

To compare the clinical efficacy of collagen membrane in combination with bone graft as a space maintainer and collagen membrane alone in the treatment of Miller’s class I and II Marginal Tissue Recession: a split mouth study.

¹Prabhjot kaur, Department of Periodontology, Swami Devi Dyal Hospital and Dental College, Barwala, Panchkula, Haryana, India.

²Yashpaul Dev, Principal and Head, Department of Periodontology, Swami Devi Dyal Hospital and Dental College, Barwala, Panchkula, Haryana, India.

³Preetinder Singh, Professor, Department of Periodontology, Swami Devi Dyal Hospital and Dental College, Barwala, Panchkula, Haryana, India.

⁴Nitin Khuller, Professor and Head, Department of Periodontology, Dasmesh Institute of Research and Dental Sciences, Faridkot, Punjab, India.

Corresponding Author: Prabhjot Kaur, Department of Periodontology, Swami Devi Dyal Hospital and Dental College, Barwala, Panchkula, Haryana, India.

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Abstract

The aim of this study was to compare and evaluate the clinical effectiveness of a collagen membrane in combination with an alloplastic bone graft as a space maintainer and collagen membrane alone in the treatment of recession defects. Eight patients participated with each having bilateral Miller’s Class I or Class II recession defect. Each site was randomly divided into two groups: group A and B. Group A was treated with a collagen membrane (Healiguide) and bone graft (Sybograft plus) beneath the membrane covered by a coronally advanced flap. Group B also had collagen membrane alone covered by coronally advanced flap. Clinical parameters were recorded which included: plaque index, modified gingival index, modified sulcular bleeding index, recession depth, recession width at the widest point, width of keratinized tissue, clinical attachment level and probing depth, measured to the nearest 0.5 mm. Patients were followed

postoperatively and healing as well as all parameters were evaluated at 1, 3 and 6 months, with recession depth as the primary outcome measure. This study revealed a favourable tissue response to bone graft and collagen membrane from both clinical and aesthetic point of view in the treatment of gingival recession. Mean percentage of root coverage was higher for the collagen membrane and bone graft treated group (Group A=63.5%) than for the collagen membrane only (Group B=32.5%). This higher percentage of root coverage for the test group was statistically significant ($p=0.003$).

Key words: Bone graft, collagen membrane, coronally advanced flap, Gingival recession, guided tissue regeneration.

Introduction

In current practice of Periodontics, clinicians are faced with the challenge of not only addressing biological and functional problems present in the periodontium, but also

providing therapy that result in acceptable aesthetics. The presence of gingival recession around anterior teeth exemplifies a situation in which a treatment modality that addresses both biological and aesthetic demands is required from the therapist.^[1]

Gingival recession has been defined as the term used to characterize the apical shift of the marginal gingiva from its normal position on the crown of the tooth to levels on the root surface beyond the cemento-enamel junction (CEJ).^[2] **Maynard and Wilson (1979)**^[3] introduced the term marginal tissue recession. The ultimate goal of periodontal therapy includes not only the arrest of progressive periodontal disease but also the restitution of those parts of the supporting apparatus which have been destroyed by disease.^[4]

Gingival recession defects may be treated by a number of procedures including rotational and advanced gingival flaps,^[5,6] free gingival or connective tissue grafts,^[7,8] and by applying principles for guided tissue regeneration (GTR).^[9-11] The coronally advanced flap is the first choice surgical technique when there is adequate keratinized tissue apical to the recession defect.^[12] Optimum root coverage results, good colour blending of the treated area with respect to adjacent soft tissues and complete recovery of the original (pre-surgical) soft tissue marginal morphology can be predictably accomplished by means of this surgical approach.

Recently, attempts have been made to achieve root coverage using surgical techniques based on the principles of guided tissue regeneration (GTR). The theoretical principles basic to GTR was first described in **1976** by **Melcher** who outlined the necessity of excluding the unwanted cell lines from healing sites to allow the growth of desired tissues.

Collagen membranes have been successfully used for GTR based root coverage. **Wang HL et al**^[13] achieved

73% root coverage using collagen membranes only with coronally advanced flaps. Studies have tried to improve the percentages of complete coverage with root surface bio-modification.^[14-18] Various agents used are: citric acid, tetracyclines and Ethylene-di-amine-tetra-acetic acid (EDTA).^[19] EDTA is a chelating agent that could enhance the attachment of connective tissue to the root surface by exposing collagen and, as a consequence, enhance root coverage.^[20]

Creation and maintenance of space between the root surface and the overlying GTR barriers are considered critical to the success of all GTR procedures, including those aimed at achieving root coverage. It is believed that this space is necessary to provide a channel for the migration of progenitor cells towards and onto the detoxified root surface, where they can differentiate into cementum and periodontal ligament forming cells. Unfortunately, it is difficult to achieve space maintenance when treating recession defects because the membrane tends to collapse against the root surface. Several techniques have been used to provide space for regenerating tissue: root modification,^[21] tenting sutures,^[22] fibrin-fibronectin glue,^[23] titanium- reinforced membranes,^[24] and bone grafts.^[25,26] The rationale for using bone graft beneath a membrane is that it can prevent collapse of the membrane into the defect, reduce the volume to be filled by regenerating cells, enhance clot stability, and stimulate and facilitate the proliferation of osteogenic progenitor cells.^[27]

Since there is limited literature on the use of type I collagen membranes combined with bone grafts for the treatment of gingival recession, a study was conducted to determine whether the addition of bone graft (i.e. Sybograf Plus) significantly influences the clinical outcome of GTR- based root coverage procedures using collagen membranes (i.e. HealiguideTM)^{**} or not.

Materials And Method

Eight patients (sixteen sites), with bilateral Miller Class I or II recession were selected from patients seeking treatment for root coverage from Out Patient Department (OPD) of Periodontology and Oral Implantology, Swami Devi Dyal Hospital and Dental College, Barwala, Panchkula. Each subject had a Miller's Class I or II facial recession defect on an incisor, canine, or premolar tooth. Subjects were excluded for the following reasons: poor plaque control, allergy to bovine collagen-containing products, pregnancy, inability to provide informed consent, or unavailability for 6-month follow-up. All patients were periodontally stable upon entry into the study. Each site was randomly allocated in two different groups. Group A was treated with collagen membrane and bone graft both and group B was treated with membrane alone.

The subjects were clearly explained the study protocol and procedure in detail and a duly signed written consent was taken from them. Following screening examination, the subjects received instruction in proper oral hygiene measures.

The materials were composed of four components: collagen membrane (Healiguide™), bone graft (Sybograf Plus), 24% EDTA as root biomodifier and 4-0 vicryl suture.

Custom made acrylic stents were fabricated on plaster/stone casts prepared during initial phase, on the occlusal surfaces of teeth to be treated to ensure reproducibility at subsequent measurement.

The following clinical parameters were recorded for each site at baseline, at 1st month, at 3rd month and 6th month post operatively (as applicable): Plaque Index (PI)^[27], Modified Gingival Index (MGI)^[28], Modified Sulcular Bleeding Index (mSBI)^[29], Probing Depth (PD), Recession Depth (RD), Recession Width at the widest point (RW),

Width of Keratinised Tissue (WKT), Clinical Attachment Level (CAL). All the readings of these clinical parameters were recorded in a proper proforma which has all the details of the subject like name, age, sex, chief complaint and parameters.

At 6 months post treatment, the percentage of root coverage was calculated according to the following criteria:^[26]

$$\% \text{ of root coverage} = \frac{\text{Recession depth (Post operative - pre operative)}}{\text{Pre-operative recession depth}} \times 100$$

Surgical Procedure (Figure 1)

After evaluation of pre-clinical records and obtaining adequate local anaesthesia, a trapezoidal-shaped flap was elevated with a split-full-split approach from the coronal to the apical direction. The probable sulcular area apical to the root exposure was elevated by split thickness keeping the blade almost parallel to the root. The soft tissue apical to the root exposure got elevated full thickness inserting a small periosteal elevator into the probable sulcus and proceeding in the apical direction to expose 3-4 mm of bone apical to the bone dehiscence. In order to permit the coronal advancement of the flap, all muscle insertions present in the thickness of the flap were eliminated. Coronal mobilization of the flap was considered "adequate" when the marginal portion of the flap would passively reach a level coronal to the CEJ of the tooth with the recession defect.^[30] The exposed root surface, after thorough root planing, was conditioned with ethylene-di-amine-tetra-acetic acid (EDTA-24%) for 2 minutes to remove the smear layer and thoroughly rinsed with sterile saline. Any remaining PDL tissue coronal to the alveolar bone was preserved. The collagen membrane was then placed according to standard GTR surgical procedure and sutured bilaterally to the de-epithelialized papilla region with 4-0 vicryl suture. Then the bone graft was placed beneath the membrane over the exposed root

surface. Subsequently, the membrane was covered with the coronally advanced flap. The tissue flap was then secured at the level of the CEJ by suturing the flap to the de-epithelialized papilla regions with 4-0 vicryl sutures. The vertical incisions were closed with 4-0 vicryl sutures. The operative site was then covered with a periodontal dressing. Post-operative instructions were given with medications and mouthwash prescribed.^[31] A procedure identical to that used in site for collagen membrane and bone graft was performed. The difference lied only in the placement of bone graft. No bone graft was placed beneath the membrane. Rest of the whole procedure was same.

Figure 1: Surgical Procedure for Group A



Figure 1(a): Recession Depth at baseline



Figure 1(b) : Incisions given



Figure 1(c): Root planning done



Figure 1(d): Application of 24% EDTA



Figure 1(e): Collagen membrane secured with sutures



Figure 1(f): Bone graft (Sybograp Plus) placed underneath membrane



Figure 1(g): Coronal advancement of the flap and sutured into place

Post-Surgical Follow up (Figure 2 and 3)

Patients were called after 24 hours for check up to evaluate any discomfort, swelling, pain, any bleeding or displacement of periodontal pack. One week following surgery, periodontal pack was removed and area was irrigated with saline, periodontal pack was placed repeatedly in case of uneventful healing. Patients were recalled every 2 weeks following surgery for 1 month and subsequently every month for the next 6 months for examination of the treated surgical site. Clinical measurements recorded pre-operative, were repeated at specific intervals i.e. 3 and 6 months post operatively.

Figure 2: Follow Up For Group A



Figure 2(a): Recession Depth at 3 months



Figure 2(B): Recession Depth at 6 months

Figure 3: Follow Up For Group B



Figure 3(a): Recession Depth at 3 months



Figure 3(b): Recession Depth at 6 months

Results (table: 1,2,3; graph: 1,2)

Statistical analysis of the data was done by using Statistical Package for Social Sciences version (SPSS) 15.0.

The present study was carried out to compare the clinical efficacy of collagen membrane in combination with bone graft as a space maintainer and collagen membrane alone in the treatment of Miller's Class I and II marginal tissue recession. For this purpose, an interventional study was carried out using a split mouth study design. A total of 8 patients (i.e. 16 sites) fulfilling the inclusion criteria were enrolled in the study. Age of patients ranged from 21 to 39 years. Mean age of patients was 29.25 ± 8.48 years. All the patients were subjected to clinical evaluation and on the basis of clinical evaluation, two sites were identified. Each

site of the mouth was randomly allocated to one of the two baseline and post-operatively are shown in the table 1,2,3 treatment protocols. Various parameters recorded at and 4.

Table 1: showing indices at different time intervals for both the groups.

	PI		mGI		mSBI	
	mean±SD	p value	mean±SD	P value	mean±SD	P value
Group A(n=8)						
BASELINE	0.70±0.39		1.03±0.28		0.98± 0.34	
1 st month	1.56±0.48	0.003 (S)	1.48±0.18	0.003(S)	1.46±0.23	0.002(S)
3 rd month	1.31±0.34	0.004 (S)	1.21±0.21	0.125(NS)	1.39±0.26	0.016(S)
6 th month	0.89±0.15	0.250(NS)	0.83±0.25	0.178(NS)	0.75±0.25	0.22(NS)
GROUP B(n=8)						
BASELINE	0.90±0.37		0.64±0.17		1.18±0.35	
1 st month	2.15±0.29	<0.001 (S)	1.40±0.33	<0.001(S)	1.68±0.33	0.001(S)
3 rd month	1.73±0.49	0.001 (S)	1.00±0.29	0.007(S)	1.36±0.26	0.26(NS)
6 th month	0.94±0.19	0.67(NS)	0.68±0.28	0.723(NS)	0.80±0.22	0.06(NS)

*S- Statistically Significant

NS- Statistically non-significant

Table 2: showing periodontal parameters at different time intervals for both the groups.

	PD		RW		WKT	
	mean±S.D.	P value	mean±S.D.	P value	mean± S.D.	P value
Group A(n=8)						
BASELINE	2.75±0.886		3.38±0.52		3.75±0.886	
3 rd month	1.87±0.64	0.006(S)	2.00±0.53	<0.001(S)	5.75±0.886	0.00(S)
6 th month	1.25±0.462	0.005(S)	1.50±0.53	<0.001(S)	6.125±0.834	0.01(S)
GROUP B(n=8)						
BASELINE	2.50±0.75		3.63±0.52		3.875±0.99	
3 rd month	1.75±0.707	0.02(S)	2.63±0.52	0.001(S)	5.00±0.755	0.002(S)
6 th month	1.625±0.744	0.021(S)	2.13±0.64	<0.001(S)	5.125±0.991	0.002(S)

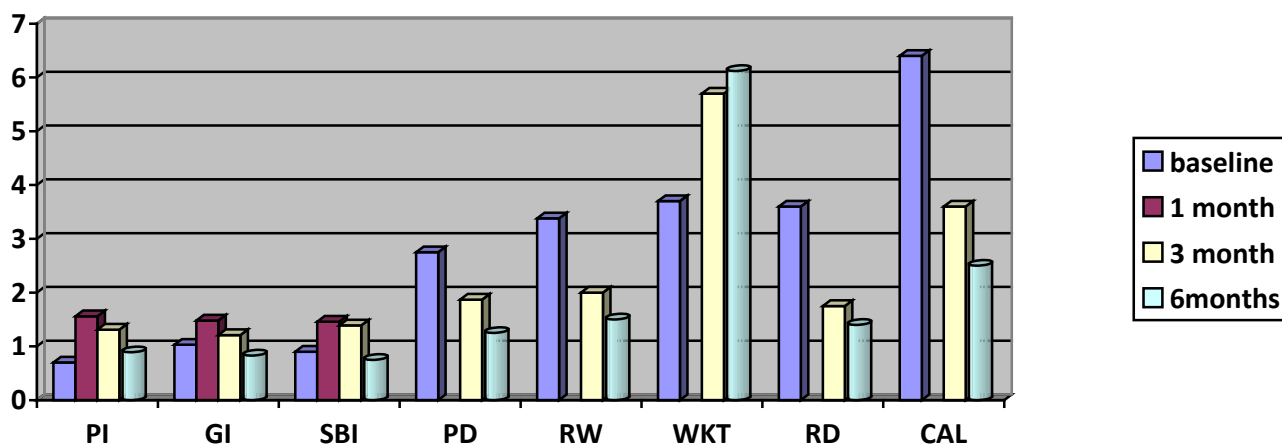
*S- Statistically Significant

NS- Statistically non-significant

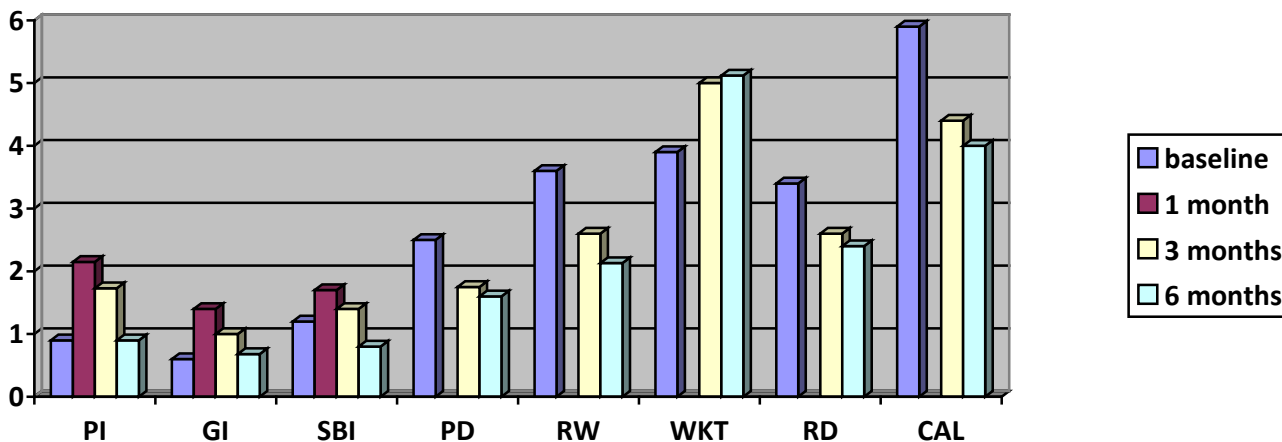
Table 3: showing periodontal parameters at different time intervals for both the groups.

	RD		CAL	
	(mean±S.D.)	P value	(mean± S.D.)	P value
Group A(n=8)				
BASELINE	3.62±0.51		6.37±0.916	
3rd month	1.75±0.886	0.00(S)	3.62±0.916	0.00(S)
6th month	1.37±1.06	0.00(S)	2.50±1.30	0.01(S)
GROUP B(n=8)				
BASELINE	3.37±1.81		5.875±0.9	
3rd month	2.62±0.91	0.02(S)	4.37±0.96	0.001(S)
6th month	2.37±1.18	0.001(S)	4.00±1.98	0.002(S)

Graph 1: showing periodontal parameters for group A at different time intervals



Graph 2: showing periodontal parameters for group B at different time intervals.



Plaque Index (PI)

Group A: Statistically, the change from baseline was significant at 1 (p=0.003) and 3 (p=0.004) months but not significant at 6 months (p=0.250). Group B: the change from baseline was significant at 1 (p<0.001) and 3 (p=0.001) months but not significant at 6 months (p=0.670). On intergroup comparison, there was no significant difference (p>0.05) between two groups at baseline. At 1-month significant difference between two groups was observed for PI, which was found to be significantly higher in Group B as compared to Group A (p=0.010), but no significant difference was observed between two groups at 3 (p=0.071) and 6 months (p=0.567) follow up.

Modified Gingival Index

Group A: Statistically, the change was significant at 1 month (p<0.003), but not significant at 3 and 6 months post operatively. Group B: Statistically, the change was significant at 1 month (p<0.001) and 3 months (p=0.007) post operatively but not significant (p=0.723) at 6 months. No significant difference was observed between two groups at 1 (p=0.583), 3 (p=0.117) and 6 (p=0.278) months follow up.

Modified Sulcular Bleeding Index

Group A: Statistically, the change from baseline was significant at 1 month (p=0.002) and 3 months (p=0.016) but was not significant (p=0.229) at 6 months post operatively. Group B: Statistically, this change was significant (p=0.001) at 1 month but not significant at 3 (p=0.262) and 6 (p=0.062) months post operatively. No significant difference for SBI was observed between two groups at baseline (p=0.245), 1 (p=0.154), 3 (p=0.849) and 6 months (p=0.678) follow up.

Probing Depth (PD)

Group A: Statistically, the change from baseline was significant at both 3rd (p=0.006) and 6th month (p=0.005)

post operatively. Group B: the change from baseline was significant at 3rd month (p=0.02) and 6th month (p=0.021). No significant difference for PD was observed between two groups at baseline (p=0.351), 3rd (p=0.685) and 6th month (p=0.197) follow up.

Recession Depth (RD)

Group A: Statistically, the change from baseline was highly significant at both the time intervals (p=0.00). Group B: Statistically, the change from baseline was significant at 3rd month (p=0.02) and 6th month (0.001). No significant difference for RD was observed between two groups at baseline (p=0.598), 3rd (p=0.111) and 6 months (p=0.068) follow up. But there was significant difference in percentage of root coverage at the end of 6 months. (p=0.001). Hence, reduction in recession depth in group A is more than group B at the end of 6 months .i.e. 63.5% for group A and 32.5% for group B.

Clinical Attachment Level (CAL)

Group A: Statistically, this change from baseline was significant at 3rd month (p=0.00) and 6th month (0.001). Group B: Statistically, the change from baseline was significant at 3rd month (p=0.001) and 6th month (0.002). No significant difference for CAL was observed between two groups at baseline (p=0.407) and 3rd month (p=0.17) but it was statistically significant at 6th month (p=0.026) follow up. Thus, results depict that gain in CAL is more for group A as compared to group B.

Recession Width (RW)

Statistically, the change from baseline was significant at both the time intervals (p≤0.001) for both the groups. But on intergroup comparison, no significant difference for RW was observed between two groups at baseline (p=0.350). Statistically, a significant difference between two groups was observed at 3 months post operatively. But no significant difference found at 6th month (p=0.053)

follow up visit. Thus, reduction in recession width is more for group A than group B.

Width of Keratinized Tissue (WKT)

Group A: Statistically, the change from baseline was highly significant at 3rd month ($p=0.00$) and 6th month (0.001). Group B: Statistically, the change from baseline was significant at both the time intervals ($p=0.002$). No significant difference for WKT was observed between two groups at baseline ($p=0.802$), 3 ($p=0.142$) and 6 months ($p=0.068$) follow up.

Discussion

Clinical parameters (i.e. PI, mGI and mSBI) remained relatively constant at all the time intervals during the study period, suggesting that surgically positioned collagen membrane was well-tolerated by the host tissues. These findings are in agreement with Blumenthal (1993)^[32], Sheih AT et al (1997)^[13], Amarante ES et al (2000)^[33], Genon CR (2001)^[34], Kimble K et al (2004)^[26], and Nandita S et al (2011)^[35] who reported that placement of collagen membranes doesn't enhance plaque accumulation or gingival inflammation. In contrast, Lee EJ et al (2002)^[36] in their histological observation, reported that collagen membrane may act as a foreign body and a plaque retentive device, thus causing osteoclastic activation during early healing phase.

Cortellini et al ^[37] have demonstrated that the GTR technique for the treatment of gingival recession results in healing by new connective tissue attachment, new cementum formation, and new coronal bone growth. Numerous studies support the concept that to obtain periodontal regeneration, adequate space needs to be maintained underneath the membrane.^[6] The creation and maintenance of a space between the root surface and the overlying GTR barrier is considered essential to the success of guided tissue regeneration therapy. This space is believed necessary to provide a channel for the

migration of progenitor cells toward and onto the detoxified root surface where differentiation of cementoblasts and formation of a new cementum/periodontal ligament is desired.^[38]

Unfortunately, space preservation in recession defects is often difficult to achieve because the morphology of the dehiscence tends to allow collapse of the membrane against the root surface. The use of a biocompatible graft material may increase this space and favor new bone formation. Also, alloplast has been shown to have osteoconductive potential.^[39] The combination of a membrane and alloplastic bone graft for the treatment of periodontal defects has been shown in some studies to result in greater bone formation than membrane treatment alone.^[26,32,40] The results of this study seem to support these findings, even with the small amount of graft material used on the root surface and the difference was significant. The concept of space maintenance underneath the membrane may also be the reason why these procedures resulted in a significant increase in tissue thickness.

Conclusion

Overall, this study suggests that the treatment of human gingival recession with a bio-absorbable membrane with or without the use of bone graft results in significant root coverage. Addition of bone graft as space maintainer proved to be effective in such cases of root coverage. The present study was short term clinical study and no histological evaluation. Studies should be designed with large sample sizes and histological evaluation to further compare the predictability of above said procedure.

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