RESEARCH ARTICLE

COMPARATIVE EVALUATION OF PLATELET RICH FIBRIN AND DEMINERALIZED FREEZE-DRIED BONE ALLOGRAFT (DFDBA) FOR THE TREATMENT OF MANDIBULAR GRADE II FURCATION DEFECT: A CLINICAL STUDY

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ABSTRACT

Introduction: Several bone graft materials have been used in the treatment of infrabony defects. 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 mandibular grade II furcation 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 testsites, PRF plugs were placed in the intrabony defect after debridement of the site and flap was sutured inplace. 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 postsurgery. 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 mandibular grade-IIfurcation defects.

Keywords: Demineralized freeze-dried bone allograft, mandibular grade- II furcation, periodontal surgery, platelet-rich fibrin

INTRODUCTION:

Furcation involment is bone resorption and attachment loss in the inter-radicular area of multi-rooted teeth resulting from plaque associated periodontal disease. The ideal goal of of the furcation therapy areas, thereby returning tooth intact and to completely close the involved furcation area, therby returning the local condition to one of antomic normalcy,facilitating long

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term maintenance therapy, thus improving the likelyhood of tooth retention.[1]

Grade II furcation defects have perplexed clinicians for many years,[1] being a lesion with the precence of two osseous walls, an intraosseous defect with the greatest potential for regeneration in terms of decrease in probing depth gain in clinical attachment level and bone-fill in the furcation area. Several barrier membranes and bone graft materials have been used in this regard.

When periodontal disease affects the furcation of a tooth, the chance that tooth will be lost, increases considerably. An increase in the exposed root surface, anatomical peculiarities and irregularities of the furcation surface all favour the growth of bacteria. These problems make it harder for the patient to maintain hygiene, and impede adequate treatment.[2]

The primary etiologic factor in development of furcation defect is plaque and the inflammatory consequences from its long term presence. Dentinal hypersensitivity is the common complain at the site of furcation defects. The complaint of dentinal hypersensitivity when inadequately addressed especially in furcation defects hinders the effective plaque control by the patients and allows for progression of defect.[3]

It has been reported thatmolars with furcation involved, caused by periodontitis, have a higher rate of periodontal breakdown and respond less favourably to periodontal therapy than molars without furcation involvement or single-rooted teeth.[4-6] This can be explained by an anatomy that impedes accessibility for individual oral hygiene in the molar region[7] and professional rootdebridement.[8] An important objective of regenerative therapy has been a predictable clinicalcourse of furcation defects after periodontal regeneration, as evidenced by the formation of a new attachment apparatus including bone, cementum, and periodontal ligament.[9] Multiple approaches have been used to resolve furcation defect including autografts,[10-14] demineralised freeze-dried bone allograft (DFDBAs),[12-15] bovine-derived xenografts,[12-14,16] barrier membranes,[17-20] and combinations of membranes and bone grafts.[21,22] Although these regenerative materials are still used today, the introduction of bio mimetic agents, such as enamel matrix derivatives,[23] Platelet Rich Plasma (PRP),[24] platelet-derived growth factor,[25-27] and bone morphogenetic proteins,[23] has given new promise for better outcomes in furcation treatment.

Choukroun et al in France in 2001 first described Platelet Rich Fibrin (PRF) .[28] Platelet Rich Fibrin (PRF) belongs to a second generation of platelet concentrates [29] and is defined as an autologous leukocyte and PRF bio material.[30,31] Fibrin is a activated form of plastic molecule called fibrinogen. PRF has been shown to act as suitable scaffold for breeding human periosteal cells in vitro, which may be suitable for bone tissue engineering.[32]

PRF 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. Clinical trials suggest that the combination of bone grafts and growth factors contained in PRP and PRF may be suitable to enhance bone density.[33]

Till date there is a lack of information in the literature on PRF in combination with osseous graft for the treatment of furcation defects which could enhance the healing potential of bone and soft tissues.

This study envisages to evaluate and compare the efficacy of autologous PRF with Open Flap Debridement (OFD) in the treatment of human mandibular grade II furcation defects compared to PRF in combination with osseous graft.

MATERIALS AND METHODS:

Aims & Objectives : To evaluate and compare the efficacy of PRF and Demineralized freeze-dried bone allograft for the treatment of mandibular buccal grade II furcation defect.

Source Of The Data:

Patientswere enrolled from the age group of 20-50 years of either sex, meeting the inclusion and exclusion criteria.

Details of the present study was explained and informed consent was obtained from each of the patient participating in the study.

Sampal size: 20 patients with 40 mandibular grade II furcation[39] defects was allotted.

Study Design:

Split mouth design

Patients were randomly allotted to the either group. One side furcation defect was treated with OFD and PRF. The other side furcation defect was treated with OFD with Demineralized freeze-dried bone allograft (DFDBA).

Test group I- Open Flap Debridement (OFD) + platelet rich fibrin

Test group II- Open Flap Debridement (OFD) + Demineralized freeze-dried bone allograft (DFDBA)

Clinical Parameter:

The efficacy of the treatment was determined by soft and hard tissue parameters. These parameters were recorded at the baseline. All the measurements of Clinical parameters like PD, relative attachment level (RAL), and gingival marginal level (GML)were recorded using UNC-15 (University of North carolina) periodontal probe and Naber's probe (a curved,colour-coded,caliberated probe marked at 3mm interval).

The measurements of defect were made using a custom fabricated occlusal stent, made of cold cure acrylic resin.

- Probing depth, (Fig.2)
- Relative attachment level, Gingival recession, if present, was measured from the CEJ in the mid-buccal region to the crest of the gingival margin.
- Furcation defect measurements of vertical component and horizontal component. (Fig.3)

Clinical measurements was re-recorded at base line and at the interval of 3 months and than at 6 month to see the comparison between PRFand Demineralized freeze-dried bone allograft (DFDBA)

Inclusion Criteria :

- Patients having at least one bilateral mandibular buccal grade II-furcation defect.
- Selected subjects should not be under any medication during 1stmonth before surgery.
- Periodontal probing depth (PPD) at mid furcation area should be $\geq$ 5 mm .
- Third molars should be excluded in the study.
- Patients should have a good oral hygiene.
- Patients should be free of any systemic disease.

Exuclusion Criteria :

- Patients with endodontically involved teeth.
- Patients with any caries lesion or restoration below CEJ.
- Patient with any systemic disease.
- Patient on any kind of medication.
- Patient with any kind of blood defect.
- Patient using any type of tobacco products.
- Pregnant and lactating women.

Prepration Of PRF:

PRF was first developed in France by Choukroun et alfor specific use in oral and maxillofacial surgery. This technique requires neither anticoagulant nor

bovinethrombin (nor any other gelling agent). The PRF protocol is very simple: A blood sample is taken without anticoagulant in 10-mL tubes which are immediately centrifuged at 3000 rpm for 10 minutes. A fibrin clot is then obtained in the middle of the tube, just between the red corpuscles at the bottom and acellular plasma at the top. Quick handling is the only way to obtain a clinically usable PRF clot. By driving out the fluids trapped in the fibrin matrix, we obtained very resistant autologous fibrin. [29] (Fig.1) (Fig.5)

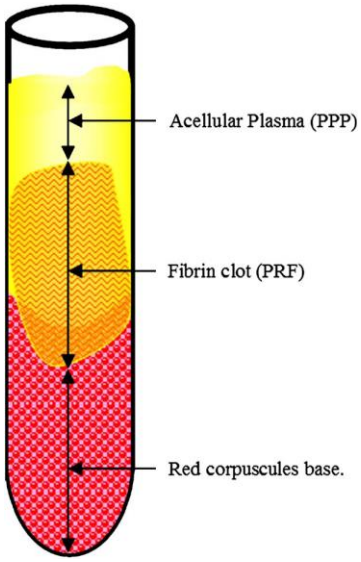

Fig.1 Diagram showing fibrin clot in the middle of the tube

Surgical Procedure:

After phase one therapy the surgical site was anaesthetized using 2% lignocaine and 1:2,00,000 concentrationof adrenaline local anaesthetic solution. The procedures for both groups were performed by elevation of the flap in the furcation defect area to provide adequate access in order to expose the furcation area. A full thickness flap was raised (Fig. 4) and the inner surface of the flap was curetted to remove epithelium and granulation tissue. Root surface was thoroughly planed using hand instruments and ultra sonic scaler followed by conditioning with 25% citric acid with the application time of 3 minutes.

After obtaining adequate access, in test group I furcation defect area was treated with PRF (Fig.6), while in test group II furcation defect area was treated with Demineralized freeze-dried bone allograft (Fig.7). Flaps were sutured back to their original position using a sling suturing technique with 3-0 silk sutures (Fig.8). Periodontal dressing(Coe-pak) was placed over the surgical site after suturing.

Post-Operative Instructions And Follow Up:

Patient was prescribed antibiotics such as amoxicillin, 500 mg tid for 5 days or erythromycin, 250 mg bid for 5 days,(in case of penicillin allergy) and analgesic such as, ibuprofen 400mg tid for 5 days. 0.2% chlorhexidene mouth wash was prescribed to be used twice daily, from the day after surgery was performed, for a period of 1 month. The sutures were removed 1 week post-operatively. Patients

were followed up fortnightly for 1st month and at one month for next two month followed by at 3 and 6 month. Clinical parameters were recorded at baseline,3 and at 6 month.

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].

Table 1: Baseline characteristics of test and control groups

Clinical parameters	Mean±SD Test Control	*P* value
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#

#Not significant. PD – Probing depth; RAL – Relative attachment level; GML – Gingival marginal level; SD – Standard deviation

Table 2: Changes in clinical parameters after 6 months

	Test Baseline	6 months	*P* value	Control Baseline value	6 months	*P*
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#

#Not significant; *Statistically significant. PD – Probing depth; RAL – Relative attachment level; GML – Gingival marginal level

Table 3: Six months postsurgery changes in clinical parameters of test and control groups unpaired *t*-test

	Mean±SD **Test** **Control**	***P* value**
PD	3.67±0.69 3.70±0.68	0.57#
RAL	2.97±1.56 2.97±1.68	0.29#
GML	−0.42±1.38 −0.32±1.59	0.14#

#Not significant. SD – Standard deviation; PD – Probing depth; RAL – Relative attachment level; GML – Gingival marginal level

Fig. 2 Control Probing Depth

Fig. 3 Grade –II furcation detection

Fig.4. Full Thickness Flap Raised

Fig. 5 Platlet Rich Fibrin

Fig. 6 Placement of Platlet Rich Fibrin

Fig. 7 Placement of Demineralized freeze-dried bone allograft

Fig.8 Placement of Sutures

DISCUSSION :

The molars are the teeth that suffer the greatest periodontal destruction in untreated patients. When periodontal disease affects the furcation of a tooth, the chance that it will be lost increases considerably. An increase in the exposed root surface, anatomical peculiarities and irregularities of the furcation surface all favour the growth of bacteria. These problems make it harder for the patient to maintain hygiene, and impede adequate treatment.[2]

The primary etiologic factor in development of furcation defect is plaque and the inflammatory consequences from its long term presence. Dentinal hypersensitivity is the common complain at the site of furcation defects. The compliant of dentinal hypersensitivity when inadequately addressed especially in furcation defects hinders the effective plaque control by the patients and allows for progression of defect.[3]

The production of a dense, physically robust PRFM made through high-speed centrifugation of intact platelets and fibrin in the absence of exogenous thrombin

yields a potential tool for accelerating tissue repair.[34]

Vertical and horizontal gains were measured on computerized tomography obtained before and 5 to 6 months after placing PRF. Eleven patients were treated with this procedure. There were no significant adverse events. The range of vertical gain was 2.4 to 5.1 mm, while horizontal gain measured 1.3 to 3.9 mm. Implants were successfully placed in 6 patients.[35]

PRF appears to be superior to collagen (Bio-Gides) as a scaffold for humanperiosteal cell proliferation. PRF membranes are suitable for in vitro cultivation ofperiosteal cells for bone tissue engineering.[32]

PRF which belongs to a new second generation of platelet concentrates, with simplified processing, and not requiring biochemical blood handling, has several advantages over traditionally prepared PRP, which has been widely used for accelerating soft tissue and hard tissue healing.[36]

The PRF protocol concentrated most platelets and leukocytes from a blood harvest into a single autologous fibrin biomaterial. This protocol offers reproducible results as long as the main production principles are respected.[28]

Pradeep et al[37] observed that, there was greater reduction in PD, greater PAL gain and greater bone fill at sites treated with PRF with conventional open flap debridement than conventional open flap debridement alone.

Sharma et al[38] carried out single centre randomized clinical trial to evaluate the effectiveness of autologous PRF in the treatment of mandibular degree II furcation defects compared with open flap debridement (OFD). Significant improvement with autologous

PRF implies its role as a regenerative material in the treatment of furcation defects.

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 mandibular grade-II furcation defect.

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