Efficacy of Platelet-Rich Plasma in Treatment of Periodontal Defects Following Surgical Extraction of Mandibular Third Molar

Baratollah Shaban[1], Majid Eshghpour[2]

[1](Department of Oral and Maxillofacial Surgery, Mashhad University of Medical Sciences, Mashhad, Iran)
[2](Dental Research Center, Department of Oral and Maxillofacial Surgery, Mashhad University of Medical Sciences, Mashhad, Iran)

Abstract: *Impacted mandibular third molar tooth has the potential to induce periodontal problems in the distal root of second molar tooth. Platelet-rich plasma (PRP) is an autologous biomaterial which has been used to enhance soft and hard tissue regeneration. The aim of the present study was to evaluate the effectiveness of PRP in management of periodontal pocket at the distal root of mandibular second molar tooth.49 patients with mesioangulary impacted third molar and periodontal problems at the distal part of adjacent second molar entered the study. The probing depth (PD) of distal root of second molar had to be more than 7.5 mm with clinical attachment loss (CAL) of more than 6 mm. In the study group PRP was applied at the osseous defect following third molar surgery while in control group nothing was used. PD, CAL, and alveolar bone loss (ABL) were re-evaluated after 6 months. After 6 months, study group had significantly higher attachment gain, lower PD, and lower ABL. Based on the results it could be concluded that PRP is an effective measure to enhance the regeneration of periodontal tissues following surgical extraction of mesioangulary impacted mandibular third molar tooth.*

Keywords: *Alveolar Bone Height, Attachment Loss, Impacted Mandibular Third Molar, Platelet-rich Plasma, Probing Depth.*

I.   Introduction

Based on the changes in human life style including inclination toward soft diets, the size of the jaw has been decreased gradually which has increased the rate of tooth impaction (specially mandibular third molars) [1]. Presence of mesioangulary impacted mandibular third molar may induce periodontal problems at the distal part of mandibular second molar tooth. In addition, surgical extraction of mesioangulary impacted third molars could lead to periodontal pocket or bone loss at the distal root of adjacent tooth [2-6].

Platelet-rich plasma (PRP) is the first generation of platelet concentrations. While it contains various growth factors including transforming growth factors (TGFs) and platelet-derived growth factors (PDGFs), PRP has been used in various researches to promote the healing rate of soft and hard tissues [7].

The aim of the current study was to evaluate the effectiveness of PRP in the bone regeneration and management of periodontal pocket at the distal part of second molar tooth following surgical extraction of impacted mandibular third molar. The null hypothesis was that there would be no significant improvement in periodontal indices following application of PRP.

II.   Materials And Methods

The present study was performed at Oral and Maxillofacial Clinic of Mashhad Dental School. The study protocol was approved by ethical committee of Mashhad University of Medical Sciences and all participants provided signed informed consent.

2.1 Study Population:

The study population consisted patients with impacted mandibular third molars in need of surgical management from September 2012 to July 2013. The inclusion criteria were having impacted mesioangular mandibular third molar, being 18 to 30 years old, having periodontal pocket distal to mandibular second molar tooth with probing depth of more than 7.5 mm and attachment loss of more than 6 mm, and being nonsmoker.

The patients were excluded from study in case they were smoker, were lactating or pregnant, had systemic disorder, were allergic to antibiotic or anti-inflammatory medications, had received any damage to the cortical bone distal to the second molar tooth during surgery.

2.2 Study Design:

Prior entering the study, all patients were instructed regarding oral hygiene in order to reach O'Leary plaque index of less than 20%. Patients were randomly allocated into study and control group (based on flip of a coin). In either group patients underwent surgical extraction of impacted mandibular third molar under local anesthesia with the same protocol: creating full thickness flap to have access to impacted tooth; removing bone and sectioning tooth using high-speed handpiece under sufficient sterile serum irrigation; removing tooth sections and irrigating socket with sufficient serum. After removing impacted tooth, the second molar tooth underwent scaling and root planning using manual instruments. The bone cavity adjacent to distal root of second molar tooth was filled with PRP in study group while remained intact in control group. The flap was sutured with 3-0 silk suture. All patients received a regimen of antibiotic (amoxicillin 500 mg, every 8 hours, for 7 days) and anti-inflammatory drugs (gelofen 400 mg, every 8 hours, for three days).

2.3 Platelet-rich Plasma Preparation:

In order to have sufficient PRP, 40 ml of blood was obtained from each patient and poured into 4 tubes containing trisodium citrate (10%) as anticoagulant and then centrifuged at 2400 rpm for 10 minutes. The upper layer of platelet-poor plasma was removed. The middle part which was PRP was extracted from each tube. In order to coagulate PRP and obtain a gel, 1 ml of Batroxobin (IranDaru, Iran) and 1 ml of 10% calcium gluconate (IranDaru, Iran) were added and the tube was shaken for 30 seconds.

2.4 Study Variables:

In order to evaluate the effect of PRP on periodontal indices, probing depth (PD) and clinical attachment loss (CAL) were measured in three different positions (distobuccal, middistal, and distolingual) at two time points including prior to the surgery and 6 months after surgery. In addition, in order to evaluate the alveolar bone loss (ABL), a standard parallel periapical readiograph was obtained prior to the surgery and 6 months after surgery. All measurements were performed by a calibrated operator unaware of patient's group.

2.5 Statistical Analysis:

All data were collected in SPSS (version 11.0) software, reported descriptively using mean and standard deviation, and analyzed using student t-test and chi-square tests with the confidence interval of 95%.

III.   Results

Total of 54 patients met the inclusion criteria and entered the study. However, 49 patients completed the study; 5 patients did not participate in the follow up sessions completely and excluded from the study population. The mean age of participants was 22.43 ± 4.59. Among participants, 32 (65.3%) were female. The demographic data of each group is presented in Table 1. No significant difference was found between the mean age and gender of study and control groups (Table 1).

The mean PD of three measured locations is presented in Table 2. According to student t-test, no significant difference was found between the mean PD of study and control group at baseline. However, the mean PD in study group was significantly lower than control group after 6 months (Table 2). In the study group the PD significantly decreased after 6 months while no significant difference observed in the mean PD of baseline and follow up in the control group (Table 2).

The mean CAL of three various locations is presented in Table 3. Considering the results of the t-test, no significant difference was observed between two groups at baseline. However, the mean CAL in study group was significantly lower than that of control group after 6 months (Table 3). Moreover, the CAL was significantly reduced in study group while was not significantly changed in control group after 6 months (Table 3).

The measured ABL indicated no significant difference at the baseline value between two groups. However, at the 6 months follow up the ABL in study group was significantly different from that of control group (Table 4). After 6 months, The ABL of study group was significantly decreased in comparison to baseline. Although the ABL was also decreased in control group after 6 months, the difference was insignificant (Table 4).

IV.   Discussion

The purpose of the present study was to evaluate the efficacy of PRP in the management of periodontal pocket at the distal part of mandibular second molar tooth which was due to the adjacent mesioangulary positioned impacted third molar. Our null hypothesis was rejected as the application of PRP improved the status of periodontal pocket significantly when compared with control group.

The results of the present study indicated that PRP could enhance the bone level at the distal root of second molar tooth and led to attachment gain after 6 months. In accordance with our findings, Moghe et al [3]

found that PRP could induce bone regeneration at the osseous defects of distal part of second molar and enhance the attachment level. In addition, Sammartino et al [8] found no significant improvement in the efficacy of periodontal regeneration by using a resorbable collagen membrane in association with PRP.

The potential of PRP in periodontal regeneration could be due to the presence of various growth factors in the structure of the PRP including PDGF and TGF-β. PDGF enhances the bone regeneration by inducing osteoblastic proliferation [9]. Moreover, bone morphogenetic proteins enhance cell differentiation in favor of cementoblasts and osteoblasts. The other mechanism with which TGF-β promote osteogenesis and healing of periodontal tissue is through production of fibronectin as a biomolecule involved in adhesion of fibroblasts to root surface and also angiogenesis of periodontal tissue [10, 11].

While the isolation of the defect site would be necessary in order to allow periodontal cells to grow rather than fibroblasts, PRP has shown to act as a membrane which would need no further membranes to induce periodontal tissue regeneration [8, 12, 13].

It has been reported that the frequency of root resorption and incidence of periodontal defects adjacent to the impacted third molar increases by age [14, 15]. Hence in the present study the age of patients was limited to the range of 18 to 30 years old. In addition, no significant difference was found between the mean age of participants in study and control group.

V. Conclusion

Based on the results of the present study, PRP is an effective measure in order to manage periodontal pocket and osseous defects at the distal part of mandibular second molar tooth adjacent to the impacted mandibular third molar. Further researches to test the effectiveness of other derivatives of platelet concentration in management of periodontal defects is recommended.

VI. Figures And Tables
Table 1: Demographic data of participants in each group.

Variable	Study	Control	P-value
Sample Size	25	24	-
Gender	Female = 17 Male = 8	Female = 15 Male = 9	0.686*
Mean Age	23.31 ± 5.12	21.89 ± 3.93	0.266†

*based on chi-square test
†based on t-test

Table 2: Probing depth (PD) in study and control groups in two time points

	n	PD (mm)		P-value
		Baseline	6 months	
Study	25	8.19 ± 0.62	4.28 ± 2.05	<0.001
Control	24	8.27 ± 0.55	7.59 ± 1.14	0.559
P-value	-	0.845	<0.001	-

Table 3: Clinical attachment loss (CAL) in study and control groups in two time points

	n	PD (mm)		P-value
		Baseline	6 months	
Study	25	8.62 ± 0.82	5.63 ± 1.92	<0.001
Control	24	8.86 ± 0.65	8.04 ± 1.77	0.412
P-value	-	0.742	0.002	-

Table 4: Alveolar bone loss (ABL) in study and control groups in two time points

	n	ABL (mm)		P-value
		Baseline	6 months	
Study	25	9.09 ± 1.22	5.92 ± 2.18	<0.001
Control	24	9.15 ± 0.94	8.25± 1.38	0.305
P-value	-	0.927	0.004	-

Acknowledgements

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