Original Research Paper

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# "Comparative Evaluation of Open Flap Debridement, T-PRF with Xenogenic Bone Graft in the treatment of intrabony defects with endo-perio lesions."

**Abstract:**

**Introduction:** Titanium- prepared platelet rich fibrin (T-PRF) is an autologous hemo-component with a high concentration of platelets that also incorporates leukocytes, and growth factors into the dense fibrin matrix and can be used as a healing biomaterial.

**Aim:** This study evaluates the use of T-PRF in intrabony defects with open flap debridement along with xenograft.

**Methodology:** A prospective single blind studyrandomized controlled trial (RCT) was conducted on 36 patients diagnosed with endo-perio lesions with intrabony defects and were divided into three groups. In Group A only Open Flap Debridement (OFD) was done, Group B received xenograft along with OFD, Group C received xenograft along with T- PRF . Clinical parameters such as Plaque Index (PI), Gingival Index (GI), Pocket probing depth (PPD), and Relative attachment level (RAL) were evaluated at baseline and 6 months. Additionally, radiographic parameters including % bone fill and bone density were assessed usingCBCT at baseline and after 6 months to measure bone regeneration.

**Results:** Statistical analysis revealed that all clinical and radiographic parameters improved significantly across all treatment groups over the study period, better results were seen in group treated with T- PRF as a membrane while Group C, treated with xenograft (Bio Oss)® along with T- PRF, showed substantial improvement in parameters.

**Conclusion:** The results suggest that combination of xenograft (Bio Oss)® along with T- PRF as a membrane and OFD holds promise for treating endo-perio lesions along with intrabony defects, leading to significant improvements in clinical and radiographic parameters.

**Key-words:** Endo-perio lesion; Intrabony defects; xenograft; titanium platelet rich fibrin; radiographic bone fill

## Introduction:

Endodontic-periodontal lesions commonly known as endo-perio lesions is defined as a pathological communication between the endodontic and periodontal tissues of a given tooth.[1] The apical advancement of a periodontal pocket can persist until the apical tissues become affected. In this instance, the pulp can turn necrotic due to an infection entering through lateral canals or the apical foramen.

In conventional root canal treatment procedure Zinc oxide Eugenol (ZOE), Calcium hydroxide, but recent studies have shown Mineral Trioxide Aggregate (MTA) as an alternative treatment option due to its superior sealability against bacterial microleakage and regeneration of PDL.[2,3]

Intrabony defects formed due to endo-perio lesion can be treated by regenerative procedures which include various biomaterials like barrier membranes, autologous growth factors, enamel matrix proteins or various combinations,[4] Thereof leading to successful regeneration of lost soft and hard tissue around tooth.

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Similar to the platelet and leukocyte-rich fibrin produced by the traditional PRF process, titanium platelet rich fibrin (T-PRF) has remarkable osseointegration properties.[5,6,7] The rationale of using T-PRF as a regenerative material lies in its property of longer resorption time with a thicker fibrin meshwork and higher cellular entrapment causing more cellularity at the required site leading to periodontal regeneration.

MTA is a bio-ceramic material, consisting of tricalcium-silicate, tricalcium-aluminate, tricalcium-oxide and silicate-oxide which form a colloidal gel on hydration that solidifies in about three hours.[8] MTA has antibacterial and bio-inductive properties which help in promotion of biologic repair and regeneration of periodontal ligament.

Bio-Oss® is a bovine porous bone mineral that has been successfully used in bone regeneration because of its slow resorption time and osteoconductive property.[9,10] Bio-Oss exhibits osteoconductive properties with a crystalline structure similar to human bone and is said to resorb within 12 to 24 months.

The use of CBCT in periodontics play an important role in assessing the intrabony defect as it gives a 3-Dimensional view and increases the quality of treatment.[11,12]

The current study compares the efficacy of these materials, which can produce long term stable result and has positive effect on periodontal bone regeneration. The use of MTA as a root canal sealer to stimulate the biologic mechanisms necessary for repair and retention in combined endo-perio lesions.[13] Thus, the present study explores MTA as a root canal sealer, T-PRF as a collagen membrane and xenogenic bone graft in resolution of intrabony defect with endo-perio lesions under magnification.

## Materials and Methods:

A total of 36 systemically healthy patients diagnosed with endo-perio lesions along with intrabony defects of age between 25- 55 years were screened. The included sites had clinical and radiographic evidence of endo-perio combined lesion in single rooted teeth with probing depth > 4mm and evidence of periapical radiolucency. Patients with systemic illness, lactating or pregnant women, smokers, and tooth with poor or hopeless prognosis were excluded from the study. The patient had completed basic periodontal therapy including oral hygiene instructions 4 weeks before surgery.

All participants underwent full-mouth scaling, accompanied by guidance on maintaining optimal oral hygiene. Root Canal Treatment (RCT) and phase I therapy were performed at the same time. The teeth were anesthetized then traditional endodontic access cavity preparation was done, following which apical patency was checked using path finder (10K). The length of the root canal was taken 1mm shorter than apex. The canals were prepared by 15K and 20K file. Biomechanical preparation of the canals were done with 2% - 4% taper rotary instruments depending on the morphology of the canal. Intermittent irrigation was done with 2% Chlorhexidine Gluconate and normal saline. Obturation was done using MTA based sealer. All teeth were restored with permanent restorative material. The surgical area was then anesthetized with 2% Lignocaine HCl and adrenaline (1:80,000), using both block and infiltration procedures. Following that, a precise intrasulcular incision along with two vertical incision was performed around the compromised tooth, extending to the neighbouring tooth to ensure adequate surgical access. A full thickness flap was carefully raised to reveal the underlying bone structure.

In Group A, the defect was treated solely with open flap debridement. In Group B, the defect was treated by filling it with xenograft (Bio Oss)® along with open flap debridement. In Group C, the defect was treated with xenograft (Bio Oss)® along with T- PRF as a membrane. Interrupted sutures were placed with 3-0 sutures. All patients were prescribed systemic antibiotics (amoxicillin 500 mg + clavulanic acid 125 mg, twice a day for 5 days), analgesics (aceclofenac 100 mg + serratiopeptidase 15 mg + paracetamol 325 mg, twice a day for 3 days), and SOS. Following a period of 7 to 10 days after the surgical procedure, the sutures and periodontal dressings were carefully taken off.

Patients were recalled at 6 months. Oral hygiene instructions were reinforced, followed by measurements of all clinical parameters (Plaque Index, Gingival Index, Pocket Probing Depth, and Relative Attachment Level), as well as radiographic evaluations (% Bone Fill) were assessed by CBCT after 6 months.

Radiographic linear measurements measured by CBCT included: CEJ to the base of defect (CEJ - BOD) [6], to Root Apex to the base of defect [6], and maximum mesiodistal width of the base of defect [6].

## Statistical analysis:

Continuous data were summarized as Mean ± SD, while discrete data were presented as n (%). Group comparisons were conducted using one-factor or repeated-measures ANOVA (group x period). Post hoc Tukey's HSD test assessed normality (Shapiro-Wilk's) and variance homogeneity (Levene's). Significance of mean differences within and between groups was determined by ANOVA. Categorical groups were compared using the chi-square ($\chi 2$) test. Statistical significance was set at $P < 0.05$ (two-tailed). Analyses were performed using SPSS software (version 22.0 for Windows).

## Result:

The current clinico-radiographic study assesses and compares the effectiveness of T-PRF as a membrane along with xenograft (Bio Oss)® and xenograft (Bio Oss)® alone with Open Flap Debridement (OFD) for treating endo-perio lesions with intrabony defects. At the end of 6 months, 36 sites were analyzed. Of the 36 patients, 25 were female and 11 were male, with a mean age group of43.58 ± 8.05 in Group A,44.42 ± 6.07 in Group B, and 41.92 ± 6.36 in Group C (Table 1).

All patients showed uneventful postoperative healing with good soft-tissue response to all treatments. There was a significant reduction in Plaque Index (PI):In Group A, the mean PI decreased from 2.39 ± 0.23 at baseline to 1.12 ± 0.04 at 6 months, with a mean reduction of 1.28, which was statistically significant ($t = 19.39$, $p < 0.001$), in Group B demonstrated a significant decline in PI from 2.44 ± 0.24 to 1.10 ± 0.05, with a mean change of 1.34 ($t = 21.08$, $p < 0.001$). and in Group C PI reduced from 2.45 ± 0.07 at baseline to 1.09 ± 0.07 at 6 months, showing the largest mean reduction of 1.36, which was also highly significant ($t = 47.24$, $p < 0.001$). Similarly, the Gingival Index (GI) improved: Group A reduced from2.23 ± 0.30to 1.13 ± 0.34,Group B reduced from 2.38 ± 0.11 to 0.82 ± 0.10, Group C reduced from 2.38 ± 0.23 to 0.53 ± 0.12.Additionally, the Probing Pocket Depth (PPD) showed positive changes: Group A decreased from 6.58± 0.67 to 4.17 ± 0.39, Group B decreased from 7.42 ± 0.67 to 3.08 ± 0.67, Group C decreased from 7.17 ± 0.58 to 2.58 ± 0.51. Finally, the Relative Attachment Level (RAL) gain was observed: Group A improved from 6.25± 0.62 to 4.25 ± 0.87, Group B improved from 6.58 ± 0.51 to 3.50 ± 0.80, Group C improved from 6.50 ± 0.67 to 2.83 ± 0.83 (Table 2).

Intragroup comparison of site-specific PPD and RAL showed a statistically significant improvement over 6 months for both the groups ($P < 0.001$). PPD and CAL did not show any statistically significant difference between the groups at baseline. On intergroup comparison, PPD and RAL after 6 months decreased significantly ($P < 0.05$ or $P < 0.01$) in both Group B and Group C.

The percentage of bone fill at 6 months showed a clear and statistically significant difference among the three groups.

Group A demonstrated a mean bone fill of 57.76% ± 4.43, whereas Group B showed a substantially higher mean value of 78.02% ± 6.31. The highest percentage of bone fill was observed in Group C, with a mean of 86.34% ± 1.43.

One-way ANOVA revealed a highly significant intergroup difference ($F = 126.45$, $p < 0.001$), indicating that the type of intervention had a significant impact on bone regeneration. Overall, Group C achieved the maximum bone fill, followed by Group B, while Group A showed the least bone fill at 6 months, highlighting the superior regenerative efficacy in Group C. (Table 3)

The intragroup comparison of bone density (Hounsfield Units) showed a statistically significant increase from baseline to 6 months in all three groups.

In Group A, mean bone density increased from 1047.29 ± 73.29 HU at baseline to 1105.63 ± 92.78 HU at 6 months, with a mean gain of 58.33 HU, which was statistically significant ($t = -3.50$, $p = 0.005$).Similarly, Group B demonstrated an increase from 1049.21 ± 56.72 HU to 1148.32 ± 2.52 HU, yielding a mean increase of 99.11 HU, which was highly significant ($t = -6.07$, $p < 0.001$).

The greatest improvement was observed in Group C, where bone density rose from 1044.10 ± 49.50 HU at baseline to 1214.29 ± 28.75 HU at 6 months, corresponding to a mean increase of 170.19 HU, which was highly significant ($t = -10.20$, $p < 0.001$).

Table 1 - Demographic characteristics of three groups

Table 2 - Comparison of mean difference from baseline to 6 months for different clinical parameters between all the groups.

Table 3- Intra and Inter group comparisons, (mean ± standard deviations and mean difference) showing radiographic changes at baseline and after 6 months.

## Discussion:

Intrabony defects along with endo-perio lesions are one of the advanced complication of periodontal disease. Several modalities have been proposed for the treatment of intra bony defects, including open flap debridement (OFD), bone grafts, barrier membranes, enamel matrix derivatives (EMD), growth factors, and platelet concentrates, which have resulted in reduced periodontal pockets, clinical attachment loss, and regeneration of new bone, cementum, and periodontal fibers.[14]

Xenografts are a biocompatible and structurally similar alternative to human bone by leaving behind an inorganic mineral matrix that serves as a scaffold.[15] Platelet concentrates are considered better biomaterial because they continuously release growth factors over time, essential for activating nearby progenitor cells, resulting in periodontal regeneration and tissue repair.

As compared to other platelet derived growth factors titanium

platelet – rich fibrin (T- PRF) has remarkable osseointegration properties. Reports indicate that T-PRF along with bone graft acts a membrane by staying in place for a month, preventing tissue resorption through the development of a denser, tighter fibrin scaffold.[16.17] Along with the bone graft and growth factors, MTA as a sealent during root canal treatment is considered better as compared to other sealants due to its superior sealibility against microleakage and regeneration of PDL.

In the effectiveness of regenerative therapy, tooth shape (single or multiple roots), defect topography , and flap configurations are crucial components.[18] Since, molar teeth have complicated root canal morphology and furcation defects, therefore only single root and single canal teeth were included in the study. Schincaglia et al. (2017) researched single versus double flap approach in periodontal regenerative treatment and concluded that any significant differences were not found between groups at 6-months, as for changes in PD and radiographic defect fill.[19] In our study, to assess the radiographic defect fill, CBCT has been used for the assessment of healing and bone filling at baseline and after 6 months.

Strict follow-up protocols were followed during the study, resulting in an overall decrease in parameters such as Plaque Index (PI) and Gingival Index (GI) in three groups from baseline to 6-month marks. In the current study, a statistically significant improvement ($P < 0.01$ or $P < 0.001$) was observed in the Plaque Index at 6-month follow-up periods. A comparison of the PI between the two groups at baseline revealed no significant differences ($P > 0.05$), indicating similar plaque scores in three groups, which suggests comparability at the start of the study (Table 4 and Graph 5).

The mean PPD reduction was maximum in the group treated with xenograft (Bio Oss)® and T-PRF (56.8%) followed by the group treated with xenograft (Bio Oss)® alone (55.0%) followed by the group treated with OFD alone (52.0 %). In our study, the xenograft and T-PRF groups showed a further decrease in PD and IBD depth compared to the OFD alone group after six months of follow up.

Radiographic parameters were assessed using CBCT as it provides a noninvasive method for assessing the hard tissue. Radiography (PA) and direct measurements using a periodontal probe based on a study carried out by Kelly A. Misch et al. (2006)[23]; CBCT offers the advantage of observing the periodontal osseous defects in multiple directions.

The intragroup comparison of % bone fill showed significant differences ($P < 0.001$) from baseline to 6 months in Group A and B. The comparison between the groups revealed a significantly greater percentage of bone fill in Group C compared to Group B and Group A, indicating that defects treated with T-PRF along with xenograft yielded better results. As T-PRF is more denser, therefore it forms a thicker fibrin meshwork and releases growth factors for a longer duration.

Similar findings were observed in a study by Gülbahar Ustaoğlu et al. (2020)[26] where significant improvements were noted in defect depth probing, percentage defect depth probing, attachment gain, and defect fill in the group treated with xenograft along with T-PRF as a membrane, for treating periodontal infrabony bone defects.

The current study supports the findings by Pradeep et al. (2017)[20] who assessed platelet-rich plasma and PRF in the treatment of 3-wall IBDs and reported similarities in PD decrease, CAL gain, and bone fill in sites treated with PRF or PRP combined with OFD. The fibrin discharges different growth factors and promotes the movement of cells that form tissues, including fibroblasts and endothelial cells that play roles in angiogenesis and differentiation in the osteoblasts, thus improving wound repair and regeneration of periodontal tissues.[24]

Also, no difference was found between the T-PRF along with xenograft and xenograft groups alone in terms of PD and CAL, while the T- PRF along with xenograft group was found to have a greater decrease in IBD depth. Besides, further reduction in IBD depth in the T-PRF group compared to xenograft can be explained by the fact that the graft materials resorb later and have greater radiopacity than T-PRF. Also, no significant difference between the T-PRF and Xenograft groups in terms of PD and CAL has been found. This may be explained by the mechanical fibrin's adhesive characteristics aiding in the stabilization of the flap and the increase of growth factors and neovascularization.[25]

## Conclusion:

The study concluded that using T-PRF as a membrane along with xenograft improved the bone regeneration outcomes in endo-perio lesions along with intrabony defects resulting in better healing of the bone defects. Additionally, T-PRF is a growth factor that is simple to prepare, a viable adjunctive for graft materials in the therapy of IBDs.

As per the findings of our study best recommended treatment is combination of OFD along with xenograft (Bio Oss)® and T-PRF as membrane in case of endo-perio lesion with intrabony defect.

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## Legends

Table 1 - Demographic characteristics of three groups

| Variable | Group A (n=12) (%) | Group B (n=12) (%) | Group C (n=12) (%) | $F/\chi^2$ value | *P* Value |
|---|---|---|---|---|---|
| Age (yrs) | 43.58 ± 8.05 | 44.42 ± 6.07 | 41.92 ± 6.36 | 0.41 | 0.667 |
| Sex: | | | | | |
| Female | 8 (60.0) | 7 (67.0) | 7 (67.0) | 0.23 | 0.890 |
| Male | 6 (40.0) | 5 (33.0) | 5 (33.0) | | |

Table 2 - Comparison of mean difference from baseline to 6 months for different clinical parameters between all the groups.

| Clinical parameters and groups | | N | Baseline | 6 months | Mean | p-value |
|---|---|---|---|---|---|---|
| Plaque Index | Group A (OFD) | 12 | 2.39 ± 0.23 | 1.12 ± 0.04 | 1.28 | < 0.001 |
| | Group B (OFD + Xenograft) | 12 | 2.44 ± 0.24 | 1.10 ± 0.05 | 1.34 | < 0.001 |
| | Group C (OFD + Xenograft + T-PRF) | 12 | 2.45 ± 0.07 | 1.09 ± 0.07 | 1.36 | < 0.001 |
| Gingival Index | Group A (OFD) | 12 | 2.23 ± 0.30 | 1.13 ± 0.34 | 1.11 | < 0.001 |
| | Group B (OFD + Xenograft) | 12 | 2.38 ± 0.11 | 0.82 ± 0.10 | 1.49 | < 0.001 |
| | Group C (OFD + Xenograft + T-PRF) | 12 | 2.38 ± 0.23 | 0.53 ± 0.12 | 1.85 | < 0.001 |
| Probing Pocket Depth | Group A (OFD) | 12 | 6.58± 0.67 | 4.17 ± 0.39 | 2.42 | < 0.001 |
| | Group B (OFD + Xenograft) | 12 | 7.42 ± 0.67 | 3.08 ± 0.67 | 4.33 | < 0.001 |
| | Group C (OFD + Xenograft + T-PRF) | 12 | 7.17 ± 0.58 | 2.58 ± 0.51 | 4.58 | < 0.001 |
| Relative attachment level | Group A (OFD) | 12 | 6.25± 0.62 | 4.25 ± 0.87 | 2.00 | < 0.001 |
| | Group B (OFD + Xenograft) | 12 | 6.58 ± 0.51 | 3.50 ± 0.80 | 3.08 | < 0.001 |
| | Group C (OFD + Xenograft + T-PRF) | 12 | 6.50 ± 0.67 | 2.83 ± 0.83 | 3.67 | < 0.001 |

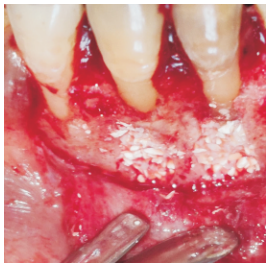
Table 3- Intra and Inter group comparisons, (mean ± standard deviations and mean difference) showing radiographic changes at baseline and after 6 months.

| CEJ to Base of defect | Baseline | 6 months | p-value | Difference |
|---|---|---|---|---|
| Group A (OFD) | 6.25± 0.62 | 4.25 ± 0.87 | < 0.001 | 2.57 |
| Group B (OFD + Xenograft) | 6.58± 0.51 | 3.50 ± 0.80 | < 0.001 | 3.43 |
| Group C (OFD + Xenograft + T-PRF) | 6.50± 0.67 | 2.83 ± 0.83 | < 0.001 | 4.38 |
| **Root Apex to Base of defect** | **Baseline** | **6 months** | **p-value** | **Difference** |
| Group A (OFD) | 3.41± 0.26 | 2.34 ± 0.18 | < 0.001 | 1.07 |
| Group B (OFD + Xenograft) | 2.71 ± 0.29 | 2.34 ± 0.24 | < 0.001 | 0.37 |
| Group C (OFD + Xenograft + T-PRF) | 2.56 ± 0.31 | 2.27 ± 0.24 | < 0.001 | 0.29 |
| **Maximum mesiodistal width of the Base of Defect** | **Baseline** | **6 months** | **p-value** | **Difference** |
| Group A (OFD) | 3.48± 0.64 | 2.02 ± 0.22 | < 0.001 | 1.47 |
| Group B (OFD + Xenograft) | 3.99 ± 0.47 | 1.18 ± 0.31 | < 0.001 | 2.81 |
| Group C (OFD + Xenograft + T-PRF) | 3.91 ± 0.39 | 0.42 ± 0.24 | < 0.001 | 3.50 |
| **Bone density(HU)** | **Baseline** | **6 months** | **p-value** | **Difference** |
| Group A (OFD) | 1047.29 ± 73.29 | 1105.63 ± 92.78 | < 0.001 | 58.33 |
| Group B (OFD + Xenograft) | 1049.21 ± 56.72 | 1148.32 ± 2.52 | < 0.001 | 99.11 |
| Group C (OFD + Xenograft + T-PRF) | 1044.10 ± 49.50 | 1214.29 ± 28.75 HU | < 0.001 | 170.19 |

| Group | Bone fill (%) Mean ± SD (n=10) | F Value | *P* Value |
|---|---|---|---|
| GroupA (OFD) | 57.76% ± 4.43 | 126.45 | 0.6353 |
| GroupB (Xenograft + OFD) | 78.02% ± 6.31 | | |
| GroupC (OFD + Xenograft + T-PRF) | 86.34% ± 1.43. | | |

Figures

1. Crevicular incision along with two vertical incision of Group B
2. Full thickness flap raised of Group B
3. Placement of xenograft (Bio oss)® of Group B
4. Sutures placed of Group B
5. Placement of T-PRF membrane of Group C
6. CBCT at Baseline and after 6 months of Group A
7. CBCT at Baseline and after 6 months of Group B
8. CBCT at Baseline of and after 6 months of Group C



GROUP B (OFD + Xenograft)

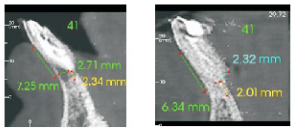
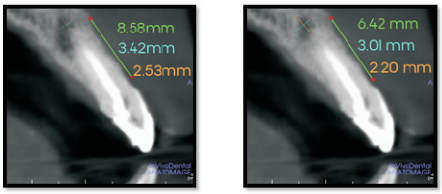
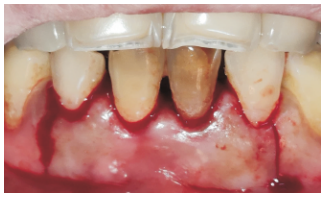
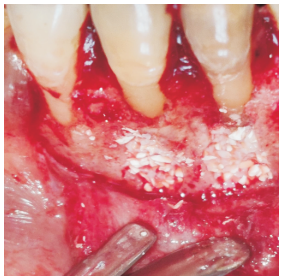


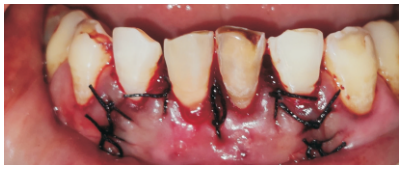

Fig. 24: BASELINE Fig. 25: 6 MONTHS POST OPERATIVE

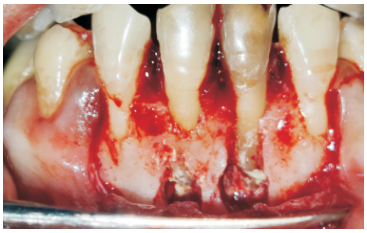
GROUP A (OFD)









GROUP C (OFD + XENOGRAFT + T-PRF)