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RESEARCH ARTICLE

A COMPARATIVE EVALUATION OF ALLOPLASTIC BONE GRAFT AND COMBINATION OF AUTOLOGOUS PLATELET RICH FIBRIN WITH ALLOPLASTIC BONE GRAF

[1*]Kitty Kuruvilla and [2]Dr. Shashikanth Hegde

[1]Yenepoya Deemed to be University, India
[2]Professor and Head of the Department, Department of Periodontology, Yenepoya deemed to be University

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**Corresponding author:*
Kitty Kuruvilla

ABSTRACT

Aim: comparative evaluation of alloplastic bone graft alone and combination of autologous platelet rich fibrin with alloplastic bone graft in the treatment of vertical intrabony defects by selecting patients with chronic periodontitis. **Methodology:** A total 28 sites with vertical intrabony defects in chronic periodontitis patients of age range 25-54 years were included in the study. They were divided into group A-14 sites underwent open flap debridement with placement of bone graft alone and group B -14 sites underwent open flap debridement with placement of bone graft and PRF after a thorough phase1 therapy. Clinical evaluation of surgical sites were carried out using PPD, MGI, RAL, Mobility at baseline, 3 months and 6 months interval. Radiographic assessment of the defect was done at baseline 3 months and at 6 month interval. **Results:** The mean probing depth was 7.43 ± 0.852 in group A and 7.86 ± 0.770 in group B. At the end of 3rd month it was 5.43 ± 0.646 in group A and 4.43 ± 0.514 in group B. At the end of 6 months it was 4.14 ± 0.663 in group A and 3.36 ± 0.497 in group B. Relative attachment level was 11.36 ± 0.842 in group A and 11.07 ± 0.730 in group B. At the end of 3rd month it was 9.36 ± 0.842 in group A and 8.00 ± 0.877 in group B. At the end of 6 months it was 7.50 ± 0.650 in group A and 5.21 ± 1.051 in group B. In modified gingival index there is no significant difference at the end of 6 months between group A and group B. The mean mobility score in group A as well as in group B 78.6% had score 1, 21.4% had score 2 in baseline. In the 3rd month too, both the groups had 78.6%- score 1 and 21.4%- score 2. At the end of 6 months, in all the 14 sites mobility score was 1 in group A as well as in group B. In baseline radiographic evaluation mean value was 13.00 ± 1.75 in group A and 14.79 ± 2.72 in group B. At the end of 3rd month it was 7.00 ± 1.03 in group A and 6.36 ± 1.08 in group B. At the end of 6 months it was 6.05 ± 0.855 in group A and 5.57 ± 0.852 in group B. This shows that group B is better than group A. **Conclusion:** In comparative evaluation of open flap debridement with bone graft and open flap debridement in combination with bone graft and PRF in the treatment of intrabony defects there was significant improvement in clinical parameters like probing pocket depth and gain in clinical attachment level in test sites at 6 month interval. Radiographic evaluation showed some evidence of bone fill in both the groups, however significantly higher percentage of bone fill was observed in test sites.

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INTRODUCTION

Periodontitis is one of the most prevalent diseases worldwide with bacterial plaque as a major etiological agent in the initiation and progression of the disease. A thorough understanding of the etiology of periodontal diseases is essential to develop efficacious and affordable periodontal therapies, but the many advances in periodontal research can be difficult to comprehend (Slots, 2000). The goals of periodontal therapy include arresting the disease process, preventing disease recurrence and regenerating the lost periodontium. Classic clinical studies demonstrated that cause-related therapy would not only arrest periodontal disease progression but also provide patients with a healthy dentition that could last a lifetime when subjected to high oral-hygiene Standards (Susin, 2013). Regeneration of lost structures has become the primary therapeutic goal in periodontics. The objectives of periodontal regenerative therapy are to reconstitute the bone, cementum , and periodontal ligament on a previously diseased root surface. Numerous therapeutic modalities for restoring periodontal osseous defects have been investigated (Bansal, 2013). A wide array of graft materials have been applied and evaluated clinically, including autogenous bone grafts, allografts and alloplasts have been utilised, of which, osseous grafting and Guided tissue regeneration are most documented (Reynolds *et al.,* 2003) There is a renewed search to enhance healing and increase the volume of regenerative bone. The use of *alloplastic materials*, which are synthetic, inorganic, and biocompatible bone graft

substitutes, may be an alternative for the treatment of intrabony periodontal defects (IBDs). The advantages are easier accessibility, eliminating the need of a donor site as is necessary with autogenous grafts, and no risk for disease transmission, which may accompany the use of allografts and xenografts (Camargo *et al.,* 2000).

Platelet-rich fibrin (***PRF***), a second generation platelet concentrate has been introduced by Choukroun et al. in 2001 that has several advantages over PRP (Yildirim *et al.,* 2000). Choukroun's PRF, a second generation platelet concentrate is an autologous leukocyte and PRF material. It requires neither anticoagulant nor bovine thrombin.

The aim of the present study was to clinically compare alloplastic bone graft and combination of autologous platelet rich fibrin with alloplastic bone graft in the treatment of periodontal vertical intrabony defects.

The objectives of the study were:

- To assess the efficacy of alloplastic bone graft alone in the treatment of periodontal intrabony defects.
- To assess the efficacy of combination of alloplastic bone graft with PRF in the treatment of periodontal intrabony defects.
- To compare the efficacy of combination of PRF with alloplastic bone graft and bone graft alone in the treatment of periodontal intrabony defects.

MATERIALS AND METHODS

A total of 14 subjects with chronic periodontitis selected from the out patients reporting to the Department of Periodontology, Yenepoya Dental College fulfilling the selection criteria were included in the study

Inclusion criteria:

- Age group 25 – 54yrs
- Minimum of 20 teeth present
- Presence of chronic generalized periodontitis
- Probing pocket depth of ≥ 4mm
- Loss of attachment ≥ 1mm
- Patients having bilateral intra bony defects

Exclusion criteria:

- Any underlying systemic diseases
- Pregnant and lactating mothers
- Use of tobacco and tobacco related products
- History of periodontal therapy in last 6 months
- Patients after recent antibiotic therapy

The ethical clearance was obtained from institutional ethical committee. The purpose of the study was explained to the subjects and an informed consent was obtained from each subject. A total of 28 sites with vertical intrabony defects in chronic periodontitis patients were included in the study using a split mouth design. Group A – 14 sites subjected for open flap debridement with bone graft alone

•Group B – 14 sites subjected for open flap debridement with PRF and bone graft.

Surgical procedure

A total of 28 sites with intrabony defect were selected for the study. Age of patient ranged from 25- 54 years. After the selected subjects signed the informed consent, patients were subjected for phase 1 therapy including oral hygiene instructions, scaling and root planing, restorative treatment, occlusal corrections, extractions if required. Patients were monitored for 4 weeks at regular intervals to confirm that the inflammatory component of periodontal tissues was reduced and sites were suitable to undergo surgical procedure. Multiple surgical sites from the selected subjects were chosen.

- Selected sites were randomly divided into two groups using split mouth design.
- Group A – 14 sites were subjected for open flap debridement with bone graft alone
- Group B – 14 sites were subjected for open flap debridement with PRF and bone graft.

Preparation of stent: An acrylic occlusal stent has been prepared as a fixed reference point to assess changes in probing depth and differences in attachment level over baseline, 3 and 6 months. The splint was trimmed so that the edge extended just apical to the prominence of the teeth. V-shaped grooves were made into the splint using a bur in order to allow probing on the proximal aspects of the teeth and to produce reproducible probing spots. The grooves were always produced on the buccal aspect of the splint.

Preparation of PRF: PRF was prepared using REMI centrifuging machine and a blood collection kit consisting of a 24 gauge butterfly needle and 9 ml blood collection tubes. A sample of blood was collected from the ante-cubital vein of the patient and transferred to 10 ml tubes without anticoagulant which are immediately centrifuged at a rate of 3000 rpm for 10 min. After centrifugation, the resultant product consists of three layers.

Following 3 layers were observed:
•acellular PPP (platelet poor plasma)
•PRF clot in the middle
•RBCs at the bottom of the test tube.
The fibrin clot obtained after centrifugation was removed from the tube and the attached red blood cells scraped off from it and discarded (Bansal, 2013).
PRF was easily separated from RBCs using a sterile tweezer just after removal of PPP and then transferred on to the sterile dapen dish.

Surgical procedure: An intraoral asepsis was performed by pre-procedural rinse of 10 ml of 0.2% chlorohexidine solution and extra oral asepsis was carried by swabbing with 5% povidine-iodine solution following which the site was anesthetized using lignocaine hydrochloride 2% with adrenaline 1: 80000. A full thickness mucoperiosteal flap was reflected after placing intracrevicular incisions around teeth. Care was taken to retain as much as interdental papillary tissue as possible. The defect was debrided and root planing was done with Gracey curettes. The surgical site was irrigated with sterile normal saline in order to remove all debris from the defect. After the debridement, the prepared PRF was mixed with R.T.R cone in a dapen dish and was placed in the defect using a carrier and was packed into the defect. Flaps were

replaced to their original level and sutured with 3.0 black braided silk suture. Simple interrupted sutures were placed. Care was taken to achieve proper approximation of flaps interdentally. Coe pak periodontal dressing was placed over the surgical site. Post operative instructions were given. Amoxicillin 500mg, tid was given for 5 days. Anti-inflammatory analgesics and chlorhexidine mouthrinse (0.2%) were prescribed. Post operative evaluation and suture removal was done after one week. Oral hygiene instructions were reinforced. After 2 – 3 weeks the patients were recalled. The surgical site was examined for healing. After 1month patient was recalled for permanent crown placement. The patients were recalled for 3 and 6 months for determining pocket depth, gain in clinical attachment level and radiographic assessment.

Statistical analysis: Data obtained were expressed in terms of mean and standard deviation. Data were analysed using SPSS version 22. P value was significant at $p<0.05$. Independent t-test and Fishers exact p test was used for comparing the mean values of clinical parameters between the groups.

RESULTS

Probing pocket depth: On an average, the probing pocket depth was 7.43 ± 0.852 in group A and 7.86 ± 0.770 in group B. At the end of 3rd month it was 5.43 ± 0.646 in group A and 4.43 ± 0.514 in group B. At the end of 6 months it was 4.14 ± 0.663 in group A and 3.36 ± 0.497 in group B. Test shows that there is significant difference from 3rd month onwards and group B has significantly less value compared to group A, which shows that B is better than A. ($p = 0.008 < 0.01$)

Relative attachment level: On an average, the relative attachment level was 11.36 ± 0.842 in group A and 11.07 ± 0.730 in group B. At the end of 3rd month it was 9.36 ± 0.842 in group A and 8.00 ± 0.877 in group B. At the end of 6 months it was 7.50 ± 0.650 in group A and 5.21 ± 1.051 in group B. Test shows that there is significant difference from 3rd month onwards and group B has significantly less value compared to group A, which shows that B is better than A. ($p = 0.008 < 0.01$)

Modified gingival index: In group A 71.4% had score 1, 14.3% each had score 2 and 3 in baseline. In group B 50% each had score 2 and 3. At 3rd month as well as 6th month, in all the 14 sites modified gingival index score was 1 in group A as well as in group B. So, test shows that there is no significant difference at the end of 6 months between group A and group B with respect to modified gingival index score.

Mobility: Baseline measurements showed grade I mobility in relation to 78.6% of the sites and grade II mobility in relation to 21.4% of the sites in both group A and group B. Results showed significant improvement in mobility after 3 months and 6 months interval in both Group A and group B. Sites with grade I mobility did not show any mobility at the end of 3rd month and 6th month interval. Sites with grade II mobility showed reduction in mobility to grade I at the end of 3rd month. At the end of 6th month all the sites in group A and group B showed no mobility.

Radiographic evaluation: On an average, the baseline radiographic measurement was 13.00 ± 1.75 in group A and 14.79 ± 2.72 in group B. At the end of 3rd month it was 7.00 ± 1.03 in group A and 6.36 ± 1.08 in group B. At the end of 6 months it was 6.05 ± 0.855 in group A and 5.57 ± 0.852 in group B. Result showed statistically significant improvement in radiographic evaluation from baseline to 6th month interval in both group A and group B. Results also showed no significant improvement in radiographic evaluation from 3rd to 6th month interval in both group A and group B.

DISCUSSION

Periodontal disease is among the most prevalent diseases worldwide and is characterized by the presence of gingival inflammation, periodontal pocket formation, loss of periodontal attachment and loss of alveolar bone around the affected teeth (Dohan, 2006; Papapanou, 2000). The goal of periodontal therapy includes not only the arrest of periodontal disease progression, but also the regeneration or reconstitution of bone and connective tissue attachment that has been destroyed by the disease process. There are a broad range of treatment options available, but only some may be regarded as truly regenerative procedures. Intraosseous defects have been shown to be at higher risk for disease progression[10]. These defects may not be readily accessible to periodontal debridement so it may require access flap surgery alone or in combination with regenerative procedures. To achieve the reconstruction of lost attachment apparatus in intraosseous defects grafting with biomaterials and application of biological agents has been tried with varying degrees of success. Bone graft materials function in part, as structural scaffolds and matrices to allow attachment and proliferation of anchorage dependent osteoblasts (Oonishi, 1977). A wide range of bone graft materials have been used for the treatment of intrabony defects including autografts, allografts, xenogarfts and alloplasts. PRF by choukran's technique is prepared naturally without addition of thrombin, and it is hypothesized that PRF has a natural fibrin framework and can protect growth factors from proteolysis. Thus, growth factors can keep their activity for a relatively longer period and stimulate tissue regeneration effectively.

The main characteristics of PRF compared with other platelet concentrates, including PRP, are that it does not require any anti-clotting agent. The naturally forming PRF clot has a dense and complex 3-D architecture and this type of clot concentrates not only platelet but also leukocytes. PRF is simpler and less expensive to prepare, as well as being less risky to the patients. Owing to its dense fibrin matrix, PRF takes longer to be resorbed by the host, which results in slower and sustained release of platelet and leukocyte derived growth factors in to the wound area ()[12]. A wide range of bone grafting materials, including bone grafts and bone graft substitutes, have been applied and evaluated clinically, including autografts, allografts, xenografts, and alloplasts (synthetic/semisynthetic materials)..The combination of PRF with bone graft demonstrated better results in probing pocket depth reduction and clinical attachment level gain as compared to bone graft alone in the treatment of periodontal intrabony defects (Bansal, 2013). PRF consists of a fibrin matrix polymerised in a tetramolecular structure; the incorporation of platelets, leukocytes, and cytokines; and circulating stem cells. Slow fibrin polymerization during PRF processing leads to the intrinsic incorporation of platelet cytokines and glycan chains in the fibrin meshes. This result implies that PRF, unlike the other platelet concentrates, is able to progressively release cytokines during fibrin matrix remodeling (Patur, 1962). It is also found that PRF organizes as a dense fibrin scaffold with a

high number of leukocytes concentrated in one part of the clot. Leukocytes seem to have a strong influence on growth factor release, immune regulation, anti-infectious activity, and matrix remodeling during healing. It is an optimal matrix for migration of endothelial cells and fibroblasts. It permits a rapid angiogenesis and an easier remodeling of fibrin in a more resistant connective tissue. Such a mechanism might explain the clinically observed soft tissue healing properties of PRF. However, histological studies are needed to establish the exact nature of this clinical attachment gain. Studies in the literature have shown that use of PRF along with bone grafts has shown better result. Sharma in 2011 conducted a study comparing open flap debridement alone and PRF with open flap debridement in 56 intrabony defects for 9 months. There was greater PD reduction, PAL gain, and bone fill at sites treated with PRF with conventional open-flap debridement compared to conventional open-flap debridement alone (Thorat, 2011).

Conclusion

In this study the effectiveness of PRF with bone graft was evaluated for 3 and 6 months, which showed reduction in probing depth, gain in attachment level and increase in bone fill in radiographic assessement. Thus, considering its autologous nature and decrease in the cost, PRF offers an excellent option to the clinician for regenerative approach. Further, long term clinical trials are required to substantiate this finding.

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