

Comparison of periosteal membrane with collagen membrane for the treatment of mandibular Grade II furcation defect: A randomized controlled clinical trial

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ABSTRACT

Background and Objectives: Furcation involvement is one of the common periodontal problems affecting patients. It is an area of complex anatomic morphology that may prove to be impossible or difficult to debride by routine periodontal instrumentation. There are various treatment modalities to address the problem, one of them is guided tissue regeneration. Periosteal membrane is an attractive alternative to traditional barrier membranes since they are autogenous and easy to procure. This study was conducted to compare the efficacy of periosteal membrane with collagen membrane for treatment of Grade II furcation defects.

Methods: 10 patients with bilateral mandibular Grade II furcation involvement were randomly assigned into two groups; Group I (Periosteal membrane) & Group II (Collagen membrane). Clinical parameters (Pocket probing depth, clinical attachment level, horizontal furcation measurement, were recorded at baseline & 6 months. Plaque index (Silness and Loe, 1964), Gingival index (Loe and Silness, 1963) were recorded at baseline, 3 months & 6 months. Radiographic parameters were recorded at baseline and 6 months

Results: Significant improvement in all clinical & radiographic parameters within both groups from baseline to 6 months was seen. The results on comparison between the groups, clinical parameters was not statistically significant. However, change in radiographic bone defect level was more in Group I as compared to Group II with a statistically significant difference.

Conclusion: Both treatment modalities are equally beneficial in management of Grade II furcation involvement. Periosteal membrane is a viable alternative to collagen membrane therapy because of its autogenous nature & cost-effectiveness..

Keywords: Periosteal membrane , Autogenous, Guided tissue regeneration...

How to cite this article: Mishra SK, Walia V, Walia N, Gupta G, Gupta N, Gulati L. Comparison of periosteal membrane with collagen membrane for the treatment of mandibular Grade II furcation defect: a randomized controlled clinical trial. *Int J Drug Deliv Technol.* 2026;16(75s): 594-601. DOI: 10.25258/ijddt.16.75s.71

Source of support: Nil.

Conflict of interest: Nil.

INTRODUCTION

Multirrooted teeth, in which inflammatory periodontal disease if left untreated, leads to attachment loss &

subsequently results in involvement of bifurcation or trifurcation. The complex anatomy of the furcation area makes it not only a high risk area for periodontal disease progression but also difficult or nearly impossible to

debride by routine periodontal instrumentation.¹ Additionally routine home care methods may be insufficient to keep the furcation area free of plaque.² Thus, the presence of furcation involvement is one clinical finding that can lead to a diagnosis of advanced periodontitis and potentially a less favorable prognosis for the affected tooth or teeth.³ The management of furcation involvement presents one of the greatest challenges in periodontal therapy as furcation - involved molar teeth respond less favorably to conventional periodontal therapy, and as a result molars are lost more often than any other tooth type.⁴ Guided tissue regeneration (GTR) is the most reliable & predictable regenerative procedure based on histologic evidence and evidence of effectiveness of GTR techniques have been reviewed systematically.⁵ It was introduced into clinical dental practice over 30 years ago, soon after Melcher⁶, followed by Karring⁷ and Nyman et al.⁸, presented the basic principles to the professional community in order to allow selective repopulation of cells from desired tissues into that space. The GTR membrane serves as a barrier which prevents the gingival tissues from contacting the root during healing. Hence, the membrane promotes cells originating from the periodontal ligament to repopulate the root surface.

A multitude of resorbable & non-resorbable membrane have been used with varied outcomes to this end.⁹ Collagen membrane has proved to be an easy to use, biocompatible, and effective membrane of the GTR technique. Autogenously harvested periosteal membrane could prove to be an attractive alternative to existing barrier membranes since they are biologically acceptable. Osteogenic cells have also been found within the periodontal tissue, on use periosteal membrane, thereby underlining its ability to regenerate alveolar bone defects.^{10,11}

On the basis of these considerations, this study was undertaken to compare the efficacy of periosteal membrane with collagen membrane in the treatment of Grade II furcation defects of mandibular molars.

Materials & Methods

10 adult subjects (2 female & 8 male) subjects were selected from patients referred to the Department of Periodontology, ITS Dental College, Greater Noida. The criteria for selection were: (1) Male & Female patients belonging to the age group 30 - 60 years. (mean age 38.9 ± 5.9) (2) Patient suffering from Chronic Periodontitis as per AAP 1999 classification.¹² (3) Patients having clinically Grade II furcation involvement of mandibular molars diagnosed clinically as per Glickman's classification.¹³ The Exclusion Criteria was : (1) Patients with known systemic disease and conditions known to predispose to periodontal diseases. (2) Pregnant & lactating mothers. (3) Patients with deleterious habits like smoking, alcohol consumption , tobacco chewing , beetlenut chewing etc. (4) Patients with < 20 teeth , partial dentures or fixed prosthetic appliance. (5) Teeth with Grade III mobility as per Miller's classification. (6) Teeth with Grade I ,Grade III and Grade IV furcation involvement. (7) Periodontal treatment within previous 12 months. (8) Use of antibiotics within previous 6 months.

(9) Use of hormonal contraceptives. (10) Use of Anti-inflammatory drugs within the past 6 months.

The furcation defects had to be probeable with color coded Naber's probe minimum of 3 mm in the horizontal direction but not entirely through the furcation. A total of 20 furcation defects in 10 patients were treated; 10 defects with the collagen membrane technique and 10 defects with autogenous Periosteal membrane technique. On a random basis, one furcation defect from each pair was selected for the test group and the opposite side furcation defect for the control group. Randomization was done according to a computerized software (www.random.org)¹⁴. Written informed consent was obtained from all patients enrolled for the study. Ethical clearance was obtained from Institutional ethical committee, ITS Dental College, Greater Noida. (Letter No: IEC/PERIO/39/13). The study was carried out in accordance of ethical principles outlined in Helsinki's guidelines.¹⁵

Pocket Probing depth and clinical attachment level, horizontal furcation measurement, Gingival Index (Loe & silness) & Plaque Index (Silness & Loe) were assessed at baseline & 6 months. Ancillary parameters were assessed additionally at 3 months, Radiographic bone defect level were assessed at baseline & 6 months.

Each patient was instructed about good oral hygiene practices, scaling and root planning was performed under local anesthesia. All patients achieved effective plaque control prior to entering the surgical phase. After this initial phase of treatment, the presurgical baseline soft tissue parameter, i.e Pocket probing depth & clinical attachment level was measured with the standardized University of North Carolina-15 (Hu- Friedy, Chicago, IL, USA) probe and a customized grooved acrylic stent & Furcation defect was assessed with the help of color coded Naber's Probe. (Hu- Friedy, Chicago, IL, USA)

Surgical Procedure

At both the sites i.e. Control & test site, (Figure 1 & Figure 2) following local anesthesia (2% Lidocaine, Lidayn, Global Dent Aids Pvt Ltd., New Delhi, India), crevicular incisions were made starting one tooth distal to the tooth being treated, and extending to a minimum of two teeth mesially. Full thickness mucoperiosteal flaps were reflected buccally and lingually. The granulation tissues were curetted out, till sound healthy bone was exposed & exposed root surfaces were thoroughly planed using hand & ultrasonic instruments to obtain a smooth hard & clean surface.

At the control site, Commercially available collagen membrane (Healiguide™, Advanced Biotech Products (P) Ltd., Tamilnadu, India) according to the size of furcation defect hydrated in saline & trimmed & was secured by 4-0 Vicryl suture (Ethicon, Johnson & Johnson Ltd., Aurangabad, India) & the mucoperiosteal flaps were replaced and secured with interrupted interdental suturing using 3-0 black braided silk suture. (Mersilk – Ethicon, Johnson & Johnson Ltd., Aurangabad, India)

At the test site, the furcation defects were covered by an autogenous periosteal membrane as a barrier. The periosteal membranes were harvested from the palatal area of the

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same side receiving treatment. Following local anesthesia, a "trap door" split-thickness flap, consisting of 1 horizontal and 2 vertical incisions, was elevated. The graft consisting of the periosteum of periosteum & connective tissue as at the donor site bone surface was bared.

The membranes both at test & control sites were placed over the furcation area so as to extend 1 mm coronally & 3 mm beyond the confines of the defect an to the alveolar bone.

The periosteal aspect was placed so as to face the furcation defect area & was secured by 4-0 vicryl sutures. This secured membrane was subgingivally covered by the mucoperiosteal flap which was repositioned & secured by 3-0 braided black silk suture.

Periodontal dressings (Coe-pack – GC America INC, ALSIP, IL USA) were given at a surgical site to cover the surgical areas. An antibiotic regimen of Amoxicillin 500 mg thrice a day for 5 days and analgesic Ibupara 400 mg thrice daily for 5 days were prescribed. The patients were advised to rinse with 10 ml aqueous 0.2% solution of chlorhexidine gluconate for 1 minute twice a day 24 hours postoperatively and routine post-surgical instructions were given. . After 10 days, the sutures and dressings were removed. Recall visits were carried out after 3 months to assess oral hygiene & 6 months to assess clinical & radiographic parameters.



Figure 1 (Control Group)

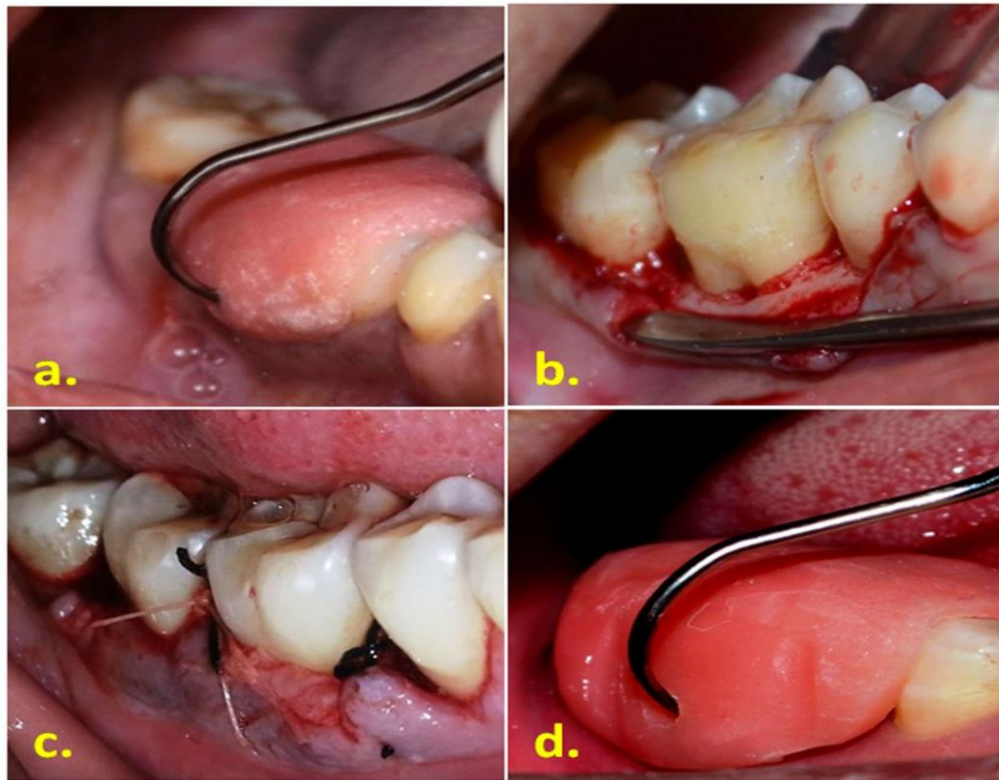


Figure 2 (Test Group)

Statistical Analyses

Descriptive data were presented as mean $\pm$ Standard deviation(SD) and range values. The difference between the measurements in the same individual was tested by paired 't' test. The Analysis of variance (ANOVA) test was used to compare the result between the groups. A confidence interval of 95% was taken to consider a significance level at p value ≤ 0.05 . Statistical analyses was performed using SPSS software (SPSS, IBM, Chicago, IL)

Results

All enrolled patients completed the study with no reported adverse events related to healing or exposure of bone or membrane. At baseline, the mean gingival index (GI) score was 2.05 ± 0.41 for the control group and test group. After 3 months of treatment, the mean values were 1.01 ± 0.29 & after 6 months it was reduced to 0.7 ± 0.34 . On comparing the pre-treatment values with post-treatment values at 6 months the differences were found to be statistically significant for both groups. ($p < 0.001$)(Table 1a)

At baseline, the mean plaque index (PI) score was 1.7 ± 0.39 for the control group and test group. After 3 months of treatment, the mean values were 1.1 ± 0.11 & after 6 months it was reduced to 1.0 ± 0.09 . On comparing the pre-treatment values with post-treatment values, after 6 months the differences were found to be statistically significant for both groups. ($p < 0.001$). (Table 1a)

Both groups post treatment showed improved scores of pocket probing depth from baseline. At baseline the mean probing depth was 4.6 ± 0.84 mm for collagen membrane treated sites (control group) , and 4.4 ± 0.97 for periosoteal membrane treated site (test group). After 6 months of treatment, the mean values were 2.5 ± 0.43 and 2.4 ± 0.48 for control group and test group respectively. On comparing the pretreatment values with post-treatment values, the reduction in mean probing depth were found to be statistically significant in both control (' p ' < 0.01) and test group (' p ' < 0.001). (Table 1b)

At baseline , the mean clinical attachment level was 3.74 ± 0.43 mm for control group and 3.63 ± 0.65 mm for test group. After 6 months of treatment, the mean values were 1.75 ± 0.47 mm & 1.77 ± 0.48 mm for control & test group respectively. On comparing the pretreatment & post-treatment values, the gain in clinical attachment level were found to be statistically significant in both the groups. (Table 1b)

At baseline, the mean horizontal furcation measurement was 4.5 ± 0.7 mm for control group and 4.8 ± 0.63 mm for test group [Table 1]. After 6 months of treatment, the mean values were reduced to 0.9 ± 0.31 mm for control group, and 1.5 ± 0.52 mm for test group. On comparing the pretreatment values with post treatment values the mean difference was statistically significant in both the groups. On comparing, both the groups the gain in horizontal furcation measurement was statistically non-significant.

At baseline, the mean radiographic bone defect level was 2.8 ± 0.52 mm for control group and 2.7 ± 0.57 mm for test

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group. After 6 months of treatment, the mean values were reduced to 2.0 ± 0.58 mm for control group & 1.4 ± 0.65 mm for test group. The radiographic bone defect fill was more in test group as compared to control group & the difference was statistically significant. ($p < 0.01$)

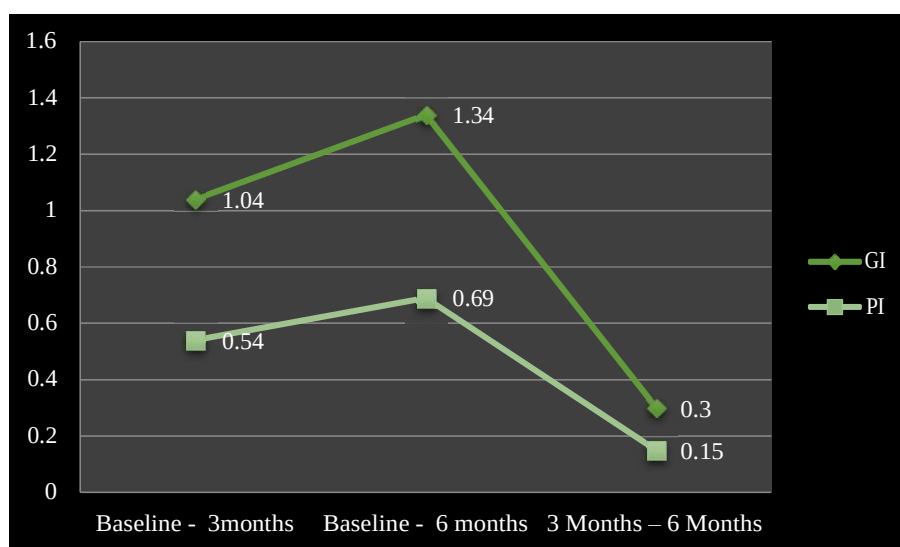
Table 1a: Comparative analysis of Gingival Index & Plaque Index from baseline to 6 months. GI – Gingival index, PI – Plaque index

	Baseline - 3months	Baseline - 6 months	3 Months – 6 Months
GI	1.04 ± 0.32	1.34 ± 0.28	0.3 ± 0.3
p value	1.000	0.880	0.886
PI	0.54 ± 0.37	0.69 ± 0.37	0.15 ± 0.13
p value	1.000	0.905	0.751

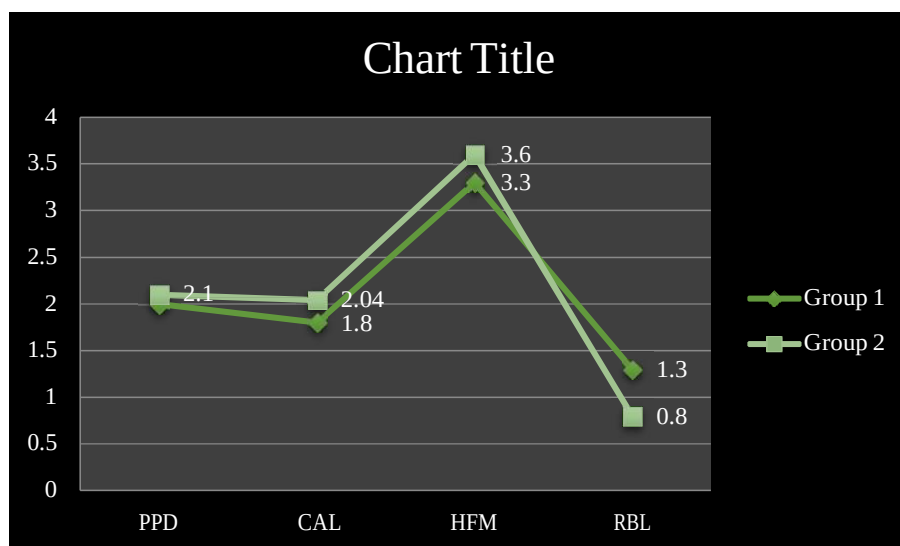
Table 1: Comparative analysis of all clinical parameters between Group-I & Group – II
PPD- Pocket probing depth, CAL – Clinical Attachment level, HFM – Horizontal furcation measurement, RBDL – Radiographic bone defect level

	Baseline – 6 Months	
Clinical Parameters	Group 1	Group 2
PPD	2.0 ± 0.90	2.1 ± 0.68
p value	0.53 ^u	
CAL	1.8 ± 0.66	2.04 ± 0.26
p value	0.78 ^u	
HFM	3.3 ± 0.67	3.6 ± 0.69
p value	0.342 ^u	
RBDL	1.3 ± 0.25	0.8 ± 0.31
p value	0.012 [*]	

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Graph 1a: Comparative analysis of Gingival Index & Plaque Index from baseline to 6 months



Graph 1b: Comparative analysis of all clinical parameters between Group-I & Group – II

Discussion

The management of furcation involvement presents one of the greatest challenges in periodontal therapy because of its unique anatomy, difficult accessibility & tendency for epithelial downgrowth.

Guided tissue regeneration is considered as a viable treatment modality for the treatment of teeth with Grade II furcation involvement. In this study, selection of mandibular grade II defects was done as Sanz and Givannoli¹⁶ summarized studies conducted on placement of barrier membrane in Maxillary class II furcation involved teeth do not lead to added benefit over open flap debridement alone. who stated that, “placement of a barrier membrane should not be indicated in the treatment of maxillary molars with furcation involvement.” In a study conducted by Metzler et al¹⁷ the GTR procedure showed limited application as a therapeutic modality for Class II furcations of the maxillary molars. To this effect a large

number of GTR membranes have been employed as a treatment of choice to address furcation involved molars.¹⁸ This study was conducted to compare the efficacy of Periosteal membrane with commercially available Collagen membrane for the treatment of Grade II furcation. The study was conducted on 10 subjects with a split mouth randomized control design. The efficacy was determined based on the clinical & radiographic parameters of two groups :

Group I : Test Group – Open flap debridement with placement of periosteal membrane

Group II: Control Group – Open flap debridement with placement of collagen membrane.

After thoroughly searching for the literature, no studies have been published or reported wherein the efficacy of collagen membrane & Periosteal membrane have been compared in a split mouth design for the treatment of Grade II furcation involved mandibular molar teeth. Keeping this

in mind the present study was conducted to compare the efficacy to two membranes in a split mouth design.

In the present study clinical & radiographic parameters were taken into consideration at baseline & 6 months. Ancillary parameters were assessed additionally at 3 months.

The present study revealed significant reduction in pocket probing depth & gain in clinical attachment level and radiographic bone defect fill in both test & control groups. These findings can be compared to observations made by Kwan et al.¹¹ and Lekovic et al.¹⁰, utilizing periosteal graft as a barrier membrane in vertical and furcation defects, respectively.

Since the study was a split mouth design, the results of the indices revealed an overall reduction in scores of Plaque Index(Silness & Loe)¹⁹ & Gingival index (Loe & Silness)²⁰ from baseline to 6 months.

In the present study there was significant improvement in horizontal furcation measurement in both the groups. The results of this study were in accordance with Verma V, Saimbi CS, Khan MA, Goel²¹ in which they used the periosteal membrane as barrier in treatment of buccal grade II furcation defects in lower molars. There was also significant improvement in horizontal furcation measurement from baseline to 6 months . A similar study was done by Lekovic & Co workers²² in which they explored the clinical effectiveness of periosteal membrane as a mechanical barrier for the treatment of furcation defects compared to open flap debridement alone. The Periosteal barrier group presented with a significant reduction in pocket probing depth from baseline to 6 months which was statistically significant. Van Swol & Co-workers²³ evaluated the effectiveness of resorbable collagen membrane in guided tissue regeneration of periodontal tissue in class II furcation defects in humans. They found out statistically significant improvement in horizontal furcation measurement from baseline to 6 months .

According to Garret S²⁴ periodontal apparatus regeneration can be estimated radiographically.

The radiographic bone fill was observed within both the groups & the difference is statistically significant as radiographic bone defect fill being more in test group as compared to Control Group . A study done by Verma V, Saimbi CS, Khan MA, Goel A²¹ in which they used periosteal membrane as a barrier for the treatment of Grade II furcation revealed that a statistically significant bone fill could be observed radiographically after 6 months. A similar study done by Bouchard P & co workers²⁵ in which they did the clinical evaluation of bioresorbable collagen membrane for the treatment of Class II furcation defects. The amount of radiographic bone fill which was observed at the end of 6 months was statistically significant & supports the present study.

The evidence of effectiveness of various commercially available collagen membrane has already been established. Periosteal membrane is an attractive & viable alternative to barrier membrane therapy since they are biologically accepted. They are highly vascular & known to contain

osteoprogenitor cells. These cells have the ability to differentiate into fibroblast, osteoblast etc.

They also override the need for commercially obtained GTR membranes as they are sourced autogenously, however the disadvantage associated with them is need for a second surgical site.

The limitations of the present study is that the histological evaluation & re-entry was not performed due to ethical reasons & non – compliance of the patients.

Conclusion

In the present study, furcation involved sites treated with autogenous periosteal membranes showed results comparable to commercially available collagen membranes. Improvement in clinical & radiographic parameters on evaluation were revealed further clinical trials with longitudinal observations & larger cohorts are required to prove the efficacy of autogenous periosteal membrane in the management of Grade II furcation involved teeth

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