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EFFICACY OF PLATELET RICH FIBRIN (PRF) IN COMPARISON TO DFDBA FOR THE TREATMENT OF INTRABONY DEFECT: A RANDOMIZED CONTROLLED CLINICAL STUDY

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ABSTRACT:

Introduction: For the treatment of infrabonydefects,several materials have been used. Demineralized freeze-dried bone allograft (DFDBA) has been histologically proven to be the material of choice for regeneration. However, platelet-rich fibrin (PRF) has been said to have several properties that aid in healing and regeneration. Hence, this study focuses on the regenerative capacity of PRF when compared with DFDBA.

Materials and Methods: A total of 40 sites with intrabony defects were selected and were assigned to the test group (open flap debridement [OFD] and PRF, *n* = 20) and the control group (OFD + DFDBA, *n* = 20). At the test sites, two PRF plugs were placed in the intrabony defect after debridement of the site and flap was sutured in place. The parameters measured were probing depth (PD), relative attachment level (RAL), and gingival marginal level (GML). These parameters were measured just before surgery (baseline) and at 6 months post surgery. The changes in PD, RAL, and GML were analyzed at baseline and postsurgically after 6 months in each group with paired *t*-test and between the two groups with unpaired *t*-test.

Results: The mean reduction in PD after 6 months in the test PRF group is 3.67 ± 1.48 mm where in control DFDBA group is 3.70 ± 1.78 mm. Gain in RAL in the test PRF group is 2.97 ± 1.42 mm where in control DFDBA group, it is 2.97 ± 1.54 mm. Gingival margin migrated apically in the test PRF group by 0.43 ± 1.31 mm where in control DFDBA group by 0.72 ± 2.3 mm. It was seen that the differences in terms of PD (*P* = 0.96), RAL (*P* = 1.00) and GML (*P* = 0.62) were not significant.

Conclusion: Platelet-rich fibrin has shown significant results after 6 months, which is comparable to DFDBA for periodontal regeneration in terms of clinical parameters. Hence, it can be used in the treatment of intrabony defects.

Key words: Demineralized freeze-dried bone allograft, intrabony defects, periodontal surgery, platelet-rich fibrin

INTRODUCTION:

Conventional periodontal treatment such as scaling and root planning and open flap debridement (OFD) are highly effective at repairing disease-related defects and halting the progression of periodontitis. While these are important steps, researchers are still challenged to develop more effective techniques that predictably promote the body's natural ability to regenerate its lost periodontal

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tissues, particularly periodontal ligament and alveolar bone. Periodontal surgical procedures utilize a variety of regenerative materials and techniques. Many of these include the use of bone grafts, bone replacement materials and more recently use of growth factors. The most extensively evaluated graft material for the treatment of infrabony defects remains demineralized freeze-dried bone allograft (DFDBA). Many studies have revealed significant and consistently superior gain in bone fill with DFDBA compared to OFD procedures.[1] Commercially prepared DFDBA has been shown to retain active bone matrix proteins such as bone morphogenetic proteins (BMPs) 2, 4, and 7. Part of which, appears to be lost, as a result of tissue processing comported to fresh allograft. There is histological evidence that DFDBA supports the formation of a new attachment apparatus in infrabony defects, whereas OFD results in periodontal repair characterized primarily by the formation of a long junctional epithelial attachment.[2] Researches have shown dramatic variability in osteoinductive property of DFDBA. Some donor bone has shown no activity at all and had thus acted as source of Type I collagen only.[3] These shortfalls in DFDBA have let the researchers toward the search of a regenerative material with similar ability to regenerate periodontal tissues with minimum disadvantages in terms of antigenicity and cost. A second-generation platelet concentrate, platelet-rich fibrin (PRF) was introduced by Choukroun*et al*. in 2001. PRF is in the form of platelet gel and can be used in conjunction with bone grafts, which offers several advantages, including promoting wound healing, bone growth and maturation, graft stabilization, wound sealing, and hemostasis, and improving the handling properties of graft materials.[4] PRF can also be used as a membrane. Platelet activation in response to tissue damage release several biologically active proteins including; platelet alpha granules, platelet-derived growth factor (PGDF), transforming growth factors-β (TGF-β), vascular endothelial growth factor (VGEF), and epidermal growth factor.[5] In periodontal infrabony defects, recent studies using PRF have shown good results as compared with OFD alone.[6,7] Reports have been published demonstrating added advantages of PRF with OFD than OFD alone. There has not been any study to date comparing the use of PRF with DFDBA in periodontal infrabony defects. Hence, the aim of this study was to evaluate the efficiency of PRF for periodontal regeneration in infrabony defects as compared with DFDBA.

MATERIALS AND METHODS:

This randomized controlled, split mouth clinical trial, comprised of 20 participants (age range, 20-55 years) with bilaterally similar periodontal infrabony defects. Participants were selected from the outpatient department of Department of dentistry fromrajendra institute of medical sciences , ranchi. The

participants agreed to participate in the study and gave their written informed consent. Participants with a probing depth (PD) ≥5 mm at two or more sites, sites exhibiting clinical and radiographic evidence of infrabony defects, and two or three wall infrabony defects at two of more sites were included in the study. Participants with known allergy to local anesthetic and chlorhexidine, antibiotic and analgesic; with habit of smoking and tobacco chewing; those unable to maintain meticulous oral hygiene after Phase I therapy were excluded from the study

Protocol

This study was carried on 40 sites. Prior to surgery, defects were assigned randomly by a coin flip to receive either PRF plug or DFDBA following OFD before the start of the surgery. The investigator of the study was unaware about the randomization process. After completion of initial periodontal treatment, including oral hygiene instructions, and scaling and root planing, participants maintaining good oral hygiene and who gave consent were selected in the study. The selected defects were analyzed clinically and radiographically to fulfill the inclusion criteria; and then the participant was scheduled for surgery. A customized acrylic stent was fabricated for each selected site so that the standard periodontal probe returns to the same position for each successive measurement. Clinical parameters like PD, relative attachment level (RAL), and gingival marginal level (GML) were measured using a UNC-15 probe. A single periodontal surgeon carried out a surgical procedure for all participants. Each site was treated through reflection of a full-thickness mucoperiosteal flap, attempting to retain all soft tissue. The exposed roots and osseous defects were debrided with hand and ultrasonic instruments. At the test site, the defects received PRF plug derived from the participant's own blood .At the control sites, DFDBA was placed . Flap was then positioned back to the original level and sutured using 4-0 silk suture. Primary closure was obtained with interrupted loop sutures. Participants were recalled after 7 days for suture removal.

Obtaining platelet-rich fibrin

A volume of 10 ml of blood was drawn from each participant through venipuncture of the right arm and placed in sterilized vacuum evacuated vials without an anticoagulant and centrifuged immediately using a tabletop centrifuge for at least 10 min at 3,000 rpm. The resultant PRF clots were compressed in a sterile syringe to obtain a plug.

Postsurgical care

Both groups were given, the same postsurgery antibiotics and instructions. Subsequent doses were taken only if necessary to control pain. Participants were instructed not to brush their teeth in the treated area, but to rinse with chlo±rhexidine solution (0.2%) twice daily for 1-min. Seven days after the surgical treatment, the sutures were

removed. After this period, the patients were again instructed for mechanical tooth brushing of the treated teeth region using a soft toothbrush.

Participants were recalled every month for 6 months, and oral hygiene reinforcement, and full mouth supragingival scaling was done. Clinical parameters were evaluated at 6 months interval [Figures 5 and 6]. The changes in PD, RAL, and GML were analyzed at baseline and post surgically after 6 months in each group with paired *t*-test and between the two groups with unpaired *t*-test.

RESULT:

All 20 participants completed the study. No postoperative complications or adverse events were seen with any of the participants during the study period. Both groups were similar at the start of the study [Table 1]. Intragroup statistically significant difference was observed from baseline to 6 months for PD and RAL for both groups ($P < 0.05$). GML did not show statistically significant

difference at 6 months for any of the groups ($P > 0.05$) [Table 2]. There were no statistically significant differences between the two groups in terms of PD ($P = 0.57$), RAL ($P = 0.29$) and GML ($P = 0.14$) at 6 months [Table 3].

DISCUSSION:

Chronic periodontitis is initiated and sustained by microorganisms living in communities, which are present in supra- and sub-gingival plaque in the form of uncalcified and calcified biofilms. Initial periodontal therapy involves the removal of both sub-.and supra-gingival plaque. It is followed by a periodontal flap surgery in sites with deeper, nonhealing pockets and persistent inflammation. Patients in this study underwent the initial periodontal therapy and further who were to underwent surgical treatmentwith 1-2 wall intrabony defect were included in the study on the basis of inclusion criteria. The clinical outcome is largely dependent on the skill of the operator in removing subgingival plaque and the skill and motivation of the patient in practicing adequate home care. Hence, both test and control sites were treated by same periodontist. In his study, DFDBA has been compared with PRF for the treatment of periodontal infrabony defects.

Bone graft materials that are needed in periodontics should be osteoinductive, have good handling characteristics, and have physical properties providing appropriate stiffness for theprocedures are DFDBA and freeze-dried bone allograft (FDBA). The osteoinductive properties of DFDBA have made it the grafting material of choice as compared to FDBA, xenografts, and alloplasts. The use of DFDBA has been successfully proven in a histologic study wherein 80% of test sites showed complete regeneration.[2] The demineralization process of DFDBA exposes its BMP's that makes it osteoinductive in nature.[8-10] Numerous growth factors, alone or in combination, have been tested for

periodontal regeneration in animal experiments. Among these are insulin-like growth factors, fibroblast growth factors, epidermal growth factor, PDGFs, VGEF, parathyroid hormone, TGF-β and BMPs.[10] Choukroun's PRF, a second-generation platelet concentrate, consists of an intimate assembly of cytokines, glycanic chains, and structural glycoproteins enmeshed within a slowly polymerized fibrin network. Beneficial effects of PRF have been studied in various procedures, such as facial plastic surgery, a sinus-lift procedure as a sole osteoconductive filling material,[6] periodontal intrabony,[6,7] furcation defects,[11] and as suitable scaffold for breeding human periosteal cells *in vitro*, which may be suitable for bone tissue engineering applications.[12] PRF induces a significant and continuous stimulation and proliferation of gingival fibroblasts, dermal prekeratinocytes, pre adipocytes, and maxillofacial osteoblasts.[6] The results of this study showed that there were significant improvements in PD and RAL at the end of 6 months for both groups. As shown in Table 2 statistically significant difference was noted in PD and RAL at 6 months for both groups ($P < 0.05$). Pradeep *et al*. in various studies on PRF has shown similar results in terms of PD reduction. These studies have statistically as well as clinically significant results.[13-15] GML did not reach a statistically significant difference in any of the groups. No statistically significant difference was seen between the two groups at 6 months for any of the parameters [Table 3]. PRF has shown promising results for periodontal regeneration in terms of clinical parameters (PD, RAL, and GML) and is comparable to DFDBA. Thus, the results of the study indicate that there is no difference in the clinical parameters between the PRF group and DFDBA group at the end of 6 months. There are several advantages of using PRF, like easy and simplified chairside preparation of PRF, cost-effectiveness, release of relatively constant concentration of growth factors over a period of 7 days, and rapid and excellent healing of the periodontium.[16] However, the drawbacks of the study were that bone fill was not evaluated, and a relatively smaller sample size was selected.

CONCLUSION:

Platelet-rich fibrin has shown significant results after 6 months, which are comparable to DFDBA for periodontal regeneration in terms of clinical parameters. PRF has several advantages when used as a graft material for infrabony defects. However, further studies are required to prove the effectiveness of PRF as a regenerative material in the treatment of periodontal infrabony defects.

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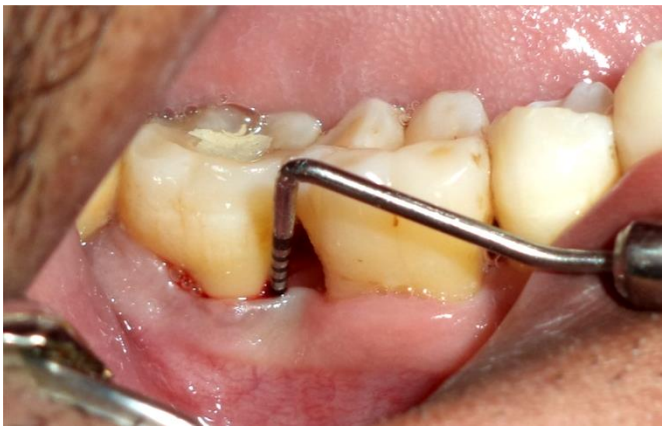
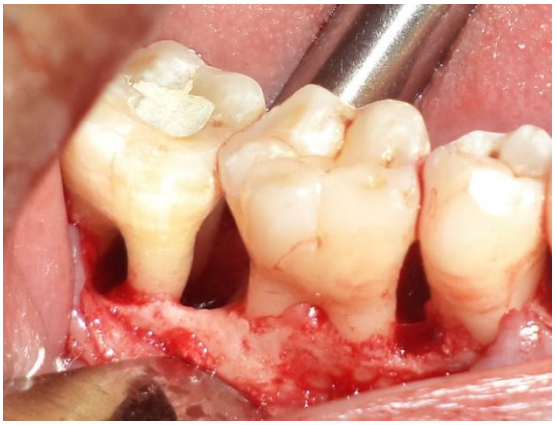
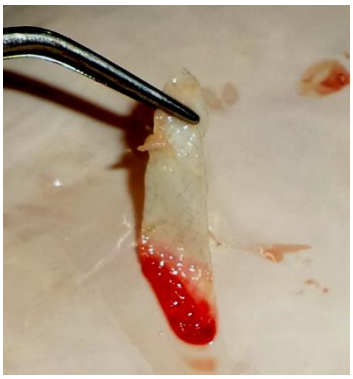
FIGURES:



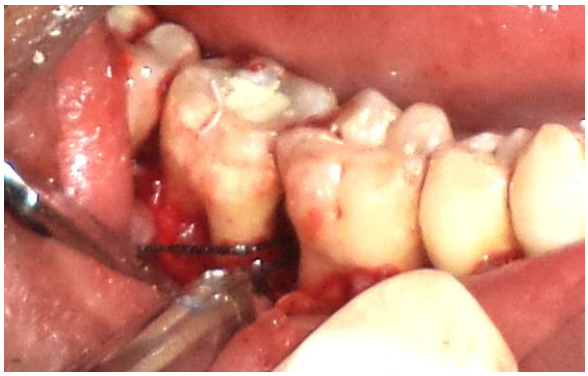
Initial probing of the test site



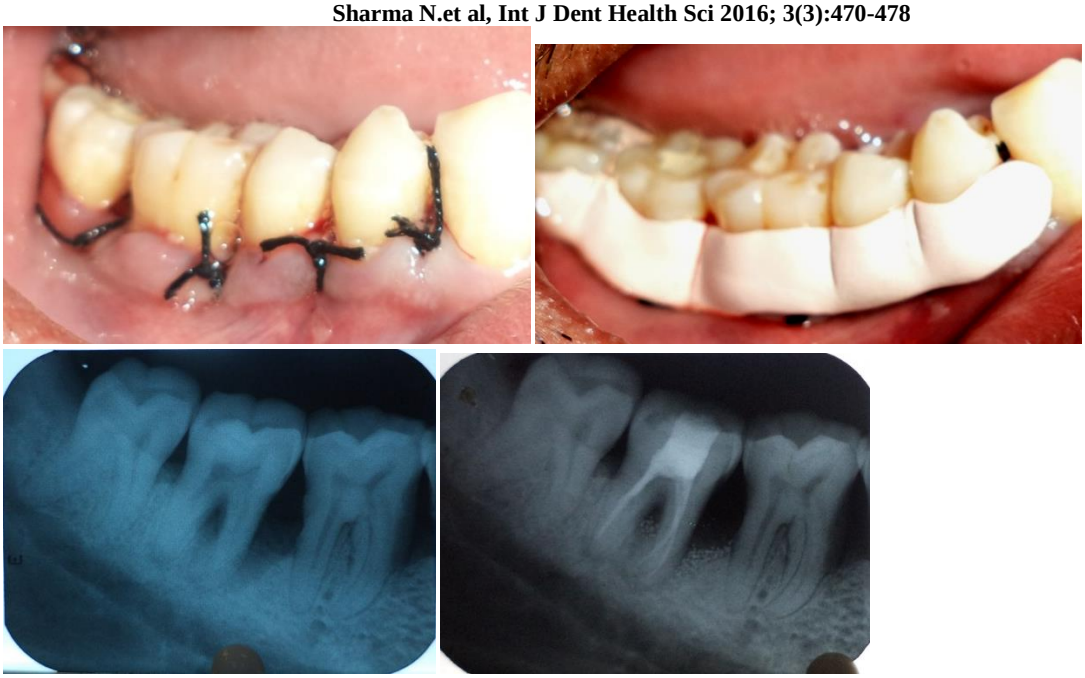
debridement completed



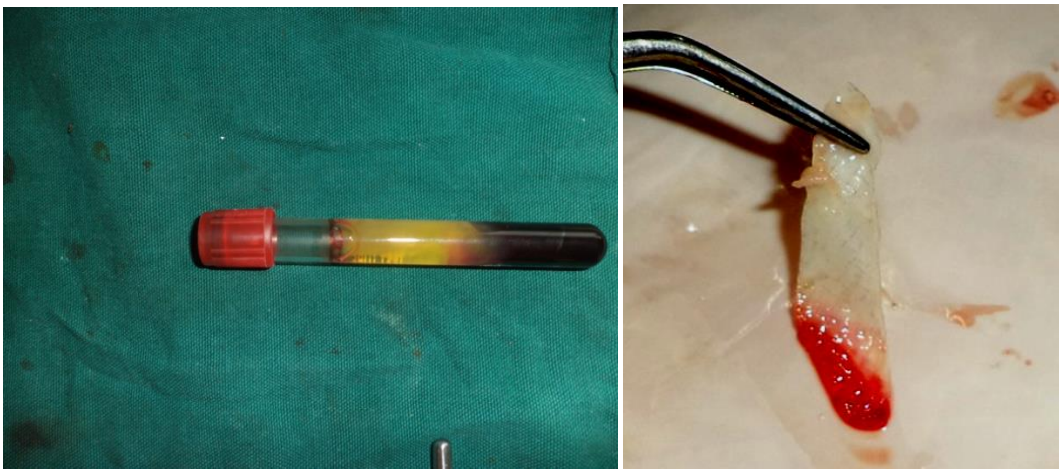
PRF obtained



PRF placed in defect



Pre–op Post-op



TABLES:

Table 1 ; baseline characteristics of test and control groups

clinical parameters	mean ± SD		P value
	Test	Control	
PD	7.07 ± 1.25	6.97± 1.97	0.84
RAL	12.27 ± 2.22	11.72±1.64	0.38
GML	5.75±1.43	4.75±1.45	0.08

Table 2 changes in clinical parameters after 6 months

	Test			Control		
	Baseline	6 Months	p value	Baseline	6 Months	p value
PD	7.07	3.27	0.00	6.97	3.40	0.00
RAL	12.27	8.75	0.00	11.72	9.30	0.00
GML	5.75	5.47	0.18	4.75	6.17	0.16