Original Research

Evaluation of collagen membrane Periocol and periosteum membrane in the treatment of gingival recession: A comparative study

Ankit Mahajan

Senior Resident, Department of Dentistry, Government Medical College and Hospital, Jammu & Kashmir (U.T)

ABSTRACT:
Background: Recession of gingival tissue is commonly observed as it mainly affects esthetics as well as functional capabilities that are associated along with periodontal structures. Different procedures have been used for providing coverage of exposed radicular surfaces. **Aim**: The aim of present study was to evaluate collagen membrane ((Periocol®) and periosteum membrane in treatment of gingival recession. **Methodology**: This was a prospective and comparative trial conducted for comparison of effectiveness Periocol® and Periosteum membranes on exposed roots after obtaining ethical clearance from Institutional Ethical and Research Committee. Thirty sites with gingival recession were selected and classified in 2 groups: a) Group I: This group used PerioCol membrane and b) Group II: In this group, treatment was done by using periosteum membrane. Patients were instructed over oral hygiene maintenance. Patient consent as informed written signed forms were obtained from all study subjects. Inclusion criteria for study were- a) Patients between age range of 20-60 years; b) Patients having no medical conditions; c) Individuals having good oral hygiene; 4) class I occlusion and 5) Subjects having Class I /II gingival recession of maxillary anteriors. Exclusion criteria for study participants were as follows- a) Class III/IV gingival recession; b) patients with past allergies; c) Severe cervical abrasion and/or radicular caries, d) Molars,) Pregnant as well as lactating women and f) Smokers. Statistical analysis: Statistical comparison was done using Paired t-test (intra-group) and unpaired t- test (inter-group) comparisons at follow-up period at base-line, 1 month and 3 months. Statistical Package for the Social Sciences version 21.0 (SPSS v21.0) was used for performing statistics. **Results**: Statistically significant improvements in probe depth, width of keratinized gingival, depth and length of gingival recession and clinical attachment loss were observed. No improvement in gingival and periodontal indices was observed. **Conclusion**: Both Perio Col® and periosteum membranes demonstrated statistically significant P values when compared between baseline and 3 month follow-up observational data. Hence, both are equally good options for treatment of gingival recession.
Keywords: PerioCol®, periosteum, gingival, recession, periodontal, gingival, roots

Corresponding author: Ankit Mahajan, Senior Resident, Department of Dentistry, Government Medical College and Hospital, Jammu & Kashmir (U.T)

INTRODUCTION
Beautiful smiles act as a major booster of a person's self-esteem as well as level of confidence. Whenever any person feels good regarding their smile, they become actively involved in social life and feel free to speak as well as laugh openly due to their high confidence. Gingival recession leads to exposure of roots of teeth which leads to unaesthetic appearance and sensitivity of teeth. Exposure of roots makes appearance dark when compared with remainder of the tooth which affects one's smile associated aesthetics. [1]
Dr. P. D. Miller classified 1985 gingival recession in 4 major classes: [2]

a) Class I (Marginal gingival tissue Recession): In this category, gingival recession remains limited to marginal gingival tissues without any inter-dental bone and/or soft tissue loss.
b) Class II (Recession of marginal gingiva combined with interdental bone/soft tissues Loss): This class shows recession in gingiva extending beyond marginal gingival that leads to loss in inter-dental tissues.
c) Class III (Recession in marginal tissues extending up to or beyond muco-gingival Junction): This type of gingival recession extends beyond muco-gingival junction i.e., junction between the attached gingiva and alveolar soft tissue mucosa.

d) Class IV gingival recession: in this form of gingival recession, there is severe marginal gingival recession accompanied along with severe loss of bone and soft tissues. [2]

Another classification of gingival recession proposed by Cairo et al (2011) is as follows-

a) Recession Type 1 or RT1: In this type of gingival recession, there is no inter-proximal loss of gingival attachment. In this stage, inter-proximal cementoenamel junction is clinically undetectable at both the mesial as well distal aspects of tooth surfaces.

b) Recession Type 2 or RT2: Here, gingival recession is associated with inter-proximal loss of attachment. Loss of inter-proximal attachment when measured from inter-proximal cementoenamel junction till depth of inter-proximal pocket is found to be lesser than or equivalent to buccal loss of attachment on measuring from buccal aspect of CEJ till depth of pocket on buccal aspect.

c) Recession Type 3 or RT3: In this type of gingical recession, there is inter-proximal loss of attachment. The amount of interproximal attachment loss (measured from the interproximal CEJ to the depth of the pocket) was higher than the buccal attachment loss on measuring from CEJ on buccal aspect of the tooth to buccal periodontal pocket depth. [3]

Different types of surgery procedures used for treating defects of gingival recession are as follows- [4]

a) Pedicle soft tissue grafts: These include- Rotational, Laterally positioned and double papilla flaps; b) Advanced flaps: These include- coronally positioned and semi-lunar flaps; c) Free soft tissue grafts: These comprise of- 1) non-submerged graft like one-staged free gingival and 2) two-staged free gingival grafts or coronally-positioned gingival flaps; d) Sub-merged grafts: These include- connective tissue graft along with laterally positioned flap; connective tissue graft along with double papilla flap and connective tissue graft along with coronal positioned flap (subepithelial connective tissue graft), envelope techniques and root surface modification agents, Enamel matrix proteins and e) Guided tissue regeneration using 1) Non-resorbable and 2) Resorbable membrane barriers.

PerioCol® is a type I collagen membranous of marine origin derived from controlled certified animals that have received certification. Perio Col is purified till higher grade for avoiding antigenicity. Collagen is primary component of natural extra-cellular matrix. Periocol has been show multiple biological activities like- hemostatis, activation of periodontal ligament along with gingival fibroblastic cells and augmentation of soft tissue width, bio-compatibility, bio-degradation and affinity for cells. These properties render periocol as an ideal material as bio-resorbable GTR barrier membrane.

Most commercially available collagenos membranes are derived from type I or combination of type I and II collagen. [5]

Alveolar bone is covered by a layer of periosteum and endosteum. Adult human bone periosteum has high vascularity and contains fibroblasts, progenitor cell population, osteoblasts and bone mesenchymal stem cells. Human host derived periosteum may be utilized as barrier membrane along with coronal repositioned gingival flap. Usage of autogenous origin periosteum is wide-spread in medical science as it shows excellent results. Periostem is richly vascularized sheath of connective tissue containing osteoblasts along with osteoprogenitor cell population. Outer periosteum layer contains densely packed collagen fibers, fibroblasts as well as progenitor stem cells. Periostem is responsible for release of vascular endothelial growth factor (VEGF) which causes promotion of revascularization in healing of wounds. [7]

Hence, the aim of present study was to comparatively evaluate collagen membrane (Periocol®) and periosteum membrane for treating gingival recession.

MATERIALS AND METHODS

a) Study design and setting: This prospective comparative study was conducted for comparing effectiveness of Periocol and Periosteum membranes on root recession in out-patient Department of Dentistry, Government Medical College, kathua, Jammu & Kashmir, U.T. Ethical clearance was obtained from Institutional Ethical and Research Committee.

b) Study participants and sampling: 30 sites with gingival recession were selected and classified in 2 groups: a) Group I: This group used PerioCol membrane and b) Group II: In this group, treatment was done by using periosteum membrane. All selected patients were instructed regarding maintenance of oral hygiene.

Consent in informed written forms were taken from study participants.

c) Inclusion criteria: 1) Patients in age range between 20 to 60 years of both genders; 2) Patients with no systemic disorders; 3) Patients with adequately maintained oral health and hygiene; 4) patients with normal class I occlusion and 5) Patients with Class I or II sites of isolated gingival recession in maxillary anterior region.

d) Exclusion criteria: The criteria for excluding subjects from the study sample were- 1) Class III or IV gingival recession; 2) individuals with past history of allergies; 3) Severe cervical abrasion or root caries, 4) Maxillary and/or mandibular molars, 5) Pregnant and/or lactating women and 6) patients with smoking history.

Design of the study

Selected patients underwent clinical examination for identifying category of gingival recession and analysis of biotype of gingival following application of topical anesthesia. Width of gingival recession and gingival periodontal height was measured using surgical stent employing the UNC-15 probe and

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digitalized Vernier caliper. Assessment of clinically examined parameters was done at time intervals set at base-line, 1 month and 3 months in either study groups.

Clinical parameters analyzed were as follows:

a) Plaque index: This was assessed based upon the criteria proposed by Silness and Loe. [7]

b) Gingival index: Observations were done based up on criteria of Loe and Silness. [8]

c) Gingival recession: Both length as well as width of gingival recession were assessed using digitalized vernier caliper. Recorded observations were noted down by rounding-off to nearest first decimal.

d) Width assessment of keratinized portion of gingiva: This was measured between gingival margin till muco-gingival junction using the UNC-15 probe.

e) Pocket probing depth

This was measured using the William's periodontal probe from gingival marginal crest up till periodontal pocket depth.

f) Assessment of Clinical attachment level (CAL): The clinical level of attachment was calculated by addition of depth of periodontal pocket and distance between margin of gingiva till cementoenamel junction.

g) Percentage of root coverage: This was calculated based upon the formula proposed by - Zucchelli and Sanctis as:

Root coverage % =

Pre-operative vertical recession depth (VRD) - Postoperative VRD × 100/ Preoperative Vertical Recession Depth

Pre-surgical operative procedure

Written consent was obtained from each of the patient S. Oral prophylaxis and root planning procedures were done. Instructions related to maintenance of proper oral hygiene were provided by explaining and demonstrating Fone' s technique of brushing. After 3 weeks of initial treatment, periodontal examination and assessment was done for oral hygiene maintenance and for recording responsiveness of gingival soft tissue.

Preparation of surgical site for studied groups

Adequate level of local anesthesia was procured using 2% concentration of Lignocaine HCl that contained 1:20,000 concentration of adrenaline. Surgical site was opened by making use of two oblique and divergent beveled incisions along with intra-sulcular and crossed sub-marginal inter-proximal incisions.

Study group I: In this study group, full-thickness flap (trapezoidal) was raised at a position 3 to 4 mm in an apical position from osseous bony crest. A split-thickness flap was then elevated for coronal placement without. Mechanical debridement of exposed surfaces of roots was done by Gracey's instruments. Following this, adaptation of Perio Col® membrane and suturing was done surrounding the tooth/teeth. Perio Col membrane was then trimmed till 2 mm in a apical position to bone margin. The full thickness flap was then used for complete coverage of the Perio Col membrane which was then fixed using sling technique of suturing.

Study group II: After reflecting muco-periosteal flap, an incision was done through periosteum wherein flap had attachment with bone thus, creating partial thickness surgical flap which had extension for exposure of periosteum that was separated out from underlying bone by making use of Glickman's periosteal elevator beginning at apical portion of periosteum while advancing coronally. Periosteum was incompletely separated from underlying bone by means of attachment at its most coronal portion.

This periosteal pedicle gingival graft was then turned on to exposed surface of root and was sutured using 5-0 bio-absorbable polypropylene suture material sing the sling suturing technique while releasing incisions were sutured using interrupted type of suturing technique.

Post-operatively, patients were prescribed medications- Diclofenac potassium, paracetamol with serratiopeptidase for five days B.D. along with Amoxicillin and Potassium clavulanate T.D.S. and an antacid (Omeprazole, 20 mg) in morning with empty stomach.

Instructions given to patients post-operatively

Post-operative instructions for patients were as follows- a) Avoid hot food as well as hard foods for initial 24 hours after surgery, b) Avoid brushing over surgical site, c) Apply ice at an intermittent interval over skin on the surgical site on day of the surgery, d) Rinse mouth atleast 4 to 5 times on a day to day basis using povidone-iodine solution mouthwash for one week, e) in case of severe pain and/or bleeding from surgical site report immediately and f) consume prescribed medications properly.

Statistical analysis: Collected data was expressed using descriptive statistics form as mean, standard deviation and standard error of mean. Parameter comparison between study groups was done by Paired t-test for intra-group and unpaired t-test for inter-group comparison at following intervals- base-line, one month and three months. Statistical analysis was done using IBM's Statistical Package for the Social Sciences version 21.0 (SPSS) statistical software.

RESULTS AND OBSERVATIONS

On analyzing clinical parameters in the study, following observations were made:

a) Test group I (PerioCol membrane): On statistical analysis, it was observed that this group's parameters i.e., gingival index and periodontal index had no significant difference after PerioCol placement. Both depth of probing and clinical attachment loss showed significant improvements (P = 0.05 and 0.05, respectively). Similarly, keratinized gingival depth

and length of gingival recession demonstrated statistically significant improvement (P = 0.04 and 0.01, respectively). Length of gingival recession was found to demonstrate extremely significant statistical improvement at 3rd month follow-up (P= 0.001) after PerioCol membrane placement. (table and graph 1)

b) Test group II (Periosteal membrane): On using periosteal membrane in cases of gingival recession, no statistically significant improvements were noted at 1st as well as 3rd months of follow-up (0.25 and 0.08, respectively). On analyzing periodontal index, again no statistically significant difference was noted at first and third months, respectively (P = 0.31 and 0.12, respectively). Statistically significant improvements in probe depth, clinical attachment loss (CAL), keratinized gingival depth and length of gingival recession (P=0.05, 0.01, 0.04 and 0.01,

respectively). Extremely significant (P=0.001) difference was noted on measuring length of gingival recession at third month (table and graph 1).

On analyzing the mean ± S. D. scores, following observations were made (table 2)-

a) Depth of probing: At base-line, the score was 1.56 ± 0.67 cm which at first month follow-up decreased to 1.24 ± 0.12 and at third month, it was observed as 1.0 ± 0.18 cm.

b) Depth of gingival recession (cm): The depth of gingival recession was found to be 2.13 ± 0.82 (at base-line), 1.78 ± 0.13 (after one month) and 1.01 ± 0.1 (3rd month).

c) Clinical attachment loss (CAL): On observations, it was found that the clinical attachment loss (in cms) was 3.34 ± 1.2 (at base-line), 2.14 ± 0.13 (1st month) and 1.2 ± 0.1 cm (at 3rd month follow-up).

Table 1: Table showing P values of studied clinical parameters at study durations- baseline, one month and three months

Clinical parameters	Test group I			Test Group II		
	Baseline	1 month	3 months	Baseline	1 month	3 months
Gingival index	0.89	0.67	0.45	0.43	0.25	0.08
Periodontal index	0.56	0.34	0.24	0.43	0.31	0.12
Probe depth	0.31	0.09	0.05	0.07	0.06	0.05
Clinical loss of attachment	0.43	0.05	0.05	0.06	0.02	0.01
Keratinized gingival depth	0.07	0.06	0.04	0.09	0.07	0.04
Length of gingival recession	0.01	0.00	0.01	0.05	0.04	0.01
Width of gingival recession	0.01	0.01	0.001	0.02	0.01	0.001

Graph 1: Graph showing P values of different clinical parameters studied
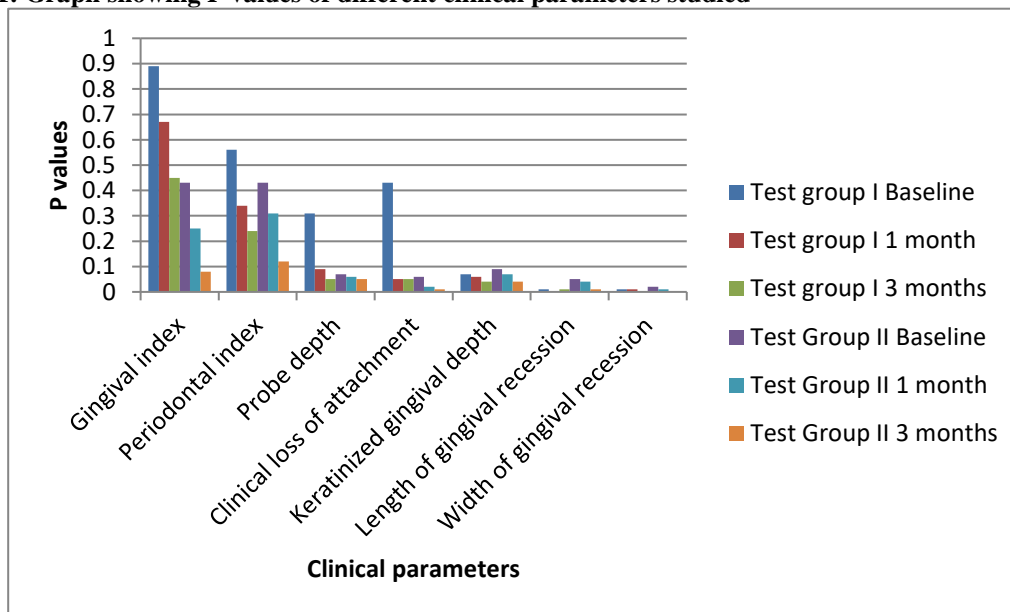

Table 2: Table demonstrating mean ± S.D. scores of depth of probing, depth of recession and clinical attachment loss in different periods of follow-up

Follow-up durations	Depth of probing (cm)	Depth of gingival recession (cm)	Clinical Attachment Loss (CAL) (cm)
Base-line	1.56 ± 0.67	2.13 ± 0.82	3.34 ± 1.2
First month	1.24 ± 0.12	1.78 ± 0.13	2.14 ± 0.13
Third month	1.0 ± 0.18	1.01 ± 0.1	1.2 ± 0.1

Graph 2: Graph showing mean ± S.D. scores of depth of probing, depth of gingival recession and clinical attachment loss at subsequent follow-up durations.
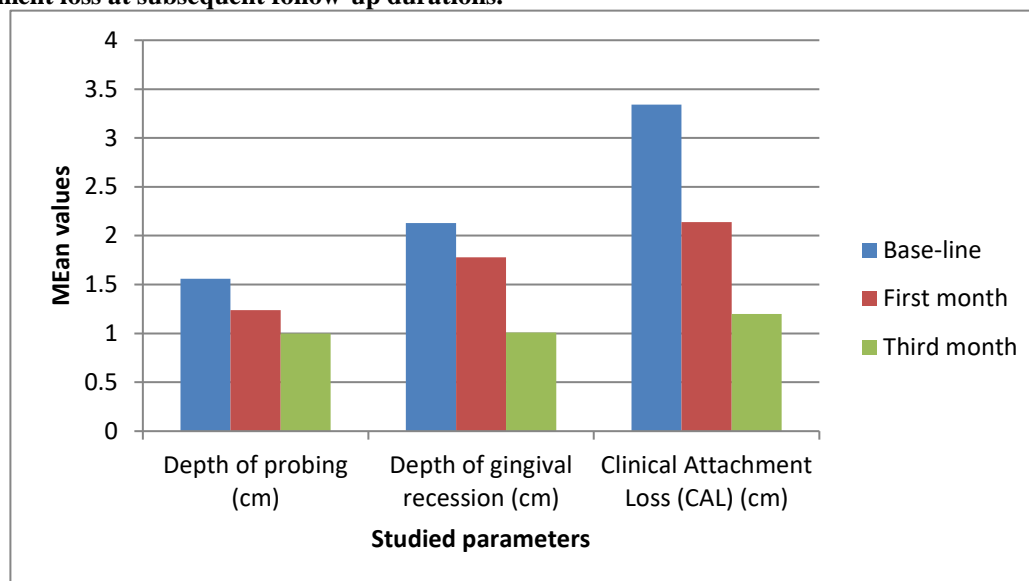
DISCUSSION

Recession of gingiva is commonly seen in common population. It leads to problems related to function and aesthetics. Inflammation is one of main etiologies among various anatomical factors such as- thin tissue biotype, abnormality in placement of tooth, trauma associated with malocclusion, abnormal attachments of frenum, class-II division 2 type of malocclusion and ieatrogenic reasons such as- mechanical trauma faulty technique of brushing teeth, poor design of partial dentures, sub-gingival margins of restorations, calculus, periodontitis and habit of smoking. [10, 11, 12]

Treatment of gingival recession can be done by variety of approaches which is dependent upon underlying etiology. There are different periodontal surgical procedures for coverage of exposed roots such as- free gingival grafts, sub-epithelial connective tissue graft, semi-lunar flaps, coronal advanced flaps and guided tissue regeneration with variable rates of success.[12]

Periosteum can be harvested in sufficient quantity from alveolar bone. It carries lowest infection risk, risk of undergoing necrosis and loss of graft as it has good vascularization and least chances of bacteriological contamination. PerioCol® , a sterile and purified membrane comprised of type 1 collagenous membrane which is derived from fish owing variety of biological functions such as-hemostatic capability, properties causing activation of periodontal as well as gingival fibroblasts, tissue augmentation, increased bio-compatibility, bio-degradation and cellular affinity. [13]

.In present study, comparison was made between PerioCol® membrane and Periosteum membrane in treating recession of gingiva. Significant differences were observed in both the study groups on analyzing various clinical parameters i.e., probing depth, depth of gingival recession, clinical loss of gingival attachment, depth of keratinized gingival, length of gingival recession and width of gingival recession. However, no significant improvement in gingival and periodontal indices was seen in both the groups.

Our findings are supported by findings of Agarwal and Dhruvakumar (2019) [14] and Tyagi et al (2023). [15] Hence, both PerioCol® as well as periosteum membrane can be used for successfully treating gingival recession.

Limitations of the study are the surgical dexterity of the operator as it requires proper handling of periosteum membrane as any tear of the graft can lead to loss of vascular supply and mishandling of PerioCol® membrane can be attributed to tearing due to tearing while suturing or malpositioning. Since this is study is a short tem study more explainable results can be obtained after long term follow-up and a larger sample size.

CONCLUSION

Gingival recession is a well recognized periodontal problem that mainly leads to loss of esthetics and tooth sensitivity eventually contributing to morbidity. Use of membranes such as PerioCol® and periosteum are important treatment strategies for successful management of such clinical conditions.

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