International Journal of Research in Health and Allied Sciences

Journal Home Page: www.ijrhas.com

Official Publication of "Society for Scientific Research and Studies" [Regd.]

ISSN: 2455-7803 Index Copernicus value [ICV] = 68.10;

Original Research

Comparative Evaluation Of Platelet Rich Fibrin With And Without Intra-Marrow Penetration In The Treatment Of Intra-Bony Defects – A Clinical And Radiographic Study

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ABSTRACT:

Periodontitis causes inflammation and destruction of the periodontium resulting in progressive bone loss and pocket formation or recession of gingival. The ultimate goal of periodontal therapy is the regeneration of periodontium to restore lost form, function and esthetics. The aim of the present study was to evaluate the contribution of intramarrow penetration to the clinical and radiolographic outcomes of open flap debridement with platelet rich fibrin in the treatment of periodontal intrabony defects. A total of 20 sites in 10 subjects suffering from chronic periodontitis showing evidence of clinical probing depth ≥5mm with radiographic evidence of almost identical intrabony defects bilaterally were selected from amongst those reporting to the department of Periodontology, Punjab Government Dental College and Hospital, Amritsar. The sites were divided randomly into 2 groups. In group1, open flap debridement followed by placement of Platelet rich fibrin was done and in group 2, open flap debridement with intramarrow penetration followed by placement of platelet rich fibrin was done. All treated sites showed remarkable reduction in probing depth, clinical attachment gain and radiographic fill of periodontal defects. The combination of intramarrow penetration and platelet rich fibrin demonstrated better results in clinical as well as radiographic parameters than platelet rich fibrin alone. The present study has concluded positive clinical and radiographic outcomes following treatment with the combination of intramarrow penetration and PRF in intrabony defects, supporting a possible role in the future.

Key words: Intra-bony defects, Fibrin

Received: 14 March, 2021 Accepted: 20 March, 2021

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This article may be cited as: Bharti V, Nagi PK, Singh M. Comparative Evaluation Of Platelet Rich Fibrin With And Without Intra-Marrow Penetration In The Treatment Of Intra-Bony Defects – A Clinical And Radiographic Study. Int J Res Health Allied Sci 2021; 7(2):87-94.

INTRODUCTION

Intrabony defects are common in periodontitis and thus, there is considerable interest in approaches that will convert such defects, at risk for disease progression, to easily maintainable shallow probing sites. This can be achieved by either resective or regenerative approaches, with the latter considered the ideal treatment. Among the various surgical techniques used to achieve the ideal biologic conditions required for periodontal regeneration, open flap debridement or access flap surgery was among the earliest procedures used and has been shown to result in successful treatment of intrabony defects. However, the reported clinical outcomes of open flap debridement may vary and there is opportunity to improve its predictability in the treatment of intrabony defects. Several authors have advocated the use of intramarrow penetration, also known as decortication, as a means to improve the local blood vessel and progenitor cell supply and, consequently, the outcomes of surgical procedures used to treat intrabony defects (Crea A et al. 2014).

Intramarrow penetration is the intentional drilling of holes through the cortical bone into the cancellous bone or the removal of cortical bone to expose cancellous bone. (Greenstein et al. 2009). The cortical bone plate may be a temporary hindrance for

access of desirable cell and tissue components from the endosteal compartment, since resorption of the cortical bone must take place before access to the bone forming components is achieved. Thus, perforations or removal of the cortical bone plate may be an advantage for a successful result. Another reason for perforating the cortical bone would be to promote bleeding and blood clot formation in the wound area, which has been regarded important for guided bone regeneration (Lundgren et al. 2000). Vascularization or angiogenesis constitutes the first phase of ossification. Decortication of the cortical bone alone is enough to form new bone tissue due to hemorrhage on the bone surface. Cortical bone decortication or perforation improves bleeding and clot formation in the wound area, allowing the migration of angiogenic and osteogenic progenitor cells into the space, which may provide a therapeutic advantage (Acar et al. 2016).

The objectives of periodontal regenerative therapy are to reconstitute the bone, cementum, and periodontal ligament on a previously diseased root surface (Choukroun et al. 2006). Different modalities of regenerative treatment have been used with varying success to accomplish the reconstruction of lost attachment apparatus in intraosseous defects (Trombelli et al. 2002). Platelet rich fibrin (PRF) is a second generation platelet concentrate, which is generated from centrifuged blood and is strictly autologous. The combination of fibrins and cytokines within platelet rich fibrin becomes a powerful bioscaffold with an integrated reservoir of growth factors for tissue regeneration. The suitability of platelet rich fibrin as a biologically active scaffold has been illustrated in a number of studies revealing proliferation and differentiation of osteoblasts and gingival fibroblasts. Clinical studies have demonstrated that platelet rich fibrin promotes soft tissue and bone regeneration as well as periodontal tissue regeneration (Li Qi et al. 2013).

Specifically, the adjunctive use of intramarrow penetration in the treatment of intrabony defects by open flap debridement has not been much investigated in clinical trials. Therefore, the purpose of this study is to investigate the contribution of intramarrow penetration to the clinical and radiographic outcomes of open flap debridement with PRF in the treatment of intrabony defects.

Materials and methods :

20 sites in 10 chronic periodontitis patients showing clinical evidence of almost identical bilateral intrabony defects were selected from amongst the patients reporting to The Department of Periodontology, Punjab Government Dental College and Hospital, Amritsar, on the basis of following criteria :

- Patients who are between 30 - 55 years of age.
- Patients who are systemically healthy.
- Patients with presence of almost identical bilateral intrabony defects based on radiographic observations with probing pocket depth of ≥ 5mm.
- Patients having sufficient platelet count for platelet rich fibrin preparation.
- Patients who showed acceptable oral hygiene during pre-surgical (phase I therapy) and are cooperative.

All subjects received verbal information regarding the procedure and written informed consent was obtained before the procedure.

Pre-surgical therapy:

A general assessment of selected subjects was made through their history ,clinical examination and routine investigations. At the initial visit, each patient underwent a full-mouth supra and subgingival scaling and root planing. In the first visit, all patients were given careful instructions regarding proper oral hygiene maintenance. Six-week post scaling and root planing, a periodontal evaluation was done to confirm the desired sites for the study. The following parameters were assessed: 1.Clinical parameters i.e. Probing pocket depth and Clinical attachment level , 2. Radiographic parameters : Linear bone fill.

Clinical parameters were assessed using a UNC-15 graduated periodontal probe and were recorded to the nearest millimeter at baseline, 3 months and 6 months post-operatively. Defect specific assessments were made at the deepest point of the defect. A customized occlusal stent was used as a fixed reference point to standardize the point of entry and direction of insertion of periodontal probe into the gingival sulcus. Vertical measurements for determination of probing pocket depth, clinical attachment level were measured from:

- Fixed reference point to the gingival margin.
- Fixed reference point to the cementoenamel junction.
- Fixed reference point to the base of the pocket.

Using above measurements following parameters were calculated as:

Pocket probing depth:

It was calculated by subtracting distance of fixed reference point to gingival margin from distance of fixed reference point to the base of the pocket.

Clinical attachment level:

It was calculated by subtracting distance of fixed reference point to the cemento-enamel junction from distance of fixed reference point to the base of the pocket.

Radiograhic parameters were recorded using RVG at baseline before surgery and again recorded at 6 months post-operatively using paralleling cone technique. The measurements included the distance from the cemento-

enamel junction to the base of the defect, distance from cemento-enamel junction to the alveolar crest and the distance from the alveolar crest to the base of the defect. These measurements were used to calculate as Linear bone fill**.** It was calculated as the difference between the values of the distance from the cemento-enamel junction to the base of defect at 6 months and baseline.

Study design:

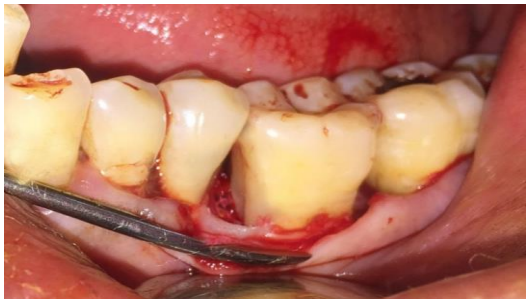
Selected sites were randomly divided into two groups: In group1, open flap debridement followed by placement of Platelet rich fibrin was done. In group 2, open flap debridement with Intramarrow penetration followed by placement of Platelet rich fibrin was done. The recall appointments were made at 3 months and 6 months.

Surgical management:

After administration of local anesthesia a sulcular incision was given and a full thickness mucoperiosteal flap was elevated on facial and lingual side and the osseous defects were thoroughly debrided using hand instrumentation with curettes and scalers and if required, with ultrasonic scalers and irrigated with sterile saline. In Group 1, the flap was presutured using 3-0 black braided silk sutures without tying the knot. Platelet rich fibrin was placed in the defect and the flap was closed by tying the knot of suture. In Group 2, the intrabony defect was penetrated using a round carbide bur to reach the marrow space, multiple perforations were performed not closer than 1 mm from each other and deep enough to obtain bleeding from the spongiosa. Then the flap was presutured using 3-0 black braided silk sutures without tying the knot. Platelet rich fibrin was placed in the defect and the flap was closed by tying the knot of suture. The surgical site was dried and non eugenol periodontal dressing was placed over the surgical sites. Post-operative instructions were given to the patients as follows :

- To take medications as and when prescribed :
  - Amoxicillin clavulanate 625 mg orally thrice daily for five days.
  - Ibuprofen 400mg orally thrice daily for five days.
  - 15ml of 0.12% Chlorhexidine gluconate mouthwash for 30 seconds twice daily after meals for 2 weeks.
- To apply intermittent cold fomentation immediately after periodontal surgery for 24 hours.
- To follow diet instructions as advised.
- To refrain from mastication and mechanical plaque control in the operated area for a period of 7-10 days.
- To report for the removal of sutures and periodontal dressing after one week postoperatively.

Showing the intrabony defect after intramarrow penetration



Post- operative assessment:

Pocket probing depth and clinical attachment level were recorded at 3 months and 6 months post operatively, employing standardized technique using a customized acrylic stent as a fixed reference point. Radiovisiography (RVG) to assess the linear bone fill was taken at 6 months post-operatively. The compiled data was put to statistical analysis.

Results:

Clinical parameters including probing pocket depth, clinical attachment level of selected sites were recorded using customized acrylic occlusal stents at baseline before surgery and again at 3 months and at 6 months postoperatively. Radiographic parameters were recorded using radiovisiography at baseline before surgery and again recorded at 6 months postoperatively. The observations thus recorded were put to statistical analysis. Table-1 shows intragroup comparison of mean change in probing depth reduction. In Group 1, the mean reduction in probing pocket depth from baseline to 3 months was 1.95±0.43mm, from baseline to 6 months was 2.90±0.51mm, and from 3 months to 6 months was 0.95±0.28mm which were all statistically highly significant. In Group 2, the mean reduction in probing pocket depth from baseline to 3 months was 2.70±0.34mm, from baseline to 6 months was 4.10±0.45mm, and from 3 months to 6 months was 1.40±0.39mm which were all statistically highly significant. Table-2 shows the intergroup comparison of mean probing pocket depth between Group 1 and Group 2. The mean difference in change in probing pocket depth between Group 1 and Group 2 from baseline to 3 months was -0.75±0.54mm, from baseline to 6 months was -1.20±0.58mm, from 3 to 6 months was -0.45±0.49mm, all were statistically significant.

Table-3 shows intragroup comparison of gain in clinical attachment level in group 1, the mean gain in clinical attachment level from baseline to 3 months was 1.85 ± 0.47 mm, while baseline to 6 months was 2.90 ± 0.61mm and from 3 to 6 months was 1.05 ± 0.28mm,

all the three being highly statistically significant. In group 2 the mean gain in clinical attachment level from baseline to 3 months was 2.65 ±0.33mm, from baseline to 6 months was 4.05±0.43mm and from 3 months to 6 months was 1.40± 0.39mm, all being statistically highly significant. Table-4 shows the intergroup comparison of mean clinical attachment level gain between Group 1 and Group 2. The mean difference in clinical attachment level gain between Group 1 and Group 2 from baseline to 3 months was -0.80 ± 0.58mm, which is statistically significant, from baseline to 6 months was -1.15±0.66mm, which is statistically highly significant and from 3 to 6 months was 0.35±0.47mm, which is statistically significant.

Table-5 shows the intergroup comparison of mean linear bone fill of the intrabony defects between Group 1 and Group 2 . In Group 1, the linear bone fill from baseline to 6 months was 0.58±0.07 mm while in Group 2 it was 1.17±0.20 mm. The mean difference in linear bone fill of the intrabony defects between Group 1 and Group 2 from baseline to 6 months was -0.59±0.21 mm which is statistically highly significant.

Table - 1; **Mean change in probing depth reduction at different time interval within both groups (in mm)**

Time	Group I			Group II		
	Mean ± SD	t value	P value	Mean ±SD	t value	P value
Baseline to 3 months	1.95±0.43	14.08	0.001	2.70±0.34	24.42	0.001
Baseline to 6 months	2.90±0.51	17.75	0.001	4.10±0.45	28.21	0.001
3 to 6 months	0.95±0.28	10.58	0.001	1.40±0.39	11.22	0.001

**p<0.001; Highly significant

Table -2 Mean change in probing depth reduction at different time intervals between both groups (in mm)

Time	Group I	Group II	Difference Mean±SEm	t-value	P value
Baseline to 3 months	1.95±0.43	2.70±0.34	-0.75±0.54	-4.392	0.002
Baseline to 6 months	2.90±0.51	4.10±0.45	-1.20±0.58	-0.780	0.001
3 to 6 months	0.95±0.28	1.40±0.39	-0.45±0.49	-0.094	0.019

*p<0.05; Significant; **p<0.001; Highly significant

Table-3: Mean gain in clinical attachment level at different time intervals within both groups (in mm)

Time	Group I			Group II		
	Mean ± SD	t value	P value	Mean ± SD	t value	P value
Baseline to 3 months	1.85±0.47	12.33	0.001	2.65±0.33	24.83	0.001
Baseline to 6 months	2.90±0.61	14.92	0.001	4.05±0.43	29.25	0.001
3 to 6 months	1.05±0.28	11.69	0.001	1.40±0.39	11.22	0.001

Table -4: **Mean gain in clinical attachment level at different time intervals between both groups (in mm)**

Time	Group I	Group II	Difference Mean±SEm	t-value	P value
Baseline to 3 months	1.85±0.47	2.65±0.33	-0.80±0.58	-4.311	0.002
Baseline to 6 months	2.90±0.61	4.05±0.43	-1.15±0.66	-5.438	0.001
3 to 6 months	1.05±0.28	1.40±0.39	-0.35±0.47	-2.333	0.045

*p<0.05; Significant; **p<0.001; Highly significant

Table- 5: Comparison of linear bone fill from baseline to 6 months postoperatively within both groups (in mm)

Group	Linear bone fill			
	Mean ± SD	Difference	t value	P value
Group 1 (Control)	0.58±0.07	-0.59±0.21	-8.546	0.001
Group 2 (Test)	1.17±0.20			

DISCUSSION

Periodontal regeneration is a complex multifactorial process involving biologic events like cell adhesion, migration, proliferation, and differentiation in an orchestrated sequence (Giannobile et al. 1996). Among the various surgical techniques used to achieve the ideal biological conditions required for periodontal regeneration, open flap debridement (OFD) or access flap surgery was among the earliest procedures used and has been shown to result in successful treatment of intrabony defects (Caffesse, Sweeney and Smith 1986). However, the reported clinical outcomes of OFD may vary and there is opportunity to improve the predictability of OFD in the treatment of intrabony defects (Graziani et al. 2012). Several authors have advocated the use of intramarrow penetration (IMP), also known as decortication, as a means to improve the local blood vessel and progenitor cell supply and, consequently, the outcomes of surgical procedures used to treat intrabony defects (Crea et al. 2014). Lee et al. (2014) showed in their study that intramarrow perforation may improve the amount of newly formed bone and accelerate angiogenesis. So a combination of IMP and open flap debridement can be more beneficial in treating periodontal intrabony defects. Favourable results have been obtained by Crea et al. (2014) and Ibrahim, El-Moula Ali and El Ghaysh (2017) who studied the validity of intramarrow penetration with open flap debridement in the treatment of intrabony defects in patients with chronic periodontitis.

There is evidence that the presence of growth factors and cytokines in platelets play key roles in inflammation and wound healing (Giannobile et al. 1996). This has led to the idea of using platelets as therapeutic tools to improve tissue repair particularly in periodontal wound healing. Several studies show rapid and accelerated wound healing with the use of PRF than without it. PRF has emerged as one of the promising regenerative materials in the field of periodontics (Preeja and Arun 2014). It can be used in various procedures such as for the treatment of periodontal intrabony defects, degree II furcation, sinus-floor augmentation during implant placement, in a coronally displaced flap in multiple gingival recessions (Sharma and Pradeep 2011).

As the adjunctive use of intramarrow penetration in the treatment of intrabony defects by open flap debridement has not been much investigated in clinical trials, this study was done to evaluate the contribution of intramarrow penetration to the clinical and radiolographic outcomes of open flap debridement with platelet rich fibrin in the treatment of periodontal intrabony defects. The clinical and radiographic parameters were evaluated in both the groups as described earlier and the data thus recorded was compiled, tabulated and statistically analysed to arrive at the results which were as follows :

Pocket probing depth

On intergroup comparison, more pocket depth reduction was seen in Group 2 as compared to Group 1 at all time intervals. The difference of mean probing pocket depth reduction from baseline to 3 months was -0.75±0.54, from baseline to 6 months was -1.20±0.58 and between 3 to 6 months was -0.45±0.49 and the values were statistically highly significant. These results are in accordance with those of Crea et al. (2014), who reported similar statistically significant reduction in probing depth following treatment of intrabony defects with open flap debridement and intramarrow penetration.

Clinical Attachment level

The mean clinical attachment level gain in Group 2 was more than Group 1 at all time intervals. On intergroup comparison, the difference of mean clinical attachment level gain in group 1 and group 2 from baseline to 3 months was -0.80±0.58 which is statistically significant, from baseline to 6 months was -1.15±0.66 which is highly significant ,from 3 to 6 months was -0.35±0.47 which is significant. The results are in accordance with the observations made by (Crea et al. 2014), (Ibrahim, El-Moula Ali and El Ghaysh 2017), (Debnath and Chatterjee 2018) and (Saini et al. 2020).

Linear bone fill

On intergroup comparison, better results were shown by group 2 as compared to group 1 and the results were highly significant. Mean defect resolution between baseline and 6 months was -0.59±0.21mm which is highly significant. Similar results were seen in studies conducted by (Crea et al. 2014), (Ibrahim, El-Moula Ali and El Ghaysh 2017) ,(Debnath and Chatterjee 2018) and (Saini et al. 2020).

In our study, the combination of intramarrow penetration and PRF demonstrated better results in clinical as well as radiographic parameters. Future long term studies with larger sample size should be carried out to further explore the role of intramarrow penetration in the management of periodontal intrabony defects.

CONCLUSIONS

The purpose of the present study was to compare the clinical and radiographic efficacy of platelet rich fibrin with and without intramarrow penetration in the treatment of intrabony defects. In a split mouth design total of 10 subjects suffering from chronic periodontitis showing evidence of clinical probing depth ≥5mm with radiographic evidence of almost identical intrabony defects bilaterally were selected from amongst those

reporting to the department of Periodontology, Punjab Government Dental College and Hospital, Amritsar. Following phase I therapy the subjects were re-evaluated. The sites were divided randomly into 2 groups. In group1, open flap debridement followed by placement of platelet rich fibrin was done and in group 2, open flap debridement with intramarrow penetration followed by placement of platelet rich fibrin was done. Clinical parameters including probing pocket depth, clinical attachment level of selected sites were recorded using customized acrylic occlusal stents at baseline before surgery and again at 3 months and at 6 months postoperatively. Radiographic parameters were recorded using radiovisiography at baseline before surgery and 6 months postoperatively. The radiographic measurements included the distance from CEJ to the base of the defect. Using above measurements at baseline and 6 months postoperatively the values of linear bone fill were calculated. The data thus recorded was compiled, tabulated and statistically analysed to arrive at the results. Following conclusions were drawn from the results:

- There was statistically significant probing pocket depth reduction found in both groups from baseline to 3 months, baseline to 6 months and between 3 months to 6 months. On comparison, group 2 showed more probing depth reduction than group 1 at all time intervals which was statistically significant.
- There was statistically significant clinical attachment level gain found in both groups from baseline to 3 months, baseline to 6 months and between 3 months to 6 months. On comparison, group 2 showed more clinical attachment level gain than group 1 at all time intervals which was statistically significant.
- There was statistically significant linear bone fill found in both groups from baseline to 6 months. On comparison, group 2 showed more linear bone fill which was statistically significant.

Within the limits of the study it may be concluded that the present 6 months randomized split mouth controlled clinical trial has successfully achieved the goals of periodontal therapy including the reduction or elimination of tissue inflammation induced by dental plaque and its by-products as well as correction of defects produced by disease process. Though the results in this study are significant for both the groups but the combination of intramarrow penetration and PRF demonstrated better results in probing pocket depth reduction, clinical attachment level gain and linear bone fill as compared to PRF alone in the treatment of periodontal intrabony defects. In this study, no complication was reported with intramarrow penetration. However, histological studies are further needed to establish the exact nature of this clinical attachment gain. Future long term studies with a larger sample size should be carried out to further explore the role of intramarrow penetration in the management of periodontal intrabony defects and to verify the results of in vitro studies in a clinical study.

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