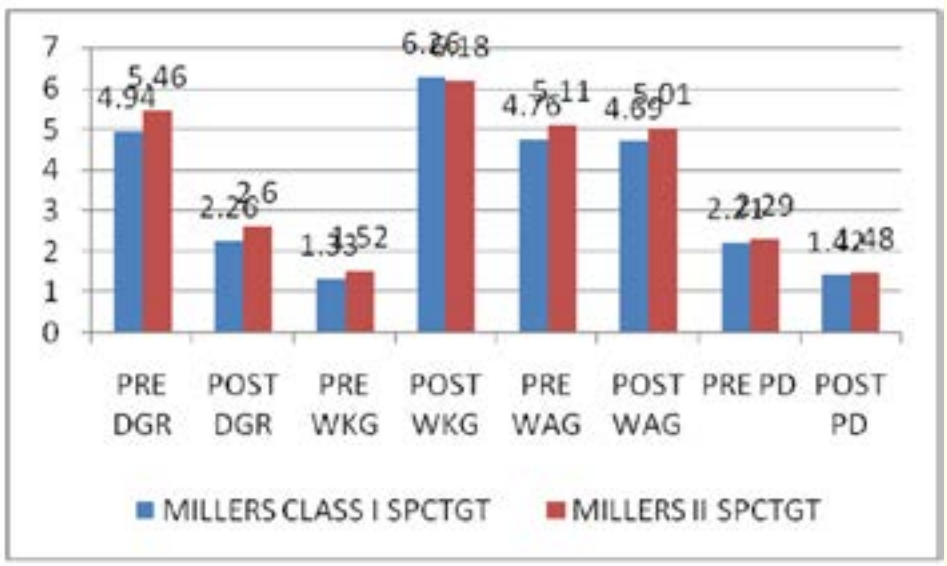
PET Group		Pre DGR	Post DGR	Pre WKG	Post WKG	Pre WAG	Post WAG	Pre PD	Post PD
Group-A and C	Mean	5.47	1.07	0.89	6.75	5.66	5.55	2.21	1.18
	SD	0.38	0.16	0.14	0.37	0.10	0.20	0.07	0.06
Group-B and D	Mean	6.23	2.02	0.99	6.39	5.80	5.71	2.30	1.26
	SD	0.13	0.16	0.10	0.18	0.06	0.06	0.03	0.05
P-Value		0.003	0.045	0.281	0.095	0.041	0.128	0.037	0.074

Table 5



Graph 5

Table 6 and graph 6 shows the comparison of the groups based on the pre and post variables of SPCTGT group based on Millers class I and class II. The results shows that statistically significant difference was seen at pre DGR, post DGR, pre WKG, pre WAG and post WAG ($p < 0.05$), whereas non-significant difference was seen in the remaining variables ($p > 0.05$).



Graph 6

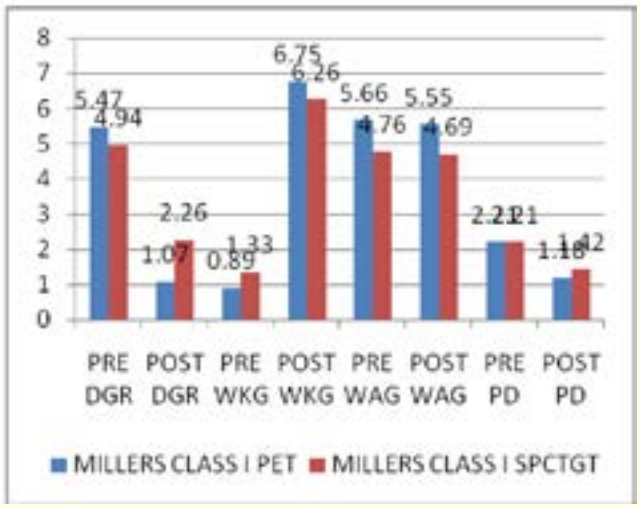
Group SPCTGT		Pre DGR	Post DGR	Pre WKG	Post WKG	Pre WAG	Post WAG	Pre PD	Post PD
Group-A and C	Mean	4.94	2.26	1.33	6.26	4.76	4.69	2.21	1.42
	SD	0.18	0.35	0.07	0.10	0.12	0.12	0.07	0.08
Group-B and D	Mean	5.46	2.60	1.52	6.18	5.11	5.01	2.29	1.48
	SD	0.25	0.48	0.08	0.16	0.11	0.14	0.05	0.04
P-Value		0.007	0.004	0.004	0.352	0.002	0.006	0.067	0.203

Table 6

Table 7 and graph 7 shows the comparison of the groups based on the pre and post variables of Millers class I group based on PET and SPCTGT. The results shows that statistically significant difference was seen at pre DGR, post DGR, pre WKG, post WKG, pre WAG, post WAG and post PD ($p < 0.05$), whereas non-significant difference was seen in the PRE PD ($p > 0.05$).

Group	Sub-group		Pre DGR	Post DGR	Pre WKG	Post WKG	Pre WAG	Post WAG	Pre PD	Post PD
Group-A	PET	Mean	5.47	1.07	0.89	6.75	5.66	5.55	2.21	1.18
		SD	0.38	0.16	0.14	0.37	0.10	0.20	0.07	0.06
Group-C	SPCTGT	Mean	4.94	2.26	1.33	6.26	4.76	4.69	2.21	1.42
		SD	0.18	0.35	0.07	0.10	0.12	0.12	0.07	0.08
P-Value			0.024	<0.001	<0.001	0.025	<0.001	<0.001	1.000	0.001

Table 7

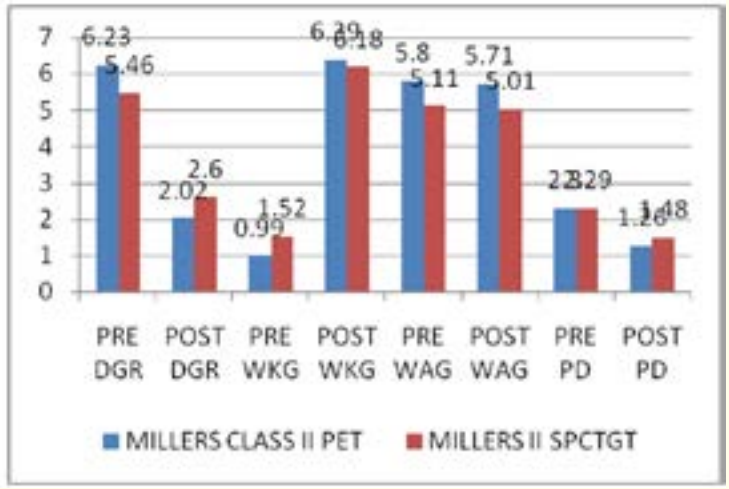


Graph 7

Table 8 and graph 8 shows the comparison of the groups based on the pre and post variables of Millers class IIV group based on PET and SPCTGT. The results shows that statistically significant difference was seen at pre DGR, post DGR, pre WKG, post WKG, pre WAG, post WAG and post PD ($p < 0.05$), whereas non-significant difference was seen in the PRE PD ($p > 0.05$).

Group	Sub-group		Pre DGR	Post DGR	Pre WKG	Post WKG	Pre WAG	Post WAG	Pre PD	Post PD
Group-B	PET	Mean	6.23	2.02	0.99	6.39	5.80	5.71	2.30	1.26
		SD	0.13	0.35	0.10	0.18	0.06	0.06	0.03	0.05
Group-D	SPCTGT	Mean	5.46	2.60	1.52	6.18	5.11	5.01	2.29	1.48
		SD	0.25	0.48	0.08	0.16	0.11	0.14	0.05	0.04
P-Value			<0.001	<0.001	<0.001	0.097	<0.001	<0.001	0.845	<0.001

Table 8



Graph 8

Table: % Reduction

Millers class I PET: 5.47-1.07 = 4.4.

% Reduction = 4.4/5.47*100 = 80.4%.

Millers class I SPCTGT: 4.94-2.26 = 2.7.

% Reduction = 2.7/4.94*100 = 54.6%.

Millers class II PET: 6.23-2.02 = 4.21.

% Reduction = 67.5%.

Millers class II SPCTGT: 5.46-2.60 = 2.86.

% Reduction = 4.61/5.46*100 = 52.3%.

Discussion

The primary objective of any treatment designed for root coverage is to reestablish the tissue margin at the cementoenamel junction (CEJ) and secure the attachment of the tissues to the root surface. This aims to create a normal, healthy gingival sulcus that exhibits no bleeding upon probing and maintains a minimal probing depth (PD).

The ultimate goal of root coverage treatments is not just to improve the appearance of the gums but also to restore and maintain periodontal health. By focusing on repositioning the tissue margin to the CEJ, securing tissue attachment, creating a healthy gingival sulcus, ensuring no bleeding on probing, and maintaining minimal probing depth, clinicians can achieve long lasting and effective results for their patients.

Numerous surgical methods have been developed to address gingival recessions. However, these typically result in healing characterized by a long junctional epithelium, with regeneration occurring primarily at the most apical part of the lesion. Although the bilaminar technique with subepithelial connective tissue grafts (CTGs) remains the most effective for root coverage, histological studies reveal that healing outcomes can be inconsistent. The periosteum eversion technique (PET) used in this study for root coverage may reduce the necessity of harvesting connective tissue from a donor site.

A variety of surgical procedures, such as free gingival grafts, guided tissue regeneration, and coronally advanced flaps, have been designed to manage gingival recession. Each method has its unique approach to repositioning and attaching the gum tissue over the exposed root surfaces.

The periosteum eversion technique (PET) represents an innovative approach to managing gingival recession, aiming to address the limitations of traditional surgical methods. While the bilaminar technique with subepithelial CTGs has been the most promising for root coverage, its healing unpredictability remains a concern. PET may offer a viable alternative by eliminating the need for a donor site, thereby reducing surgical complexity and improving patient comfort. Further studies and clinical trials are necessary to evaluate the long-term efficacy and consistency of PET in achieving optimal root coverage and periodontal health.

The periosteum is frequently utilized in dental procedures. Singh and Gautam [1] explored the use of a periosteal pedicle graft (PPG) enhanced with platelet-rich fibrin (PRF) in conjunction with the vestibular incision subperiosteal tunnel access (VISTA) technique to cover exposed root surfaces. They concluded that the PRF-reinforced PPG with VISTA was effective for treating gingival defects. Similarly, Singh and Kiran [3] introduced the periosteum eversion technique (PET) for root coverage. In PET, the periosteum is separated from the mucoperiosteal flap after an initial incision and then used to cover the denuded root surface. This method achieved 100% root coverage after six months. Singh also reported the periosteum inversion technique, where the periosteum retains its blood supply and survives on the root surface, achieving 100% root coverage after 1 year.

Kumar Singh and Saxena [5] demonstrated the effectiveness of PPG as a barrier membrane combined with demineralized freeze-dried bone allograft (DFDBA) for bone regeneration in a periradicular bone defect. Singh., *et al*. developed the periosteum transposition technique for root coverage, treating a patient with a Miller Class I recession and achieving complete coverage after one year [3].

In the current study, PET showed a 19.8% greater reduction in gingival recession depth compared to the subepithelial connective tissue graft technique (SPCTGT). This is attributed to the well-vascularized periosteum's ability to respond to bacterial contamination. Research has shown that periosteal cells release vascular endothelial growth factor (VEGF), which promotes vascularization. Periostin, a protein initially found in the periosteum, facilitates osteoblast attachment and spreading through integrins, leading to the production of collagen and various growth factors important for regeneration. SPCTGT's success is due to its bilaminar structure, where a free connective tissue graft is overlaid with a pedicle graft, ensuring survival through plasmatic circulation from capillaries.

Singh and Gautam's [1] study on using PPG with PRF in the VISTA technique provides an innovative approach to root coverage. PRF, derived from the patient's blood, acts as a bioactive scaffold that supports tissue regeneration.

The periosteum eversion technique (PET), described by Singh and Kiran, leverages the periosteum's inherent regenerative capabilities by flipping it over the exposed root surface. This technique ensures that the periosteum remains well-vascularized, which is crucial for successful healing and tissue integration [3].

Kumar Singh and Saxena's [5] use of PPG with DFDBA in treating periradicular bone defects showcases another application of the periosteum. The PPG serves as a barrier membrane, while DFDBA provides a scaffold for new bone formation.

Singh., *et al*.'s periosteum transposition technique involves reflecting a partial-thickness flap and repositioning the periosteum over the exposed root. This method ensures that the periosteum remains vital and promotes root coverage through its rich supply of growth factors [7].

The current study's findings that PET resulted in a 19.8% greater reduction in gingival recession depth compared to SPCTGT underscore the advantages of using periosteum-based techniques.

The periosteum's vascularization and ability to release growth factors such as VEGF play a pivotal role in its superior performance. SPCTGT's success is largely due to its bilaminar structure, which ensures the survival of the graft through plasmatic circulation. However, PET's use of the periosteum's natural properties offers a potentially more consistent and effective solution for root coverage [6].

Conclusion

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.

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