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Original Research Article

Can Platelet Rich Fibrin enhance the role of alloplastic bone graft in socket preservation: A Randomized Clinical Trial

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ABSTRACT

Background: Socket preservation aims at limiting the resorptive events that occurs as a consequence of tooth extraction. Besides the use of autologous and commercially available graft materials, there has been an increasing shift towards the utilization of biological substitutes like Platelet Rich Fibrin for socket preservation.

Materials and Methods: A randomized clinical trial was conducted in fourteen extraction sites, out of which seven were filled with alloplastic bone graft material alone (control group) and rest were filled with alloplastic bone graft material along with PRF (test group). The sites were assessed clinically and radiographically at baseline and six months post treatment. The mean +/- SD was calculated for alveolar ridge width and height.

Results: Although alveolar ridge width and height reduced significantly in the span of six months in both test and control groups, there was no statistically significant intergroup difference in both groups at six months post treatment in these parameters. Wound healing was comparatively better in the test group compared to the control group initially, but at the end of the study period both groups attained same level of healing.

Conclusion: Even though alveolar socket preservation has a clinically significant effect on preserving the residual ridge dimensions, use of PRF as an adjunct to alloplastic bone graft in socket preservation procedure has no additional benefit over alloplastic bone graft material alone.

1. Introduction

Alveolar process is the portion of the maxilla and mandible that forms and supports the tooth socket. It constitutes the most labile structure surrounding the tooth and is highly sensitive to external mechanical stimuli.[1] Being a tooth-dependent structure it shows atrophy when teeth are lost.[2,3] This loss of alveolar bone creates clinical challenges in the rehabilitive dental procedures. Hence, post extraction preservation of residual alveolar ridges has become essential, for which various techniques have been suggested.[4]

The term "Alveolar socket preservation" has been used to describe "a technique in which completely contained extraction sockets are filled with a bone substitute material and/or sealed with membranes, whereas in alveolar ridge preservation, damaged extraction sockets are also included."[5] It has been found that these procedures results in maintenance of dimensional stability of bone.[6]

A large number of studies have reported a plethora of biomaterials which can be used for socket preservation, including autologous bone, bone substitutes, autologous blood-derived products, and bioactive agents, among others.[7]

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More recently a paradigm shift has been seen towards autologous biological substitutes. These are the products created by collecting and concentrating naturally occurring cells from patients own body. Among these substitutes are the platelet concentrates which contain quantitatively enriched and functionally intact platelets.[8]

Platelet Rich Fibrin is a second generation platelet concentrate which contains 210 folds higher concentration of platelets and fibrin when compared to intact whole blood. It is associated with slow and continuous increase in cytokine levels[9] and contains multitude of growth factors exhibiting varied properties such as cell migration, attachment, proliferation and differentiation.[10] Besides, platelets and leukocytes, the fibrin matrix supporting these certainly constitutes the determining element responsible for the real therapeutic potential of PRF.

However, conflicting outcomes makes it difficult to draw conclusions on whether PRF can bring benefit on hard and soft-tissue healing in socket preservation.[11] Considering this background and healing properties of PRF this study was undertaken to evaluate the potential of PRF in socket preservation.

2. Materials and Methods

This prospective, randomized, clinical trial was conducted in the Department of Periodontology. The study was undertaken following Helsinki's guidelines for conducting randomized clinical trial. A total of 12 patients were enrolled in this study, all were above the age of 18 years and reported to the department for treatment of non-restorable, or hopeless tooth/teeth. Patients who were medically compromised, pregnant and lactating females were excluded from the study. Following enrollment, eligible patients were randomly assigned either control group (socket preservation with alloplastic bone graft material placement (Graft alone)) or test group (socket preservation with alloplastic bone graft material placement with Platelet Rich Fibrin (Graft + PRF)), using Coin and Toss method. At baseline clinical, radiographic records were obtained and study models were fabricated. Ridge width was measured from study models using caliper at 3mm and 5 mm from the alveolar crest at three reference points (Centre of extraction site, 3mm distal to extraction site, 3mm mesial to extraction site). Ridge height was calculated with standardized intraoral peri-apical radiographs.

Surgery was performed under the local anesthesia with a solution of 2% Lignocaine with 1:2,00,000 adrenaline under all aseptic conditions. Teeth were extracted atraumatically using periotomes. Sockets were, thoroughly debrided, gently curetted and irrigation was done with sterile saline. Clinical measurements were made using UNC-15 probe. For the test group, PRF was prepared using standard protocol.[12] (Figure 1) In the control group graft was condensed into the socket and sutured while in the test

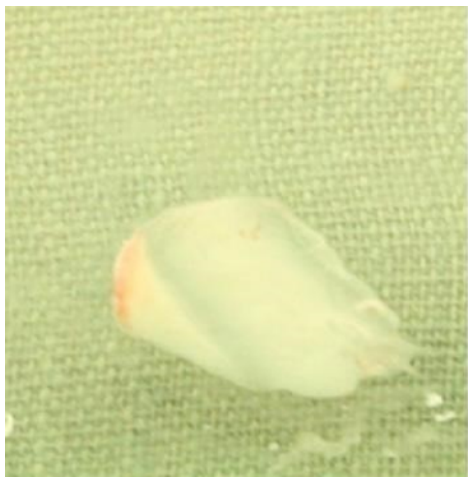

Fig. 1: Showing platelet rich fibrin membrane

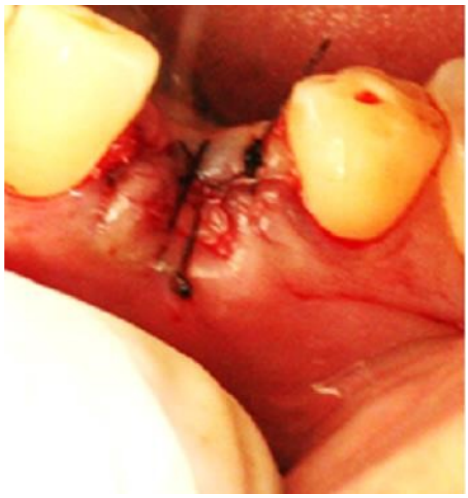

Fig. 2: Showing platelet rich fibrin membrane filled in socket and secured with suture

Fig. 3: Showing clinical evaluation at 6-months postoperative follow-up

Table 1: Inter group comparison depicting changes in alveolar socket ridge width at baseline and 3 months at 3mm, 5mm

	Control group		Test group		P value
	Mean	SD *	Mean	SD	
Alveolar socket width at 3mm+ (baseline)	11.81	1.72	10.90	1.26	0.0590(ns)#
Alveolar socket width at 5mm (baseline)	13.24	2.21	12.38	1.63	0.1603(ns)
Alveolar socket width at 3mm (6months)	9.29	2.15	9.76	1.64	0.4242(ns)
Alveolar socket width at 5mm (6months)	11.81	1.97	11.52	1.40	0.5905(ns)

*SD: Standard Deviation, # ns: non-significant, + mm: millimeter

Table 2: Inter group comparison for change in alveolar socket ridge height at baseline and 3 months

	Control group		Test group		P value
	Mean	SD	Mean	SD	
Alveolar socket height (baseline)	8.443	2.18	10.62	3.07	0.1508(ns)
Alveolar socket height (6months)	7.48	1.81	10.22	3.01	0.0614(ns)

*SD: Standard Deviation, # ns: non-significant, + mm: millimeter
Value < 0 05 considered statistically significant

Fig. 4: Showing radiographic evaluation at 6-months postoperative follow-up

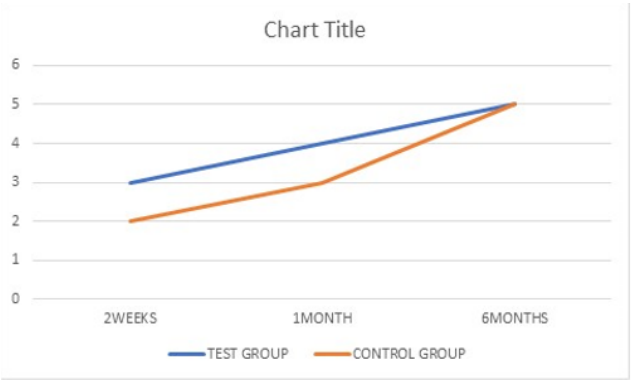

Fig. 5: Showing comparison of healing pattern observed for the test and the control group

group PRF was placed over the graft and the margins of PRF were adapted buccally and lingually. The site was then secured with suture.(Figure 2) Following surgery a short course of analgesic (Ibuprofen 400 mg twice daily) and antibiotic (Amoxicillin 500 mg thrice daily) for five days was prescribed. Patients were given detailed verbal and written postoperative and follow-up instructions. All patients were recalled at two weeks for suture removal. Healing pattern was analyzed using Landry et al scale.[13] Clinical (Figure 3), radiographic (Figure 4) evaluation was done at 1month and 6 months.

For the statistical analysis Epi info version 7 software was used, Mean and standard deviation were calculated for both test and control groups for the predefined parameters. Intragroup comparison was done using unpaired t test and for intergroup comparison paired t test was used.

3. Results

14 extraction sockets were preserved based on inclusion and exclusion criteria. With no dropouts 83.3% of male and 16.6 % of females constituted the test group and 66.7% of males and 33.3 % of females constituted the control group. Patients had a mean age of 49.00±19.95 years for control and 41.43 ± 17.61 years for test group.

The mean baseline width for control and test group decreased after 6 months at 3mm and 5mm from the alveolar crest (Table 1). Bone resorption at 3mm from alveolar crest was statistically significant for both the control group (decrease in width from11.81±1.72 mm to 9.29±2.15mm) (p value = 0.0001) and the test group (decrease in width from 10.90±1.26mm to 9.76±1.64mm)(p value = 0.0004).

Bone resorption in both groups was statistically significant with p value of 0.0001 for control group (decrease in width from 13.24±2.21 mm to 11.81±1.97 mm)

and p value of 0.0073 for test group (decrease in width from 12.38±1.63mm to 11.52±1.40 mm) at 5mm from alveolar crest. At baseline no statistically significant difference was seen in alveolar socket ridge width at 3mm and 5mm with a p value of 0.0590 (Table 1) and 0.1603 (Table 1), respectively. After 6 months, intergroup comparison showed statistically non-significant difference in alveolar socket width at 3mm (p value=0.4242) (Table 1) and 5mm (p value =0.5905) (Table 1). No statistically significant difference (p value=0.0614) (Table 2) was seen in alveolar socket height on radiographic analysis at 6 months post treatment on intergroup comparison. Although initial wound healing was comparatively better in the test group compared to the control group, at the end of the study period both groups attained same level of wound healing.(Figure 5)

4. Discussion

Alveolar bone is a dynamic and active tissue which is constantly undergoing renewal in response to various influences. In response to tooth loss, the alveolar bone loss is inevitable[14] this poses a challenge in prosthetic rehabilitation.[15,16] So, alveolar ridge preservation has been suggested to reduce the rate of bone resorption and to preserve the socket dimension.[17–19] For this purpose various biomaterials have been introduced which include autografts, allografts, xenografts.[20] Furthermore, synthetic bone materials are also being suggested, which have proven to be of increasing importance as an alternate to autogenous bone grafts.[21] Besides these there has been a paradigm shift towards the use of platelet concentrates in bone regeneration.[22] PRF has gained immense popularity since its discovery. It has a good healing potential owing to the high concentration of platelets and growth factors.[23] Thus, the present study was undertaken to clinically evaluate the socket preservation procedure following atraumatic tooth extraction using alloplastic bone graft material alone and with PRF. Current scientific evidence suggested that most of the alveolar bone loss occurs in the first few months post extraction after which the loss is gradual, which justifies the follow up period of this study.[24]

From the analysis of the present study it was observed that the alveolar bone width and height dimensions reduced significantly at the end of study period but there was no statistically significant difference in both the groups. These results were in accordance with the study conducted by Suttapreyasri et al., where the buccal and lingual marginal ridge reduction after 8 weeks of healing in PRF was less than control but not statistically significant difference was found within the groups.[25] Similarly, comparable results were observed in a study by Thakkar et al, who reported that even though intergroup comparison was not statistically significant, ridge preservation with PRF and DFDBA which resulted in less dimensional change than DFDBA(Demineralized Freeze Dried Bone Allograft) alone.[26] Also, Baslarli et al., failed to find a statistically significant difference between PRF treated and non PRF treated sockets in terms of increased osteoblastic activity, claiming that PRF only has the potential characteristics of an autologous fibrin matrix which can accelerate healing but has no added advantage in bone regeneration.[27] Furthermore, the results of the studies with the use of PRF in treatment of intrabony defects have also evidenced no statistically significant difference in bone regeneration with the test and the control group.[28] Thus, results of the present study, further added onto the evidence which suggest that there is no role of PRF on bone preservation clinically. Although there are other studies which report otherwise.[29]

Majority of the studies done till date report data clinically and very few have attempted to analyze the histological aspects after the use of PRF. As the use of PRF is based on its healing potential, the precise effect on healing and bone resorption in sites treated with PRF can only be assessed after close histological study. Moreover, the effect size of the studies showing the positive results with use of PRF must also be critically evaluated. In the light of current evidence, it is suggested that the majority of treatment outcomes are intangible.

5. Conclusion

The empirical results reported herein should be considered in the light of some limitations. It is recommended that future research with large sample size, long follow up period, are necessary to validate the supplementary use of PRF with bone graft. Moreover, clinical studies must be supported with histological evidence to prove that PRF has an added advantage, if any, with respect to change in alveolar width and height following tooth extraction.

6. Source of Funding

None.

7. Conflict of Interest

None.

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