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Incidence of Periodontal Pocket Development in Distal Root of Mandibular Second Molar Following Impacted Third Molar Removal in Compare to Using Bone Graft & Platelet rich Plasma

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Abstract--- Background : *Extraction of deep impacted mandibular third molar lead to periodontal defect in the adjacent second molar, the using of bone graft & PRP as regenerative material aid in healing improvement & preventing periodontal pocket development.*

Materials and Methods: *Population sample included in this research was randomly selected from patients attended the teaching dental hospital of the college of dentistry/ Almuthana university seeking dental treatment. 30 patients (20 females & 10 males), the age of these patients ranged from 17-26 years. All selected patients were nonsmokers, with bilateral mandibular third molar inclusion in mesio-horizontal position. In the study group, the alveolar cavity was filled with PRP, BPBM alone. The alveolar cavities of the control group were treated without PRP & BPBM. Inclusion criteria included the presence of a pocket that was located distally to the second mandibular molar with a probing depth greater than or equal to 7mm.*

Results: *Following 18 weeks, a significant reduction in pocket depth & gain in clinical attachment level at distal root of second molar in both group treated with bone graft & platelet rich plasma in compare to control group.*

Conclusion: *The using of bone graft & platelet rich plasma is necessary for filling bony defect following deep impacted third molar extraction to prevent periodontal defect development distally to the second molar and improvement new bone regeneration.*

Keywords--- *Platelet-rich Plasma, Bovine Porous Bone Mineral, Mesioangular Impacted Third Molar.*

I. INTRODUCTION

Periodontal diseases (gingivitis and periodontitis) are destructive inflammatory diseases of the gingiva and the supporting structures of the teeth, induced by a microbial biofilm commonly called dental plaque. The fundamental principle of the bacterial etiology of gingivitis was first established in a landmark study by **Löe et al. in 1965.1** Third molars, the last teeth to erupt into the human dental arch, have been shown to be the most frequently impacted teeth in all human ethnicities. **2**. They are the last teeth to erupt into the oral cavity and supplement the function of the second molars. The average age for third molar crypt formation is around five to seven years with initial cusp

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calcification occurring between seven to 12 years.**3-4** Impacted third molars, like other impacted teeth, can predispose the remaining dentition to an array of problems, such as pericoronitis and/or orofacial infection, caries and/or periodontitis of the adjacent tooth, root resorption of the adjacent tooth, cystic or neoplastic changes, orthodontic or prosthetic problems, or even temporomandibular joint symptoms.5,6 Above all, third molar symptoms seriously impinge on the quality of life.7,8In all cases surgical extraction of the third molar must attempt to conserve or even lead to the regeneration of the periodontal tissues on the distal surface of the adjacent second molar. However, the regeneration of such periodontal tissues seems difficult to achieve, because it represents a complex biologic process that is affected by local oral conditions, such as plaque accumulation, the inflammation of periodontal tissue, and the angulation of the third molar and its positional relationship with the adjacent second molar. **9**

Since the 1980s, several studies have focused on the relationship between impacted third molars and periodontal health, as well as the effect of removing impacted third molars, on the health of the periodontium. **9-10** Platelet-rich plasma (PRP) is a material containing many autologous growth factors, such as platelet derived growth factors (PDGF) and transforming growth factor, among others, which may be used in repairing and preventing periodontal complications at the distal root of the second molar adjacent to the extracted third molar.11-12

Bone grafts to fill the extraction socket have long been discussed and showed some promising results.8,9 Bovine porous bone mineral (BPBM)§ was selected because of its safety, high biocompatibility, and the highly porous nature of the particles, which can promote cell adhesion and differentiation.13-14

The aim of this clinical study was to assess the efficacy of autologous PRP in bone regeneration techniques to prevent periodontal complications at the distal root of the mandibular second molar following extraction of a mesioangular impacted third molar.

II. MATERIALS AND METHODS

Patient Selection

Population sample included in this research were randomly selected from patients attended the teaching dental hospital of the college of dentistry/ Almuthana university seeking dental treatment. 30 patients (20 females &10 males). The age of these patients ranged from 17-26 years. All selected patients were nonsmokers, with bilateral mandibular third molar inclusion in mesio-horizontal position.

In the study group, the alveolar cavity was filled with PRP, BPBM alone. The alveolar cavities of the control group were treated without PRP &BPBM. Inclusion criteria included the presence of a pocket that was located distally to the second mandibular molar with a probing depth greater than or equal to 7mm and a probing attachment level greater than or equal to 6 mm. Furthermore, the post extraction defect needed to present with the vestibular and lingual cortical bone intact (that is, not damaged during surgery). The exclusion criteria included systemic diseases, a compromised immune system, and a platelet count less than 150,000/mm3, allergies or hypersensitivity to drugs, antibiotics, anti inflammatories and cortisone medication for the 12-month period before surgery.

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III. PREOPERATIVE THERAPY AND PREPARATION OF PRP

Before surgery, all patients received oral hygiene instructions to reach an O'Leary plaque index that was less than or equal to 25%.15 A 40-mL quantity of blood was drawn from each patient and collected in 4 Vacutainer tubes (Vacutainer; Becton Dickinson, East Rutherford, NJ) containing a 10% trisodium citrate anticoagulant solution. The tubes containing the blood were placed in a centrifuge device at 1,200 rpm for 15 minutes, after which we obtained the separation of 3 fractions: platelet-poor plasma (PPP) on top, PRP in the middle, and red blood cell fraction at the bottom. A 2-mL quantity of the top layer corresponding to PPP was removed for each of the 4 tubes with a Pasteur pipette and discarded. The PRP was collected from each tube, together with 1 to 2 mm of the red blood cellular fraction to ensure that the largest and newest platelets were collected.

IV. PREOPERATIVE MEASUREMENTS

We performed an orthopantomogram and intraoral radiography using the Rinn alignment system on all patients. We evaluated the plaque index16 as well as the gingival bleeding index17 immediately before surgery. The plaque and gingival indices were then evaluated at 12 and 18 weeks after surgery to allow for proper healing at the treated sites. Measurements of PD, PAL, and gingival recession were made using cold resin occlusal stents taken from a model obtained from an alginate cast for all patients to be treated. The stents were made so as to cover the occlusal surface, the third vestibular and lingual coronal site of the mandibular second molar adjacent to the site to be treated. Grooves were made in the resin stents such that it was possible to perform measurements before and after surgery by using the same position and the same angulation of the periodontal probe. These examinations were conducted on dental chair using plane dental mirrors and color coded WHO periodontal probes. PD, PAL, and gingival recession were assessed at 12 and 18 weeks so as not to interfere with the healing of the treated sites.

Surgical Procedure

All operations were done under local anesthesia by the same oral surgeon in the same operating room and under similar conditions. Local anesthesia was achieved by an inferior alveolar nerve block, together with infiltration of the mucosa of the buccal nerve with a full thickness incision was made to prepare the flap. The flap incision extended from the vestibular side of the retromolar trigon to the marginal periodontal portion of the second molar, corresponding to its distolingual cusp. The incision continued vestibularly around the intrasulcular surface of the second molar. We then proceeded by making a vestibular releasing incision to the papilla between the first and second molars, on a 45° angle. We first performed an osteotomy using a Lindemann burr in conjunction with constant irrigation, followed by an odontotomy using a diamond burr. After extraction of the impacted third molar we prepared the residual bone cavity and proceeded with scaling the root surface of the second molar, the bone cavity was filled using 3 different therapeutic approaches: in 10 cases BPBM was placed and condensed with amalgam plugger to the bony defect as well as the adjacent second molar, 10 cases PRP was applied while the residual bone cavity was left empty in the remaining cases (controls).

Coagulation of the PRP was obtained by adding 1mL batroxobin (Botropase, Ravizza, Italy) and 1 mL of 10% gluconate of calcium 446 mEq (Fisiopharma, Palomonte, Italy), which was shaken in a sterile tube for

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approximately 30 seconds to obtain, within approximately 1 minute, a gel to be applied to the bone defect walls. Then the flap was closed using silk 4-0 sutures that were removed 10 days later.

All patients received postoperative instruction (ice packs for 6 hours after surgery, alternating 30 min of application with 30 min pause, soft warm diet for the first 24 hours and normal oral hygiene from the day after surgery, mouthwash with 0.2% chlorhexidine gluconate twice daily for 10 days). Patients were given antibiotics (amoxicillin and clavulanic acid 625mg every 12 hours for 8 days mg per day 5 days) and analgesic drugs (flurbiprofen 200 mg per day for 3 days).An oral hygiene check-up and periodontal support therapy were provided for all patients at 2, 4, and 6weeks after surgery.

V. RESULTS

All subjects completed the postoperative follow-up without any significant complication. For all cases, we averaged the results obtained by probing at the level of the distal surface of the second molar. All results were calculated using the mean value _ standard deviation for each of the parameters considered. The Student t test was used to compare the differences between the 2 groups A statistically significant PD reduction was noted when the two treated groups were compared to the untreated control group. Again, as with the PD reduction a statistically significant CAL gain was noted when the two treated groups were compared to the untreated control group. With regard to GR, no significance difference was noted among the three groups or the different time points.

Table 1: The mean of the probing depth (PD),clinical attachment level(CAL) and gingival recession in platelet rich plasma comparing to control group. Mean Variations in the probing depth (PD) in millimeters corresponding to the distal surface of the mandibular second molar (n=30 bilateral cases).

	Platelet-Rich plasma	Control	Difference Between groups	P Value
Initial	8.92±1.02	8.90±0.71		> 0.05
At 12 wks	4.12±1.30	7.29±0.92	3.17±1.55	<0.05*
At 18 wks	3.59± 1.1	7.20±0.98	3.61±1.51	<0.05*

Mean Variations in clinical advantage in millimeters (n=30 bilateral cases).

Initial	**6.91-+1.01**	**6.82-+0.78**		**> 0.05**
At 12 wks	2.89-+ 1.29	5.82-+0.85	2.93-+1.35	<0.05*
At 18 wks	2.39-+ 1.28	5.84 -+0.90	3.45-+1.42	<0.05*

<0.05* significant.

Mean Variations in gingival recession (GR) in millimeters (n=30 bilateral cases).

At 12 wks	**0.76-+0.38**	**0.97-+0.46**	**0.21-+0.41**	**>0.05**
At 18 wks	0.82-+0.35	0.81-+0.49	0.01-+0.61	>0.05

Table 2 :The mean of the probing depth (pD),clinical attachment level(CAL) and gingival recession in bone graft group comparing to control group Variations in the (PD) in millimeters corresponding to the distal surface of the mandibular second molar (n=30 bilateral cases)

	BPBM	Control	Difference Between groups	P Value
Initial	7.55-+ 0.57	7.48 -+0.58		> 0.05
At 12 wks	4.45-+ 0.52	6.55-+ 0.54	2.1-+0.50	<0.05*
At 18 wks	4.1 -+0.61	6.44-+ 0.52	2.34-+0.56	<0.05*

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Variations in the (CAL) at the distal surface of the lower second molar

	BPBM	Control	Difference Between groups	P Value
Initial	6.45-+0.61	6.42-+0.61		> 0.05
At 12 wks	4.31-+0.66	6.31-+0.58	2-+0.50	<0.05*
At 18 wks	3.96 -+0.64	6.26-+0.60	2.3-+0.6	<0.05*

Variations in the (GR) at distal surface of the lower second molar

At 12 wks	0.97 -+0.92	1.01-+0.57	0.04-+0.41	>0.05
At 18 wks	1.01 -+0.92	1.04 -+0.56	0.03-+0.61	>0.05

VI. DISCUSSION

Extraction of mesioangular impacted mandibular third molars when they provoke periodontal damage at the distal root of the adjacent second molar has been practiced for some time. **18**

Periodontal complications to the distal root of the second inferior molar after avulsion of the adjacent included third molar have been extensively studied in the past. **19-20**

Recently, autologous platelet-rich plasma was used to promote healing, which reduced the incidence of possible periodontal complications27

The use of PRP was shown to be a useful tool in aiding periodontal and bone regeneration in vivo because of the high content of growth factors. **11-21.** The use of PRP has shown to be a valid technique for promoting bone regeneration at the level of the distal surface of the mandibular second molar following extraction of a mesioangularly inclined, deeply impacted third molar

The mechanism by which PRP can influence periodontal regeneration is ascribed to the presence of PDGF and TGF β, although this is not yet completely acknowledged. Some in vitro studies **22** have suggested that PDGF acts principally on osteoblastic proliferation and that, on the other hand, morphogenetic proteins (which are part of the TGFβ superfamily) act as a cellular differentiation agent favoring the expression of markers of mineralization when they are incubated with preosteoblastic cells. This suggests that TGFβ could favor the differentiation of osteoblasts and cementoblasts and the production of fibronectin, a molecule involved in the adhesion of fibroblasts to the radicular surface and in the angiogenic process. As the result of its fibrin content, the PRP gel permits stabilized coagulation of the blood, thereby favoring regeneration of the osseous defect, particularly in the early stages. **23-24**

The regeneration techniques proposed in this article showed that the use of BPBM is capable of preventing periodontal defects while promoting bone regeneration.

BPBM was chosen for its safety, high porosity, and wide interior surface of the granules that are capable of favoring adhesion and cellular differentiation because of the penetration of the blood vessels inside. The crystalline structure and its chemical composition ensure a high compatibility with the tissues. Manystudies **25, 26** confirmed the efficacy of using BPBM in treating different clinical problems.

Our results have shown the using of PRP & BPBM as regenerative materials is necessary to cause a satisfactory reduction in the PD and attachment gain preventing periodontal defect development and increase the possibility of new bone formation.

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