ORIGINAL RESEARCH

Evaluation of PRF and PLA–PGA Membrane Along with Hydroxyapatite Crystal Collagen Fibers Bone Graft in the Treatment of Infrabony Defects

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Abstract

Aim: The present study was carried out to compare the effectiveness of leukocyte platelet-rich fibrin (L-PRF) membrane and polylactic acid-polyglycolic acid (PLA–PGA) membrane along with hydroxyapatite crystal collagen fibers bone graft in the treatment of human infrabony defects using cone beam computed tomography.

Materials and methods: A total of 28 systemically healthy patients was chosen which were found appropriate after initial therapy. Each group comprises of 14 defects, according to randomized parallel design. The group A was managed by hydroxyapatite crystal collagen fibers bone graft in conjunction with L-PRF membrane, while group B was treated by hydroxyapatite crystal collagen fibers bone graft in conjunction with PLA–PGA membrane. Clinical and radiographic measurements were recorded at baseline and 6 months postoperatively.

Results: Statically significant difference was seen in mean probing pocket depth (PPD), mean R-CAL, and DD from baseline to 6 months in group A and group B but there was no statically significant difference in mean PPD reduction (0.35 ± 1.90 mm), mean R-CAL gain (0.28 ± 1.85 mm) and DD reduction (0.12 ± 1.42 mm) seen at 6 months when compared between both the groups.

Conclusion: At 6 months post-surgery both treatment modalities demonstrated statistically significant improvements with regards to CAL gains, PPD reduction, and reduction in radiographic defect depth.

Clinical significance: Platelet-rich fibrin (PRF) membrane and PLA–PGA membrane along with hydroxyapatite crystal collagen fibers bone graft are useful in the treatment of infrabony defect. Platelet-rich fibrin membrane with hydroxyapatite crystal collagen fibers bone graft have shown to be better in regeneration of bony defect as PRF membrane has growth factors which help in bone regeneration.

Keywords: Hydroxyapatite crystal collagen fibers bone graft, PLA–PGA membrane, Platelet-rich fibrin membrane.

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Introduction

Periodontal disease is an immuno-inflammatory disease featured by the destruction of the periodontal ligament, cementum, and alveolar bone.[1] Bone defects resulting from periodontal disease can be in the form of osseous craters, inconsistent bony margins, hemi septal defects, furcation involvement, vertical defects, and a combination of these defects. The primary aim of periodontal reconstructive surgery is to revitalize and restore all tissues of periodontium with their functions.[2]

The bone grafts serve as a scaffold for the native cells of the host and supply elements that assist in triggering regeneration by means of osteoconductive or osteoinductive pathways.[3] To achieve this, various bone grafts, such as autografts, allografts, xenografts, and alloplasts have been successfully utilized in the treatment of infrabony defects.[3] Literature reported that the use of synthetic bone substitute materials by-passes the disadvantages of bone grafts, like autografts, allografts and xenografts as there is no risk of disease transmission and abundant supply being available.[4] Calcium sulfate, calcium phosphate ceramics, hydroxyapatite, β-TCP, bioactive glass, and combination there off are the widely used synthetic bone substitutes existing and have compositional similarities to natural bone.[5]

Collagen (Col) is a natural element of the body that plays an important role in tissue integrity. It has a triple helix shape that inhibits enzyme activity from breaking it down, allowing cells to adhere together. Collagen's spongy nature, absorptivity, and stability also make it an ideal scaffold for osteoblast deposition. Col fibers assist in healing of wound, hemostasis and stabilization of graft material inside the defect areas. Miyamoto et al.[6] and Masanori Kikuchi et al.[7] stated that Col-reinforced self-setting HA cement are biocompatible and have improved mechanical properties.

Nyman et al.[8] were the first to show that the guided tissue regeneration (GTR) technique could be used to acquire new

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attachment by using a nonresorbable ePTFE membrane. Since then, numerous publications have reported effective improvement in bone abnormalities employing GTR technique.[9,10] Nonresorbable GTR membrane requires surgical removal when regeneration therapy is completed, which adds to the patient's and clinician's difficulty. Resorbable GTR membrane has been proposed to avoid the need for surgical removal. Using bioabsorbable membrane barriers, Cortellini et al.[11] and Becker et al.[12] revealed considerable clinical benefits in the management of human infrabony defects and Class II furcation defects. Caffesse et al.[13] employed a bioresorbable membrane made of a polylactide/polyglycolide copolymer (Resolut) to treat surgically produced periodontal defects in dogs, with outcomes were equivalent to those achieved with ePTFE nonresorbable membranes (GTPM, Gore-Tex). The GTR technique is often combined with bone grafts and/or bone graft substitutes placed underneath the membrane with the intention to support the barrier material and to prevent it from collapsing into the defect or onto the root surface (i.e., achieve space provision) and/or to enhance bone regeneration.

The platelet-rich fibrin (PRF) is a bioactive paradigm that encourages stem and progenitor cell differentiation and proliferation in the local environment. It functions as an immune regulatory mode with anti-inflammatory properties as well as has a steady, non-stop discharge of growth factors over a 7–14-day period.[14] PRF clot can be compressed into membrane using PRF box. PRF membrane combined with bone grafts have shown to have added clinical and radiographic benefit.

As there is little evidence available in literature and regenerative potential of hydroxyapatite crystal with collagen fibers bone graft along with PRF membrane and PLA–PGA membrane in the management of human infrabony defect have not been evaluated so far, the present study was carried out to compare the effectiveness of PRF membrane and PLA–PGA membrane along with hydroxyapatite crystal collagen fibers bone graft in the treatment of human infrabony defects using cone-beam computed tomography (CBCT).

Materials and Methods

A total of 28 systemically healthy subjects (14 males and 14 females; mean age: 39.53 ± 2.54 years, between the ranges of 28–58 years) in need of periodontal therapy at the Department of Periodontics were selected for the study. The research design was first approved by the Institutional Ethical Committee (IEC) and was conducted in accordance with the Helsinki Declaration of 1975, as revised in 2013. After ethical approval, all subjects were verbally informed and informed written consent was obtained to participate in the randomized, double blinded, controlled clinical trial. The study period was of 6 months. Study was registered under CTRI: registration number – CTRI/2019/12/022466. IEC approval number: DMIMS (DU)/IEC/Aug2019/8268.

Sample Size Calculation

Sample size was calculated using the data of the previous studies by Bodhare et al.[15] using OpenEpi, version 3, open source calculator—SSMean. The result of the calculation is 13 in each group, so, a round figure of 26 sample will be undertaken for the entire study.

The subjects were classified as chronic periodontitis based on the 1999 consensus classification of periodontal diseases.

Inclusion Criteria

The inclusion criteria were the presence of minimum 1 or 2 interproximal infrabony osseous defect and which are noticeable on CBCT along with PPD ≥5 mm and CAL ≥5 mm following phase I therapy [scaling and root planning (SRP)] in asymptomatic tooth.

Exclusion Criteria

Patients with aggressive periodontitis, known systemic illness, any drugs known to impair periodontal therapy outcomes, insufficient platelet count (200,000/mm^3), pregnancy/lactation, and cigarette use were all excluded from the study. After the reevaluation of phase I therapy, those with poor oral hygiene [if plaque index (PI) > 1] were also eliminated from the research. Teeth exhibiting furcation abnormalities, non-vital and/or mobility of grade II teeth, and periapical disease were also excluded.

Presurgical Therapy

Before surgery, each patient was given detailed instructions on maintenance of proper oral hygiene. Under local anesthetic, a full-mouth supra- and subgingival SRP treatment was done. Periodontal examination was performed 6–8 weeks after phase I therapy to confirm the study's desired sites.

Before initiating the surgery, randomization of infrabony defects was done by flipping a coin. The defects were randomly allocated into group A and group B, each consisting of 14 defects. The Group A was managed by hydroxyapatite crystal collagen fibers bone graft (Ostoform) in conjunction with PRF membrane, while Group B was treated by hydroxyapatite crystal collagen fibers bone graft (Ostoform) in conjunction with PLA–PGA membrane (Biomesh).

All procedures were done by one operator (DM), while pre- and posttreatment clinical and radiographic assessments were performed by another operator (PJ), who was blind to the type of treatment the patients would get. SRP was conducted at baseline until the operator deemed the root surface to be smooth and clean (DM). After treatment, no antibiotics or anti-inflammatory drugs were prescribed (Flowchart 1).

Clinical and Radiographic Measurements

The clinical parameters recorded before surgical procedures included plaque index (PI), papillary bleeding index (PBI), probing pocket depth (PPD), relative clinical attachment level (R-CAL), and relative gingival marginal level (R-GML) at baseline and 6 months postoperatively from the apical level of customized acrylic stents with grooves to ensure a reproducible placement of the University of North Carolina (UNC) no. 15 periodontal probe.[†]

The infrabony defect sites were investigated with CBCT at baseline and 6 months postoperatively. The CBCT analysis included the measurement of bone defect height [CEJ–BD (base of the defect)], level of alveolar crest [CEJ–AC (alveolar crest)], bone defect depth (AC-BD), and the mesiodistal (MD) and buccolingual (BL) bone defect width.[15]

PRF Preparation

A standard protocol of Choukroun et al.[16] was followed for the preparation of PRF. About 10 mL of intravenous blood was withdrawn by venipuncturing the antecubital vein. Blood was collected without adding anticoagulant in two sterile glass tubes containing 5 mL of blood in each tube which was instantly centrifuged for 10–12 minutes at 3000 rpm in a centrifugation machine.[‡]

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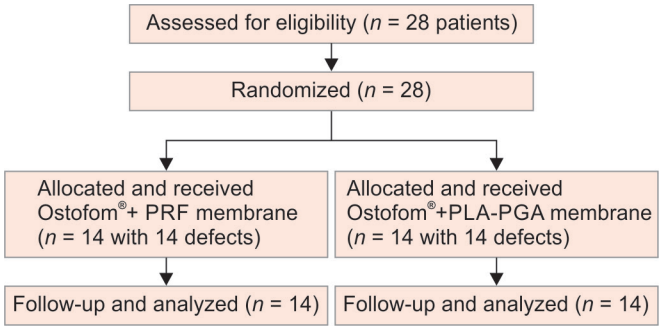
[‡]*R-4C, REMI Elektrotechnik LTD, Vasai, INDIA.*

Flowchart: Study flowchart. PRF, platelet-rich fibrin; PLA-PGA, polylactic acid-polyglycolic acid; *n*, number of patients



Centrifugation resulted in the formation of fibrin clot (PRF) in the center of the glass tube, in between red blood corpuscles settled down to the base and platelet-poor plasma above meshed fibrin. PRF was taken out using sterile tweezers and transferred in a sterile dappen dish. This PRF plug was squeezed out to obtain a membrane with the help of PRF box.[II]

Surgical Procedure

Intraoral asepsis was performed with 0.12% chlorhexidine digluconate[III] rinse and iodine solution[IV] was used to carry out extraoral antisepsis. After the injection of local anesthesia,[V] buccal and lingual crevicular incisions were given and full-thickness flaps were raised. The interproximal soft tissue was preserved as much as feasible. Careful root planning and debridement of the defect were carried out using ultrasonic instruments and area-specific curettes.[#] No osseous recontouring was carried out. By maintaining absolute isolation and hemostasis, the flap was pre-sutured to allow quick flap approximation after placing the graft.

In group A, a plug of PRF was compressed as PRF membrane which was extended over the defect. PRF membrane was lightly raised on one side to fill the defect with hydroxyapatite crystal collagen fibers bone graft (Ostoform). Bone graft was placed and packed into the defect up to the alveolar crest wall to fill but not to over fill the defect. Adaption of the PRF membrane was done till it overlay at least 3 mm beyond the bony defect.

In group B, a clean template to acquire the approximate size and shape of the membrane, sterile aluminum foil was used. To ensure total bone contact and prevent gingival connective tissue invasion below the material, the GTR membrane was cut so that it overlaps the alveolar bony walls of the deficiency by at least 2 mm. The membrane was cut to be 1.5–2 mm broader than the interproximal gap. This was an attempt to create a vast area of contact with the root surface and the underlying bone in order to promote optimal adaptation. Sutures were put in the flap without tying the knot prior to membrane implantation to enable for fast flap closure after membrane deployment.

The membrane was folded in half and then pass interproximally beneath inter-dental contacts. The dense surface faced the soft tissue and the rough side faced the bone. The membrane was applied over the defect and held in place with moderate pressure. Before suturing the flap, the PLA–PGA membrane were lightly raised on one side to fill the defect with hydroxyapatite crystal collagen fibers bone graft (Ostoform). Bone graft was placed and packed into the defect up to the alveolar crest wall to fill but not to over fill the defect and membrane was placed back. The flap was coronally positioned and sutures were placed 1–2 mm coronal to CEJ to ensure primary closure. The mucoperiosteal flaps were repositioned and secured in place using 3-0 non-absorbable silk surgical suture.[**] The vertical mattress and interproximal sutures were placed. Gentle pressure application was done to the operated area using saline-soaked gauze for minimum 2 minutes, to secure the soft tissue and remove space in between clot which might interrupt re-attachment. The surgical area was protected and covered with periodontal dressing.[††]

Postoperative Care

Patients were advised to take antibiotics[VI] thrice daily and analgesics[VII] twice daily for 5 days after surgery. Patients were advised to swish with 0.2% chlorhexidine mouthwash for about 3 weeks. Removal of periodontal pack and sutures were carried out at 7–10 days postoperatively. Tooth brushing with hard bristles or mastication on surgical site was not permitted for 3 weeks. Meanwhile, patients were advised to practice Charter's method of tooth brushing by using soft toothbrush. Subjects were asked to restart oral hygiene protocol with careful tooth brushing (Modified bass technique), utilization of interproximal brush and to stop use of chlorhexidine mouthwash after 3 weeks.

Maintenance Care

Patients were recalled for evaluation of PI and PBI at 3 and 6 months postoperatively. All the reported subjects were reinforced with oral care protocol and full-mouth ultrasonic supra-gingival scaling during the follow-up visits.

Re-evaluation

A comprehensive post-surgical evaluation was done at 6 months. Clinical measurements, such as PI, PBI, PPD, R-CAL, and R-GML were measured. Cone beam computed tomography and clinical photographs were also obtained for comparison of the results.

Primary and Secondary Outcome Measures

The primary outcome of the study was bone defect fill. The secondary outcomes included PPD, CAL, PBI, and PI which was done after 6 months.

Statistical Analysis

The mean and standard deviation (mean ± SD) values were measured for all the parameters. The data were analyzed using statistical software (SPSS version 15.0, SPSS, Chicago, USA). Student's paired *t*-test was applied for the data analysis in each treatment Group (Intragroup) to compare the baseline to 6 months values while the data analysis between the two groups (Intergroup) was carried out by using Student's unpaired *t*-test. The observed difference was considered significant (S) if the probability value (*p*) was < 0.05 and if it was > 0.05 then considered as nonsignificant (NS).

[II] *OSUNG MND Co., Ltd. ParkMan Design.*
[III] *Hexidine, ICPA lab, India.*
[IV] *Getadine-5%, Genpro Healthcare LLP.*
[V] *Lignox 2%, Indoco Remedies LTD.*
[#] *Gracey, Hu-Friedy, Chicago, IL, USA.*
[**] *Ethicon, Johnson & Johnson Ltd., Somerville, NJ, USA.*
[††] *Coe-Pak, GC America Inc., Chicago, IL, USA.*
[VI] *Almox-500, Alkem Laboratories LTD.*
[VII] *Zerodol-SP, Ipca Laboratories LTD.*

Results

All 28 patients (28 defects) including 5 females and 10 males (mean age 39.53 ± 2.54 years) between the age range of 28and 58 years completed the study. All treated cases showed uneventful wound healing. Group A had 6 two and half wall defects and 8 two-wall defects and group B had 5 two and a half-wall defects, 9 two-wall defects. Following the surgical procedure and throughout the study period, healing of wound was uneventful. No undesirable effects, or any patient complaints of allergic reactions or infection associated with the used bone graft were reported. None of the selected subjects were dropped out before the end of study.

Overall, patients maintained their oral hygiene levels during the course of the investigation. The full-mouth mean PI score and mean PBI scores measured at baseline, 3 and 6 months recall for both the groups.

Clinical Parameters

At baseline, statistically NS differences were noted in the examined parameters (PPD, R-CAL, R-GML) among the group A and group B ($p < 0.05$), suggesting that the random allocation method was efficient (Table 1).

At 6 months, the mean PPD reduction for group A was 4.71 ± 1.20 mm when compared with mean PPD reduction for group B was 4.35 ± 1.39 mm, there was no statistically significant mean PPD reduction which was 0.35 ± 1.90 mm noted when both the groups were compared ($p > 0.05$) (Tables 2 and 3).

When comparison was made between the mean gain in CAL after 6 months in group A was 4.71 ± 1.20 mm and group B was 4.42 ± 1.34 mm, no significant difference in CAL gain was seen to be 0.28 ± 1.85 mm when both the groups were compared ($p > 0.05$) (Tables 2 and 3).

At 6 months, the mean gingival recession (GR) for group A was 0 mm when compared with mean GR for group B was 0.07 ± 0.26 mm, the difference in mean GR was 0.07 ± 0.26 mm which was found to be statistically NS ($p > 0.05$) (Tables 2 and 3).

Radiographic Parameters

At baseline, statistically NS differences were noted in the examined radiographic parameters (CEJ-AC, CEJ-BD, AC-BD, MD, BL) among the group A and group B ($p < 0.05$), suggesting that the random allocation method was efficient (Table 4).

The mean decrease in radiographic values of CEJ-AC was analyzed between group A (0.85 ± 1.59 mm) and group B (0.55 ± 0.95 mm), statistically NS difference (0.30 ± 1.25 mm) was seen ($p > 0.05$) (Tables 5 and 6).

The mean reduction in radiographic values of CEJ-BD was analyzed between group A (3.88 ± 1.56 mm) and group B (3.44 ± 1.21 mm), statistically NS difference (0.43 ± 1.93 mm) was seen ($p > 0.05$) (Tables 5 and 6).

The mean reduction in radiographic values of AC-BD were analyzed between group A (3.03 ± 0.75 mm) and group B (2.89 ± 1.01 mm), statistically NS difference (0.12 ± 1.42 mm) was seen ($p > 0.05$) (Tables 5 and 6) (Figs 1 to 4).

The mean reduction in radiographic MD dimension was analyzed between group A (1.49 ± 0.45 mm) and group B (1.01 ± 0.58 mm), statistically NS difference (0.47 ± 0.80 mm) was seen ($p > 0.05$) (Tables 5 and 6).

The mean reduction in radiographic BL dimension was analyzed between Group A (1.87 ± 1.57 mm) and Group B (2.46 ± 1.38 mm), statistically NS difference (0.58 ± 2.43 mm) was seen ($p > 0.05$) (Tables 5 and 6).

Table 1: Baseline defect characteristics for group A (Ostofom® + PRF membrane) and group B (Ostofom® + PLA/PGA membrane) (Mean ± SD; in mm)

Parameters	*Group A*	*Group B*	*p-value*
Probing pocket depth (PPD)	7.14 ± 1.40	6.78 ± 1.62	0.52 NS
Relative clinical attachment level (R-CAL)	11.64 ± 1.54	10.57 ± 2.10	0.14 NS
Relative gingival marginal level (R-GML)	4.5 ± 0.65	3.78 ± 1.25	0.09 NS
Radiographic defect depth (DD)	3.73 ± 0.77	3.85 ± 1.03	0.72 NS

NS, $p > 0.05$; S, $p < 0.05$

Table 2: Comparison of clinical and radiographic parameters between group A (Ostofom® + PRF membrane) and group B (Ostofom® + PLA/PGA membrane) at 6 months post-surgery (Mean ± SD; in mm)

Parameters	*Group A*	*Group B*	*Difference*	*p-value*
Reduction in probing pocket depth (PPD)	2.42 ± 0.51	2.42 ± 0.51	0	1 NS
Gain in clinical attachment level (CAL)	6.92 ± 0.91	6.14 ± 1.23	0.78 ± 1.67	0.1 NS
Relative gingival margin level (R-GML)	4.5 ± 0.65	3.71 ± 1.26	0.78 ± 1.47	0.06 NS
Reduction in radiographic defect depth (DD)	0.69 ± 0.36	0.95 ± 0.30	0.25 ± 0.69	0.15 NS

NS, $p > 0.05$; S, $p < 0.05$

Table 3: Comparison of difference in clinical and radiographic parameters between group A (Ostofom® + PRF membrane) and group B (Ostofom® + PLA/PGA membrane) at 6 months post-surgery (Mean ± SD; in mm)

Parameters	*Group A*	*Group B*	*Difference*	*p-value*
Reduction in probing pocket depth (PPD)	4.71 ± 1.20	4.35 ± 1.39	0.35 ± 1.90	0.49 NS
Gain in clinical attachment level (CAL)	4.71 ± 1.20	4.42 ± 1.34	0.28 ± 1.85	0.57 NS
Reduction in gingival recession (GR)	0	0.07 ± 0.26	0.07 ± 0.26	0.33 NS
Reduction in radiographic defect depth (DD)	3.03 ± 0.71	2.90 ± 1.04	0.12 ± 1.42	0.74 NS

NS, $p > 0.05$; S, $p < 0.05$

At 6 months post-surgery, both treatment modalities demonstrated statistically significant improvements with regards to CAL gains, PPD reduction, and reduction in radiographic defect depth. But at 6 months, PRF+ Ostofom group showed slightly better results as PRF has growth factors present in them which helps in healing.

Table 4: Baseline radiographic defect characteristics for group A (Ostofom® + PRF membrane) and group B (Ostofom® + PLA/PGA membrane) (Mean ± SD; in mm)

Parameters	*Group A*	*Group B*	*p-value*
CEJ-BD	9.16 ± 1.93	8.17 ± 1.71	0.19 NS
CEJ-AC	5.43 ± 1.86	4.31 ± 1.43	0.12 NS
AC-BD	3.73 ± 0.77	3.85 ± 0.99	0.72 NS
MD	2.76 ± 0.55	2.43 ± 0.88	0.27 NS
BL	4.28 ± 1.27	4.19 ± 1.57	0.87 NS

NS, $p > 0.05$; S, $p < 0.05$

Table 5: Comparison of radiographic parameters between group A (Ostofom® + PRF membrane) and group B (Ostofom® + PLA/PGA membrane) at 6 months post-surgery (Mean ± SD; in mm)

Parameters	*Group A*	*Group B*	*Difference*	*p-value*
CEJ-BD	5.27 ± 1.69	4.71 ± 1.01	0.55 ± 1.89	0.29 NS
CEJ-AC	4.57 ± 1.72	3.76 ± 1.15	0.81 ± 2.11	0.17 NS
AC-BD	0.69 ± 0.36	0.95 ± 0.34	0.25 ± 0.63	0.15 NS
MD	1.27 ± 0.28	1.41 ± 0.77	0.14 ± 0.87	0.56 NS
BL	2.40 ± 1.18	1.73 ± 1.54	0.67 ± 1.67	0.15 NS

NS, $p > 0.05$; S, $p < 0.05$

Table 6: Comparison of difference in radiographic parameters between group A (Ostofom® + PRF Membrane) and group B (Ostofom® + PLA/PGA membrane) at 6 months post-surgery (Mean ± SD; in mm)

Parameters	*Group A*	*Group B*	*Difference*	*p-value*
CEJ-BD	3.88 ± 1.56	3.44 ± 1.21	0.43 ± 1.93	0.41 NS
CEJ-AC	0.85 ± 1.59	0.55 ± 0.95	0.30 ± 1.25	0.37 NS
AC-BD	3.03 ± 0.75	2.89 ± 1.01	0.12 ± 1.42	0.74 NS
MD	1.49 ± 0.45	1.01 ± 0.58	0.47 ± 0.80	0.05 NS
BL	1.87 ± 1.57	2.46 ± 1.38	0.58 ± 2.43	0.38 NS

NS, $p > 0.05$; S, $p < 0.05$

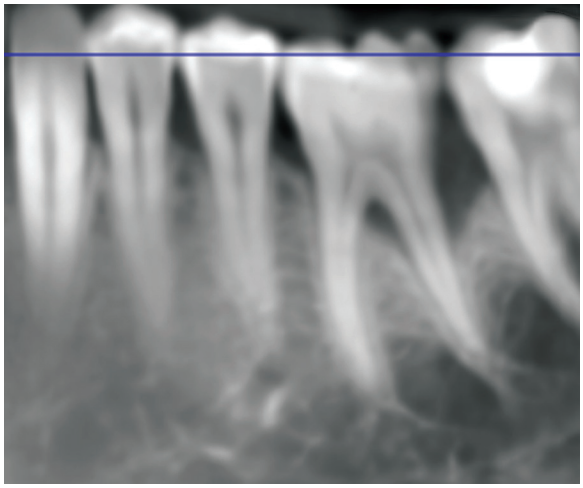


Fig. 1: Preoperative radiograph of group A

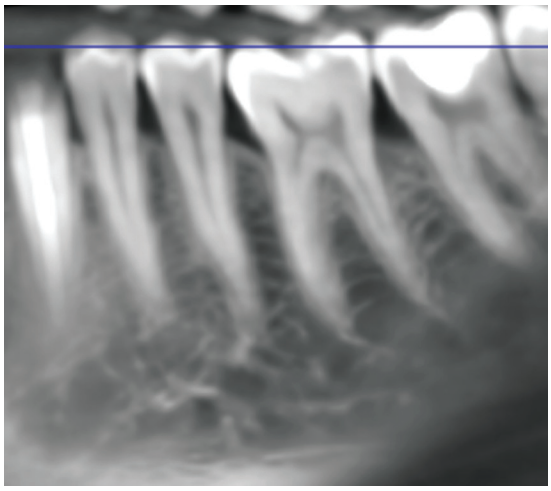


Fig. 2: Postoperative radiograph (6 months) of group A

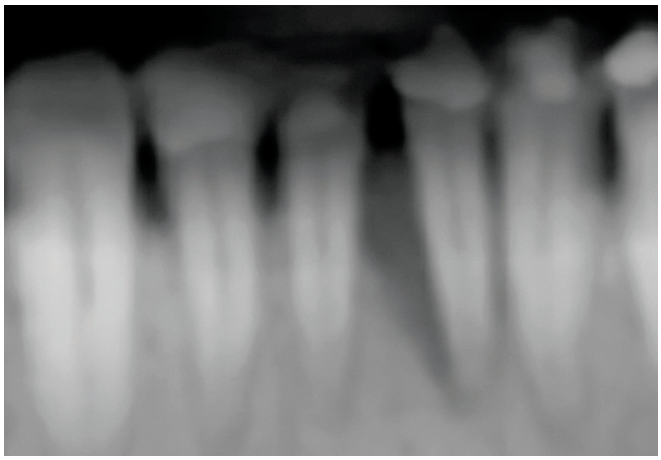


Fig. 3: Preoperative radiograph of group B

Discussion

Successful periodontal therapy for infrabony defects is clinically defined as complete resolution of defect by bone fill and improvement in the clinical parameters. Infrabony defects are well-recognized and documented model for clinical assessment of regenerative techniques. Scant literature is available on comparison of PRF membrane with hydroxyapatite crystal collagen fibers bone graft in the treatment infrabony defects. Thus, the current investigation was carried out to clinically compare the efficacy of PRF membrane and PLA–PGA membrane along with hydroxyapatite crystal collagen fibers bone graft in the management of infrabony defects.

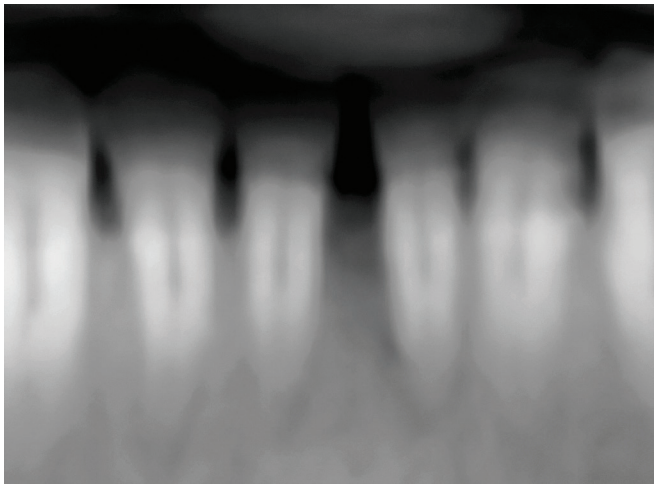


Fig. 4: Postoperative radiograph (6 months) of group B

In our study, the wound healing in all the treated patients was uneventful over the 6-month monitoring period. Plaque, infection, and smoking are the influencing factors for the outcomes of periodontal regeneration. There were no signs of allergic reactions, infection, or any other complications in any of assigned patient after the use of Ostofom®, PRF, and PLA/PGA membrane indicating the biocompatibility of grafting modalities.

In current study, the mean gain in CAL achieved was 4.71 ± 1.20 mm in Ostofom® + PRF membrane group which is compared with other similar studies reported in literature; Elgendy and Shady[17] had a mean CAL gain of 3.90 ± 0.44 mm when treated with nanocrystalline hydroxyapatite bone graft with PRF membrane in the treatment of infrabony defect at 6 months follow-up. Yan Xu et al.[18] had a mean CAL gain of 4.45 ± 1.13 mm in the treatment of infrabony defect when treated with concentrated growth factor along with Bio-oss bone graft at 6 months postoperatively. The mean gain in CAL achieved was 4.42 ± 1.34 mm in Ostofom® + PLA/PGA membrane group at 6 months in our study. Similar observations were reported by Mehrotra et al.[19] They evaluated the efficacy of Ostofom® + PLA/PGA membrane in the treatment of furcation defect and observed a mean CAL gain of 2.00 ± 0.82 mm at 6 months post-surgery. Cieplik et al.[20] observed a mean CAL gain of 6.00 mm in the treatment of infrabony defect using ß-TCP + PLA/PGA membrane at 1-year follow-up.

When comparing baseline to 6 months in the current study, both groups showed a substantial gain in CAL. The synergistic capabilities of osteoinduction and osteoconduction provided by the combination of PRF with hydroxyapatite crystals and collagen fibers increase the effect of bone regeneration and bone remodeling. PLA–PGA and PRF membranes have the benefit of preventing epithelial cells and their associated connective tissue from growing into the defect region. This permits the wound to be repaired by the cells that made up the wound in the first place, promoting regeneration to a higher level. The membrane aids in the stabilization of blood clots and the containment of graft materials within defects, resulting in improved regeneration.[19]

In current study, the mean reduction in PPD was 4.71 ± 1.20 mm in Ostofom® + PRF membrane group which is compared with other similar studies reported in literature. Lekovic et al.[21] had a mean PPD reduction of 4.47 ± 0.78 mm using Bovine porous bone mineral along with PRF membrane in the treatment of infrabony defect. Bodhare et al.[15] had a mean PPD reduction of 5.75 ± 1.16 mm using demineralized freeze dried bone allograft (DFDBA) along with PRF membrane in the treatment on infrabony defect at 6 months follow-up. Rexhepi et al.[22] had a mean PPD reduction of 4.28 ± 0.68 mm in in the treatment of infrabony defect when treated with L-PRF and inorganic bovine bone (IBB) at 12-month follow-up. The mean reduction in PPD was 4.35 ± 1.39 mm in Ostofom® + PLA/PGA membrane group at 6 months. Similar observations were reported by Mehrotra et al.[19] observed mean PPD reduction of 1.50 ± 0.52 mm in the treatment of furcation defect using Osteofom + PLA/PGA membrane at 6 months follow-up. Stavropoulos et al.[23] had a mean PPD reduction of 4.0 ± 1.2 mm using PLA/PGA membrane along with Bio-oss in the treatment of infrabony defect at 6 month follow-up.

Greater CAL gain and PPD reduction observed in Ostofom® + PRF membrane group may be described by the supplemental biologic effects of PRF. Reasonably, action of PRF can be explained due to its several cellular effects. PRF improves bone regeneration by stimulating the process of natural healing which seems to have influenced the regenerative outcomes. Another feature of PRF when used along with bone grafts act as biological link among bone substitute. PRF when used in combination with bone graft has resulted in additional benefit of fast healing due to osteogenic ability of PRF. PLA/PGA membrane used in the study has special characteristic including interconnective porous structure, promotes good nutrient flow, blood vessel formation, cell occlusiveness, and biodegradability. The PLA–PGA membrane had been totally resorbed, and there was no evidence of any negative effects on periodontal wound healing.[24,25] Therefore, regeneration using PLA–PGA membrane seems to be effective management modality in infrabony defects.

In our study mean change in Ostofom® with PRF membrane group from CEJ-BD was 3.88 ± 1.56 mm, from CEJ-AC was 0.85 ± 1.59 mm, from AC-BD was 3.03 ± 0.71 mm ,the mean change in MD dimension was 1.49 ± 0.45mm and BL dimension was 1.87 ± 1.57 mm and the mean change in Ostofom® with PLA/PGA membrane group from CEJ-BD was 3.44 ± 1.21 mm, from CEJ-AC was 0.55 ± 0.95 mm, from AC-BD was 2.90 ± 1.04, the mean change in MD dimension was 1.01 ± 0.58 mm and BL dimension was 2.46 ± 1.38 mm when viewed on CBCT at 6 months follow-up. Similar observations were reported by Bodhare et al.[15] had mean change in CEJ-BD of 3.30 ± 1.10 mm, from CEJ-AC was 0.13 ± 0.22, mean change in MD dimension was 0.70 ± 0.68 mm and BL dimension was 1.60 ± 0.27 mm using DFDBA along with PRF membrane at 6 months follow-up. Gupta et al.[24] did a CBCT study and had a mean DD (AC-BD) reduction of 1.67 ± 1.17 mm, defect width (MD) reduction of 0.65 ± 0.28 mm and defect angle change of 4.30 ± 5.76 degree using PRF in infrabony defect at 6 month post-surgery.

This clinical and radiographic study explores the equivalent potential of the PRF membrane and PLA/PGA membrane when used with hydroxyapatite crystals collagen fiber bone graft, indicating its safe use in periodontal defects; which further enhances the scope of this materials with continuous up gradation in their surface characteristics to become and remain invaluable for management of various osseous defects in the field of periodontal regeneration. Limitations of our study are that the extensive assessment is desirable to evaluate the constancy of the outcomes. Clinical outcomes of the present study are needed to be verified by histological evidence and the randomized clinical trials with a greater number of patients should be conducted to quantify the data for the regenerative treatment. Furthermore, such studies should be conducted which include the histological evaluation. Clinician can use either PRF or PLA–PGA as membrane

for regenerative procedure. But using PRF was comparatively easy and showed slightly better results than PLA–PGA membrane.

Conclusion

At 6 month post-surgery both treatment modalities demonstrated statistically significant improvements with regards to CAL gains, PPD reduction, and reduction in radiographic defect depth. Greater PPD reduction and CAL gain were found in L-PRF membrane along with Ostofom® (HA/Col) group than the PLA/PGA membrane in combination with Ostofom® (HA/Col) group at 6 months after surgery but the difference was statistically NS when compared between both the groups. Grafting with L-PRF membrane along with Ostofom® (HA/Col) group resulted in higher radiographic defect fill compared with PLA/PGA membrane in combination with Ostofom® (HA/Col) group but the difference was not statistically significant.

Therefore, it can be summarized that regenerative approach for both the groups significantly added benefit in terms of PPD reduction, gain in CAL and radiographic defect fill for the management of human infrabony defects.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent

Informed consent was obtained from all individual participants included in the study.

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