Original Article

Evaluation of the Effect of Platelet-Rich Fibrin on the Alveolar Osteitis Incidence and Periodontal Probing Depth after Extracting Partially Erupted Mandibular Third Molars Extraction

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Abstract

Aims: To evaluate whether the alveolar osteitis (AO) incidence after extracting partially erupted third molars differs when platelet-rich fibrin (PRF) is administered in the alveolar socket and to assess the influence of PRF on postoperative pain levels and periodontal probing depth. **Settings and Design:** In this split-mouth randomized study, 50 patients (17 men/ 33 women; mean age, 23.96 years) with bilateral symmetric partially erupted mandibular third molars were enrolled. **Material and Methods:** PRF was randomly placed in one extraction socket, whereas the other socket was left empty. A verbal rating scale was used to evaluate postoperative pain levels. AO development was evaluated on the 7th postoperative day. At 3 months postoperatively, periodontal probing depth was measured on the distal surface of the second molars. **Results:** In total, 8% of patients in the PRF group and 18% of the patients in the control group were diagnosed with AO. None of the smokers in the PRF group and 37.5% smokers in the control group were diagnosed with AO. Mean postoperative pain levels were lower in the PRF group than in the control group at all time points. At 3 months postoperatively, periodontal probing depths were found to be ≤3 mm in both groups. **Conclusions:** PRF significantly reduced the AO incidence among smokers and had a positive effect on postoperative pain levels but not on periodontal healing.
Key Messages: PRF did not significantly change the AO incidence among nonsmokers or positively affect periodontal healing, but it positively affected postoperative pain levels.

Keywords: *Alveolar osteitis, mandibular third molar, platelet-rich fibrin, probing depth*

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Introduction

The removal of third molars is one of the most frequent procedures conducted at oral and maxillofacial surgery units.[1,2] There are various reasons for the surgical extraction of third molars, such as infections, caries, cysts, tumors, orthodontic purposes, and for the prevention or repair of periodontal defects in the adjacent second molars.[3,4] After the surgical extraction of third molars, patients commonly complain of pain, swelling, trismus, and other complications, including alveolar osteitis (AO), and periodontal problems.[1,2]

AO is a self-limited condition and generally resolves after 5-10 days, but it causes severe pain, foul taste, halitosis, and regional lymphadenitis and negatively affects a patients' quality of life.[5] Periodontal problems occur mainly on the distal surface of the second molar and manifest as continued sensitivity owing to root exposure or increased probing depth.[3] Many attempts, including pharmacological agents, platelet-rich plasma

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(PRP), or platelet-rich fibrin (PRF) administration, cryotherapy, ultrasound, and laser, have been made to reduce the frequency and severity of complications and improve postoperative healing.[2,6] PRF is a second-generation platelet concentration, produced by a simplified technique lacking biochemical handling, is associated with the ease of manipulation, and exhibits a more controlled release of growth factors compared with that of PRP.[2,3,6] Moreover, PRF exhibits a cicatricial capacity that creates a physiological architecture to improve the healing process.[5,7]

The present study aimed to evaluate whether the AO incidence after extracting partially erupted third molars differs when PRF is administered in the alveolar socket and to assess the influence of PRF on postoperative pain levels and periodontal probing depth on the distal aspect of the second molars. The null hypothesis was that PRF significantly decreases the AO incidence and postoperative pain levels after oral surgical procedures and positively affects periodontal healing.

Subjects and Methods

The current study was a randomized, split-mouth, single-center clinical trial conducted in the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry, Ankara University, between February 2013 and February 2014. The official approval from the institutional ethics committee was obtained prior to the research [Ankara University, Faculty of Dentistry Local Ethical Committee 41/04 (11. 26. 2012)]. The study was conducted in accordance with the ethical standards of the committee responsible for human experimentation and with the Helsinki Declaration of 1975, as revised in 2008. Moreover, all patients signed a detailed informed consent form. Inclusion criteria were as follows: (a) the presence of bilateral, symmetrically oriented, partially erupted lower third molars requiring extraction for prophylactic reasons; (b) the absence of pathology associated with the third molars; (c) no pre-existing systemic diseases; and (d) no chronic opioid use. Patients who had no second molars and pregnant or lactating women were excluded from the study.

In total, 50 healthy patients (17 men, 33 women) aged 15–43 years who met the abovementioned criteria voluntarily participated. After obtaining demographic information and data regarding smoking habit, patients were examined clinically and radiographically. Patients were informed regarding the procedure, potential complications, and follow-up appointments.

Study Design

After removing the third molars in all 50 patients, PRF was placed on one side of the extraction socket (PRF group, $n = 50$) and the other side was left empty (control group, $n = 50$). There was a minimum of 7-day gap between the two surgical procedures in each patient for the variables to return to preoperative baseline prior to the second surgical procedure. The extraction socket into which PRF would be placed was determined by flipping a coin before the first surgical procedure.

Surgical Procedure

All procedures were performed by the same surgeon (HU) using a standardized protocol. Local anesthesia was obtained using 2.5% articaine with 1:100.000 epinephrine (2-mL Ultracaine D-S Forte Ampul; Sanofi Aventis). Horizontal incision was made with no. 15 scalpel blade, a full-thickness mucoperiosteal flap was raised, and all lower third molars were extracted with elevators. Besides, if a tooth sectioning was required on one side, the other side also received the same modality to standardize the surgical trauma. Following the extraction, granulation tissues and follicular remnants were removed, and the postextraction residual cavity was irrigated twice with 20-mL sterile physiologic saline solution. Subsequently, PRF was randomly inserted into the socket as the study site, whereas the contralateral socket was left empty as the control site. The flap was repositioned by simple interrupted 3.0 silk sutures. Postoperative prescriptions were paracetamol (500 mg) thrice per day and 0.2% chlorhexidine mouthwash thrice per day for 7 days.

Prf Preparation

Before the procedure, 10-mL venous blood was drawn into anticoagulant-free, glass-coated plastic tubes that were immediately centrifuged at 3000 rpm for 10 min (NF 200 centrifuge; Nuve, Ankara, Turkey). After centrifugation, PRF was dissected 2 mm below its connection to the red corpuscles situated beneath and placed into extraction sockets in the study group.

Postoperative Evaluations

A verbal rating scale was used to evaluate postoperative pain level, which comprised six pain severity descriptors: none, mild, moderate, severe, very severe, and excruciating. Patients were asked to rate their pain intensity at 6, 12, 24, 48, and 72 h and 7 days postoperatively.

Patients were evaluated on postoperative day 7 for assessing alveolus healing. At this follow-up appointment, the clot in the extraction socket was evaluated for the clinical signs of AO. The findings of the clot were divided into four groups: lacking of clot with exposed bone /partial clot formation; empty socket filled with food debris/black-red-colored partial clot formation/ normal healthy healing tissue. Patients experiencing "severe" level of pain for at least 4 postoperative days,

with the occurrence of situations outside the normal healthy healing tissue, were diagnosed with AO.

Three months postoperatively, periodontal probing depth was measured in millimeters as the distance from the free gingival margin to the base of the pocket along the distal surface of the mandibular second molar at the distobuccal, mid-distal, and distolingual points. All postoperative evaluations were performed by the surgeon blinded to treatment assignment.

Appropriate descriptive statistics (frequency, mean, and standard deviation) were determined for each variable. The chi-square test was used to compare qualitative variables. For continuous variables, the Kolmogorov Smirnov test was applied to ensure for a normal distribution. Because data did not follow a normal distribution, a non-parametric test, Mann–Whitney U test, was used for comparison. The significance level was determined as $P < 0.05$. Statistical analysis was performed using SPSS 20.0 (SPSS 20.0 for Windows; SPSS Inc., Chicago, IL, USA).

Results

This study included 50 patients (17 men and 33 women), with a mean age of 23.96 (range: 15-43) years. As each patient served as his or her own control, no significant differences were observed in the demographic variables between the study and control groups.

On postoperative day 7, blood clot was found in 92% of the extraction sockets, and empty socket with exposed bone was found in 8% of the cases. On evaluating the clot features, partial clot formation and food debris in the remaining space were observed in 5% of the extraction sockets and black-red-colored partial clot formation was present in 5% of the extraction sockets. In 82% of patients, normal healing occurred. On evaluating the clot in the extraction sockets along with the level and duration of postoperative pain, 13 patients were diagnosed with AO. The AO incidence was 8% ($n = 4$) in the PRF group and 18% ($n = 9$) in the control group. However, this difference was not statistically significant ($P > 0.05$, [Table 1]). None of the smokers in the PRF group and 37.5% of the smokers in the control group were diagnosed with AO. A statistically significant difference was observed in the AO incidence in smokers between the groups ($P < 0.05$, [Table 2]).

The mean postoperative pain score decreased gradually after 6 h postoperatively in both groups. Although the mean postoperative pain score was lower in the PRF

Table 1: The overall incidence of alveolar osteitis (AO) in the PRF and the control group, $P = 0.137$, ($P > 0.05$)
Abbreviations: AO, alveolar osteitis; PRF, platelet-rich fibrin.

The Incidence of AO	Yes	No	Total
PRF Group	4	46	50
Control Group	9	41	50
Total	13	87	100

Table 2: The incidence of alveolar osteitis (AO) among the smokers, $P = 0.018$, ($P < 0.05$)

The incidence of AO in Smokers	Yes	No	Total
PRF Group (n=16)	0 (0%)	16 (100%)	16
Control Group (n=16)	6 (37.5%)	10 (62.5%)	16
Total	6	26	32

Table 3: The average values of pain. The difference was statistically significant at the postoperative 24 h ($P = 0.049$) and 7th day ($P = 0.017$).

Pain	PRF Group Median (Min-Max)	Study Group Median (Min-Max)	Z	p
6th hour	2.12 (0 - 5)	2.32 (0 - 5)	-0,731	0,465
12th hour	1.88 (0 - 5)	2.10 (0 - 5)	-0,784	0,433
24th hour	1.38 (0 - 5)	1.94 (0 - 5)	-1,971	0,049*
48th hour	1.08 (0 - 5)	1.56 (0 - 5)	-1,696	0,090
72th hour	0.88 (0 - 5)	1.40 (0 - 5)	-1,934	0,053
7th day	0.74 (0 - 5)	1.22 (0 - 5)	-2,392	0,017*

group than in the control group at all time points, the difference was statistically significant only at 24 h and 7 days postoperatively ($P < 0.05$,[Table 3]).

At 3 months postoperatively, periodontal probing depths were ≤3 mm on the distal surface of the mandibular second molars at distobuccal, mid-distal, and distolingual points in both PRF and control groups.

Discussion

This study aimed to evaluate the effect of PRF administration on the AO incidence, postoperative pain levels, and probing depths on the distal aspect of the second molars after removing partially erupted third molars. Our null hypothesis was partially rejected because although AO incidence was found to be lower in the PRF group than in the control group, this finding was statistically significant only among smokers; furthermore, the mean postoperative pain score was significantly lower only at 24 h and 7 days postoperatively in the study group.

AO is one of the most frequent inflammatory complications after the extraction of lower third molars, and consistent with previous studies,[5,8] the AO incidence following lower third molar extraction was 13% in the present investigation. Although PRF application decreased the AO incidence, the difference between the groups was not statistically significant ($P > 0.05$). However, in recent studies, the AO incidence after extracting lower third molars with simultaneous PRF placement was found to be significantly lower than that after extracting lower third molar without PRF placement.[5,9] Moreover, our study demonstrated statistically significant difference in the AO incidence in smokers ($P < 0.05$); the AO incidence among smokers was notably higher in the control group (37.5%) than in the PRF group (0%). Smoking is known to decrease neutrophil chemotaxis and phagocytosis and inhibit immunoglobulin production. Furthermore, nicotine absorbed through the oral mucosa acts as a vasoconstrictor, and the negative pressure created during smoke inhalation causes the removal of the clot from the alveolar socket. Thus, smoking is considered to be one of the most important risk factors for AO.[8] The reduced incidence of AO among smokers after PRF administration can be explained by PRF's special three-dimensional structure that ensures a reserve of platelets, leukocytes, and cytokines, which can stimulate cell migration and accelerate wound healing. In addition, the organized fibrin matrix of PRF supports clot formation and prevents mechanical dislodgement.[5,9]

Several studies examined the effect of PRF on postoperative pain after the removal of lower third molars; however, there is no definite consensus in this regard. Singh *et al.*[11] found no significant effect of PRF placement on postoperative pain following third molar extraction. Despite in two of these studies[6,10] patients simultaneously underwent bilateral removal of impacted third molar, Asutay *et al.*[11] performed the second surgery 4 weeks after the first surgery. We also waited for a minimum of 7 days before the second surgery in order that patients be able to distinguish between the level of pain on each side. And the pain levels were only significantly lower in the PRF group at 24 h and 7 days postoperatively. Although the periodontal status of the adjacent second molar can be adversely affected by the removal of third molar,[3] in this study, the periodontal probing depth at 3 months postoperatively was found to be ≤3 mm in both groups. The pocket depth measurements were much less than those measured in other investigations.[3,12,13] The diverse surgical protocols followed, sample population in each study, difficulty levels of surgeries performed, and/or assessment methods might have caused the variation in results among these studies.

Our study has some limitations, such as a relatively small sample size and short follow-up period. In addition, the differences between age groups and genders were not examined. Further studies with a larger sample size, longer follow-up durations, and different difficulty levels of surgery are warranted to obtain more reliable results with respect to the efficacy of PRF on the AO incidence, postoperative pain levels, and periodontal healing following the removal of mandibular third molars.

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Conflict of interest

There are no conflicts of interest.

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