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Effectiveness of the Platelet Rich Fibrin with Suture and without Suture on Postoperative Complications Following Removal of Lower Third Molars

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Abstract

Background: The removal of impacted 3rd molar is a traumatic surgical procedure that may lead to some postoperative sequelae such as pain, swelling, and trismus. The aim of this study was to evaluate the effects of PRF with suture, and without suture, on post-operative complications after removal of 3rd molars. **Patients and Materials:** This study enrolled 60 patients with partially impacted lower third molars at three centers; Postgraduate Clinic- Department of Oral and maxillofacial Surgery/College of Dentistry/ University of Sulaimani, Private Dental and Maxillofacial Clinic, and Maxillofacial Unit of Kalar General Hospital from November of 2021 till April of 2022. They were randomly allocated into 3 groups of 20 patients each. Group I was managed by PRF with suture, group II was managed by PRF without suture and group III was left without PRF and without suture. Pain, swelling, and maximum interincisal mouth opening were evaluated after the procedure at 1st, 3rd and 7th post-operative days. **Results:** In terms of pain (p=0.06), trismus (p=0.71), and swelling (p=0.05), there were no statistically significant differences between the study groups and the control group. In contrast to the control group, the values of the three parameters connected to the study groups were lower. In the group of PRF with suture, Visual Analogue Scale (VAS) pain scores on the 3rd and 7th days were significantly (P=0.008 and P=0.038, respectively) less than other groups. Regarding swelling and trismus, there was no significant correlation (P>0.05) between groups. **Conclusions:** Application of PRF with and without suture had no significant effects on postoperative complications such as pain, swelling, and trismus following removal of partially impacted third molars.

Introduction

Extraction of 3rd molar is considered the most frequent procedure in oral surgery that may be complicated by pain, swelling, and trismus due to the inflammatory responses ***[1]***.

To improve post-surgical state of the patient who undergo this procedure and to prevent or reduce these complications, investigations are becoming increasingly important and so many studies have advocated he use of various drugs, biological factors, and surgical techniques ***[2]***. Besides, the entire process still needs to be better understood because numerous intracellular and extracellular processes that are controlled by signaling proteins are involved in both hard and soft tissue repair***[3]***. In this regard it has been studied that platelets (PLTs) play an essential role in hemostasis, wound healing process, osteogenesis, angiogenesis, bone growth, and microbial growth ***[4]***. Moreover, PLT concentrates considered as natural products that are used to improve the healing of both hard and soft tissues and reduce some postoperative complications ***[9]***.

Platelet rich plasma (PRP) and platelet rich fibrin (PRF) can be obtained through developed technologies to concentrate PLTs with cautions in legal limitations on blood management processes ***[5]*** owing to biochemical blood handling with addition of anticoagulants***[40].*** Furthermore, PRP is not FDA-approved and considered 'off-label' use, which has the potential to drive up healthcare costs ***[41].*** PRF is a second-generation PLT concentrate which possess effects on hemostasis, osteogenesis, angiogenesis, bone development, and microbial propagation ***[6]***. It is frequently used to enhance soft/hard tissue repairing and more preferred than PRF in regard to its easiness preparation, application, low cost without biochemical blood handling requirement especially bovine thrombin or other anticoagulants ***[7]***.

PRF basically consists of a fibrin matrix, leukocyte, cytokines, and growth factors such as platelet-derived growth factor (PDGF), transforming growth factor beta (TGF-β), epidermal growth factor (EGF), fibroblast growth factor, keratinocyte growth factor, insulin-like growth factor, platelet-derived EGF, interleukin-8, tumor necrosis factor alpha (TNF-α), connective tissue growth factor, and granulocyte-macrophage colony stimulating factor (G-M/CSF). All these components in PLTs might manage and control the tissue healing course which is relatively alike in most types of tissues ***[8]***.

Another effective factor that impacts wound healing and initial post-operative difficulties is wound closure technique that are utilized for lower 3rd molar surgery which presents as primary and secondary closure techniques. Primary closing of the operating wound which is routinely practiced conventional method; can be conducted through tight approximation of the wound edges with sutures. However, this type of healing might result in substantial postoperative impediments as the inflammatory exudate cannot escape out. Also, there are likelihoods of primary closure to result in dehiscence and lead to secondary intention. Alternatively, various methods for secondary closure of wound are preferred, wherein the socket stay in contact with oral cavity enabling ooze out of the inflammatory products ***[10]***. During all surgical operations, correct preoperative planning and the integration of surgical technique with surgical principles are critical for reducing the risk of complications ***[2]***. Thus, in this study we aimed to investigate the effect of PRF with/without suture on post-operative complications after removal of 3rd molar tooth.

Patients and methods

A. Sample size and location

This prospective, randomized, clinical trial was conducted on 60 patients (30 males and 30 females) that visited Postgraduate Clinic, Department of Oral and Maxillofacial Surgery, College of Dentistry, University of Sulaimani, Dr. Nezar Private Dental Clinic, and Maxillofacial Unit at Kalar General Hospital, Sulaimaniyah, Iraq from November 2021 to April 2022.

B. Inclusion criteria

Patients who required the removal of partially impacted 3rd molars with difficulty scores (3 – 5) on the basis of Pederson Difficulty Index (PDI) ***[11]***, regardless of gender that aged 18 to 45 years. In addition to we included cases with partially impacted lower 3rd molars in the mesioangular position; class IB based on classifications of Winter, 1926, Pell and Gregory, 1933 ***[14,15]***

C. Exclusion criteria

Patients who were not fit for treatment under local anesthesia, those with medical condition that could be complicated by the procedure (American Society of Anesthesiologists; ASA>II), pregnant, immunocompromised peoples, smokers, patients with diabetes and patients on steroid therapy or those had

allergy to the antibiotic and the analgesics used in the study and patients with incomplete follow-up were excluded from the study.

D. Group allocation

The patients were randomly distributed into 3 groups of 20 patients each. Group 1 allocated to PRF with suture that comprised patients having extraction socket filled with PRF then closure of the socket. Group 2 allocated to PRF without suture that comprised patients having an extraction socket filled with PRF without closure of the socket and group 3 allocated to control group that involved patients having an extraction socket left without PRF and without closure of the socket.

E. PRF preparation

Before starting the surgical process, venous blood was collected from the patients into 2 sterile 10 mL plastic tubes and immediately centrifuged using electronic centrifuge for 10 minutes at 3000 rpm (round per minute). As a result, 3 parts were formed in the tube including the PRF in the middle layer that can be separated from the other layers 2.0 mm below the point of contact with the lower erythrocytes layer to be used in the post-extraction cavity. The inner layer formed by plasticized PRF in the 1st tube, inserted directly into the post-extraction cavity, while the outer layer of PRF in the 2nd tube molded into a PRF-box by gentle compression with a loading plate. Then, a fibrin membrane of uniform thickness was obtained, covered with the first layer of PRF previously introduced into the alveolus (Figure 1).

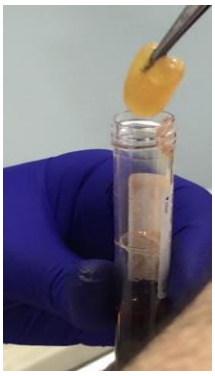

Figure-1: Plasma rich fibrin (PRF) prepared from collected blood from allocated patients.

F. Patient assessment

After the history of each case was obtained, patient was clinically examined. Preoperative and postoperative panoramic radiographs were taken (Figure 2). Pre-operatively, 4 baseline linear measurements were recorded in mm on each side of the face, using 4 reproducible anatomical landmarks while patient was in neutral head position. Facial measurement points were S1: Ear lobe, S2: Corner of the mouth, S3: Lateral canthus of the eye, and S4: Angle of the mandible, using a special measuring tape (Figure 3A). Also, mouth opening (MO) was recorded by measuring the vertical distance between the upper right and lower right central incisors using a caliper. Each linear measurement was repeated twice, and the average was reported.

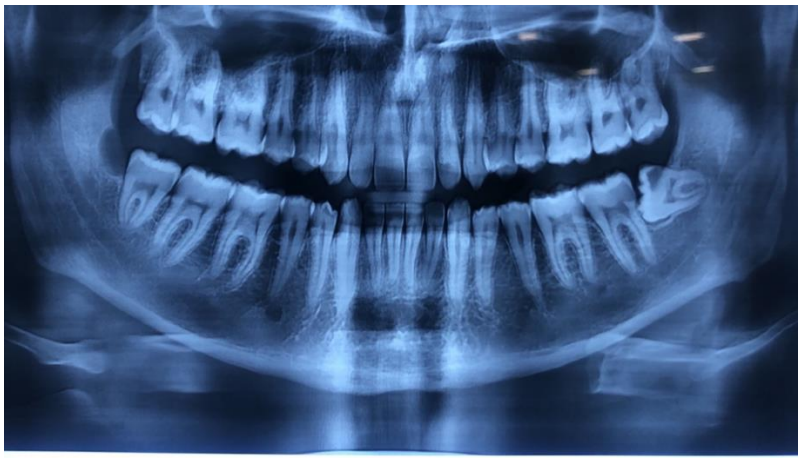

Figure-2: Pre-operative panoramic radiograph showing partially impacted lower 3rd molar.

During peri-operative process, in theatre, and immediately before the removal of 3rd molars, the patients were allocated into the 3 intervention groups using the aforementioned randomization method. A table was used to randomly determine which patient needs to undergo the allocated surgical procedure.

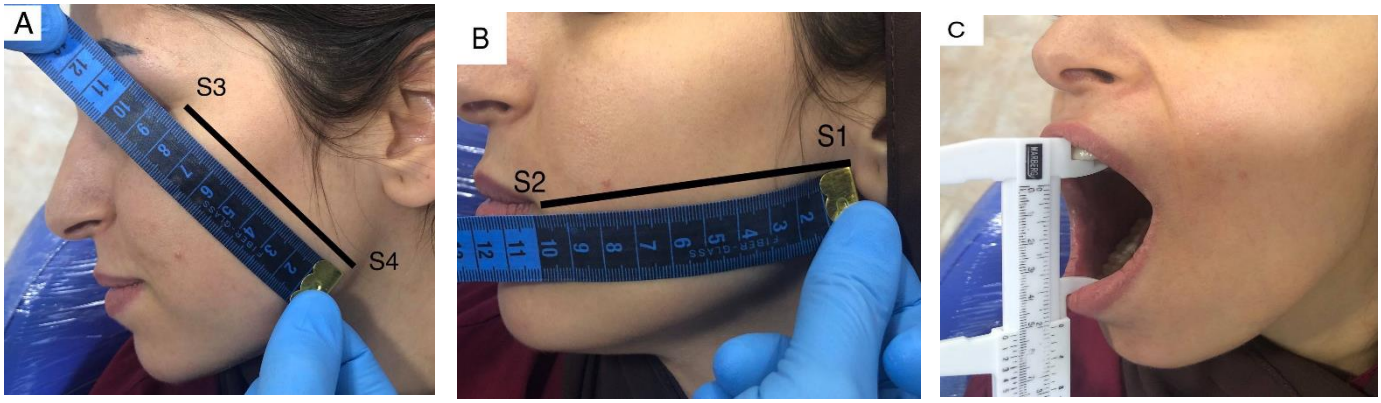

Figure-3: Patient's facial measurement points (A and B) and maximum inter-incisal opening measurements. (C).

G. Surgery protocol

After allocating the patient, anaesthesia was achieved by Inferior Alveolar Nerve (IAN) block with long buccal nerve block using lidocaine hydrochloride (2%) with 100,000 epinephrine (Septodont Lignospan® standard). Next, 2 cartridges (1.7 mL) were administered; one for the IA and lingual nerves, and another for buccal nerve. Additional amount of local anesthesia was administered when the patient still felt pain during surgery.

Each participant underwent the removal of partially impacted lower 3rd molars (Figure 4A) by the same surgeon and under similar operative conditions using the standard surgical technique. Briefly, a small distal reliving incision from the position that the distobuccal cusp of the 3rd molar occupy when the tooth was in a vertical position to a maximum of 5.0 mm in length using Stassen modification. Then, teeth were extracted using elevators (Bein's straight lever and/or Meissner's forceps, granulation tissues were removed, and the sockets were washed with normal saline (0.9%; w/v sodium chloride) after extraction (Figure 4B). In group I, PRF were firmly placed in the extraction socket, and then sutured with figure-eight technique using black silk 4-0, while in the group II, PRF were firmly placed in the extraction socket and left without suture and in the group III, the socket was left without PRF and without suture.

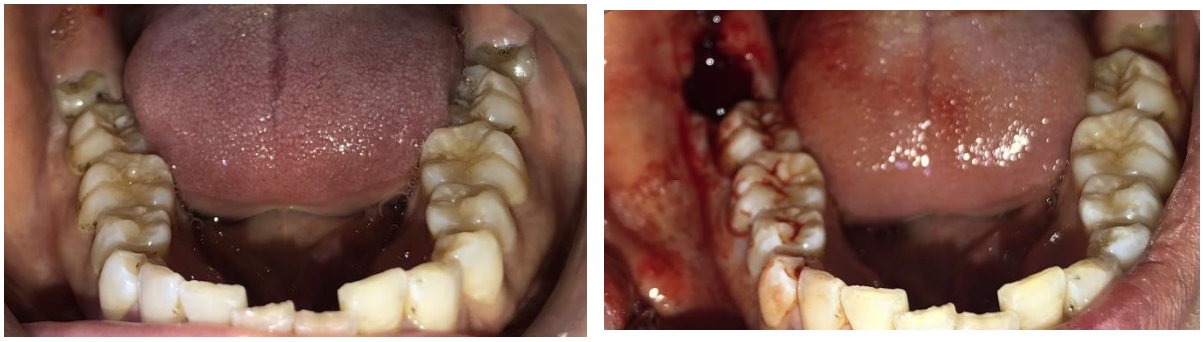

Figure-4: Mandibular 3rd molar before extraction (A) and its site after extraction (B).

Post-operative care

After surgery, the patient maintained a sterile gauze tampon in the operated area for 20 minutes and had been prescribed with 1000 mg amoxicillin-clavulanic acid, twice daily with 500 mg paracetamol orally three times daily, and 0.12% chlorhexidine mouth rinse twice daily for 1 week. In addition, patients were required to follow a semi-liquid diet and exercise restriction 7 days after surgery. Pain, swelling, and trismus were measured for each patient before surgery and at follow-up visits on the first, third, and seventh postoperative days.

Measurement of pain intensity

Patients were asked to rate their pain intensity at the first, third , and seventh postoperative days using the Numerical Rating Scale (NRS) ***[12]***, which contains pain intensity grades from 0 to 10, where 0 means no pain at all and 1 to 3 means mild pain, 4 to 6 means moderate pain, and 7 to10 means severe or the worst imaginable pain.

Measurement of facial swelling

Soft tissue edema was examined by the patients subjectively using 2 -point visual analogue scale VAS (0 indicates no swelling, and 1 indicates swelling), and objectively by the investigator who used a tape for measuring 2 lines delineated on the skin of the operated side by skin landmarks as horizontal line assessed by point S1; the most proximal point of the earlobe, and S2; the corner of the mouth point. Whereas, vertical line determined by point S3; the lateral angle of the eye exocanthion (Ex) and point S4; the point of the angle of the mandible. The difference between the two readings (pre-operative and post-operative) was used to evaluate the amount of residual swelling at 1st, 3rd, and 7th post-operative days.

Measurement of maximum mouth opening

The magnitude of potentially existing trismus was assessed using clipper (plastic ruler) in which the intermaxillary distance between the incisal edges of the upper and lower right central incisors was measured at the possible maximum jaw opening pre-operatively and post-operatively on 1st, 3rd, and 7th days ***[13]*** (Figure 3B). The above measurements were all carried out by a single observer for all participants to decrease measurement bias using self-prepared well-designed questionnaire.

Duration of surgery

Furthermore, duration of surgery for each case measured in minutes, which corresponded to the period between starting the incision and placement of the PRF and then suturing in group I, and between starting the incision and placement of the PRF and replacing the flap to its original position in group II, and between starting the incision and replacing the flap to its original position in group III. Compliance with post-operative instruction, evaluated by the patient by recording the duration (in days) of using the antibiotic, analgesics, and chlorhexidine mouth wash.

Patient consent

All participants were provided with informed consent in both English and Kurdish languages and were asked to sign the written consent form. The procedure for the treatment, its complications, and follow-up period was explained to the patients and they were free to withdraw from the study at any time they wish.

Ethical approval

The protocol of this study was approved by the Ethical Committee of the College of Dentistry, University of Sulaimani, Sulaimaniyah, Iraq with number (80/21)/2021.

H. Statistical analysis

Analysis of data was carried out using IBM-SPSS, version 27.0 software (Statistical Package for the Social Science, SPSS Inc., Chicago, IL, USA). A $P<0.05$ was accepted as statistically significant ($\alpha=5\%$ and power >80%). The Shapiro–Wilk test was used for normal distribution of data of individual parameters. Differences in individual parameters among the groups was tested using chi-squared test for abnormally distributed variables (swelling and pain). Non-parametric analysis for comparing means within the group variables was tested by using Mann-Whitney U Test.

Results

The average age of the participants in the first group was 28.15±3.64, the average age of the second group was 27.45±5.02, and the average age in the third group was 26.96±3.63. The results of the average process time were 39.15±3.80 and 24.60±1.69 in the second group, and the least time to complete the process in the third group was 14.05±1.76 (Table 1).

Table- 1: Socio-demographic and operative time characteristics.

Variable	Group 1 PRF With Suture	Group 2 PRF Without Suture	Group 3 Without PRF/Sutures
Male	10	10	10
Female	10	10	10
Mean age	28.15	27.45	26.96
Mode of age	30	26	27
Std of age	3.64	5.02	3.63
Maximum age	34	41	33
Minimum age	21	19	19
Operation time (Mean±SD)	39.15±3.80	24.60±1.69	14.05±1.76

In the current study, there was no statistical significance between all 3 groups in regards to age, sex, operation time, pre-operative facial measurement and pre-operative mouth opening. In the group I, VAS pain scores on the 3rd and 7th day were significantly less (P=0.008 and P=0.038, respectively) than other groups (Table 2).

Table- 2: Pain scores after 1, 3, and 7 days' post-operation using Mann-Whitney U Test.

Post-operation time		**Group**						**P-value**
		PRF with suture		**PRF without suture**		**Without PRF/without suture**		
		Count	**%**	**Count**	**%**	**Count**	**%**	
1 Day	Nil	12	60	10	50	8.0	40	0.360
	Mild	6.0	30	7.0	35	7.0	35	
	Moderate	1.0	5.0	2.0	10	3.0	15	
	Severe	1.0	5.0	1.0	5.0	2.0	10	
	Very Severe	0.0	0.0	0.0	0.0	0.0	0.0	
	Worst	0.0	0.0	0.0	0.0	0.0	0.0	
3 Days	Nil	14	70	13	65	13	65	0.915
	Mild	5.0	25	7.0	35	5.0	25	
	Moderate	1.0	5.0	0.0	0.0	2.0	10	
	Severe	0.0	0.0	0.0	0.0	0.0	0.0	
	Very severe	0.0	0.0	0.0	0.0	0.0	0.0	
	Worst	0.0	0.0	0.0	0.0	0.0	0.0	
7 Days	Nil	19	95	18	90	16	80	0.329
	Mild	1.0	5.0	2.0	10	4.0	20	
	Moderate	0.0	0.0	0.0	0.0	0.0	0.0	
	Severe	0.0	0.0	0.0	0.0	0.0	0.0	
	Very severe	0.0	0.0	0.0	0.0	0.0	0.0	
	Worst	0.0	0.0	0.0	0.0	0.0	0.0	
P-value		0.030		0.017		0.016		

Regarding the facial swelling, there was no significant difference between groups on days 1, 3, and 7 (P>0.05) (Table 3).

Table- 3: Swelling scores after 1, 3, and 7 days of surgery using Mann-Whitney U Test.

Post-operation time		**Group**						**P-value**
		PRF with suture		**PRF without suture**		**Without PRF/without suture**		
		Count	**%**	**Count**	**%**	**Count**	**%**	
1 Day	Yes	3.0	15	2.0	10	3.0	15	0.868
	No	17	85	18	90	17	85	
3 Days	Yes	3.0	15	1.0	5.0	1.0	5.0	0.494
	No	17	85	19	95	19	95	
7 Days	Yes	1.0	5.0	0.0	0.0	1.0	5.0	0.601
	No	19.0	95	20	100	19	95	
P-value		0.527		0.333		0.424		

When trismus values were examined, we found that there was no significant difference (P>0.05) in the mean of mouth opening MO between all groups in the variable mouth opening (MO) it turns out that all the results were not statistically significant (Table 4).

Table- 4: Maximum interincisal mouth opening of the patients using Mann-Whitney U Test.

Post-operation time	Group			P-value
	PRF with suture	PRF without suture	Without PRF/without suture	
	Mean±SD	Mean±SD	Mean±SD	
0 Day	49.4±0.37	48.2±0.49	48.5±0.43	0.862
1 Day	48.6±0.54	47.2±0.66	47.8±0.45	0.643
3 Days	48.6±0.54	47.1±0.68	48±0.44	0.692
7 Day s	48.7±0.52	47.7±0.61	48.1±0.43	0.774
P-value	0.998	0.993	0.885	

Discussion

In this study, application of PRF with/without suture to the socket of the extracted tooth was to examine whether the symptoms such as pain, facial swelling, and trismus in the immediate postoperative period were relieved or remained and worsened.

Accordingly, we extracted partially impacted lower 3rd molars in the mesioangular position; class IB based on classifications of Winter, 1926, Pell and Gregory, 1933 ***[14,15]***. Additionally, anatomy of the root that might not be dependent of the tooth spatial location is crucial to determine the trouble of the process ***[16]***. Obviously, variation in the root anatomy of wisdom tooth frequently affects the possibility of the operating removal process. Removing of the bone and the dissecting of the tooth considerably related to some complications ***[17]***. In the present study, the same surgeon performed tooth removal in whole participants, and the same surgeon followed the outcomes.

Various tasks have been comprehensively studied to avoid 3rd molar removal post-operative squeal such as using PRF which was prepared for the first time by Choukroun et al in 2001 through centrifugation of collected venous blood without biochemical blood handling ***[18]***. The slow polymerization during PRF preparation appears to produce a fibrin network very alike to the normal one that is rich with PLT and growth factors. Thus, prepared PRF improves cell migration and propagation to accelerate physiologic wound healing process ***[19]***.

Several studied have been conducted to determine the relationship between PRF utilization and pain, edema, and spasm of the jaw muscles that developed after the extraction process of 3rd molar ***[20-22]***. Their obtained outcomes are different that might be due the use of subjective data in their project ***[23-25]***. In this respect, Kumar et al., 2015 stated that direct PRF insertion to the site of extracted 3rd molar potentially diminished pain, swelling, and trismus after one day of surgery ***[21]***. However; Ozgul et al., 2015 found significant swelling in the control group 3 days after the extraction without significant difference in pain intensity between groups ***[26]***, while Singh et al. 2012 mentioned that using PRF not reduced postoperative pain after tooth removal ***[27]***.

Moreover, different studies have been performed to investigate the effect of primary/secondary suturing on the amount of pain, edema development, and jaw muscle spasm following removal of impacted 3rd molar ***[28]***. In this concern, Osunde et al., 2011 examined the effect of the suturing process on postsurgical discomfort and they realized that significant correlation was not found between the thorough closing and a one stitch in the angle of the flap, however; individuals with incomplete closure showed reduced postsurgical discomfort and pain ***[29]***.

Similarly, Maria et al., 2012 mentioned that less postoperative variable was found in patients with secondary closures, but considerable swelling and hematoma were seen in patients with complete closing

[30] which is agreed with the sequelae found by Danda et al., 2010 after removal of impacted mandibular 3rd molars in a complete and split mouth study ***[10]***. However, Bello et al., 2011 displayed reduced facial edema in patients with incomplete suturing with no significant differences in trismus and pain intensity between groups ***[31]***. Consequently, in our study, we could not observe significant correlations between the groups related to pain intensity, facial edema, and jaw muscle spasm postoperatively. These outcomes were consistent with 2 other studies ***[26,27]***, but inconsistent with another study ***[21]***.

Furthermore, controversial ideas are reported in different studies regarding the application of the PRF to the socket to affect the pain intensity after removal of 3rd molars ***[32]***. Hence, we used VAS to evaluate the pain degree in the current study. Accordingly, Thong et al., 2018 ***[33]***, Hjermstad et al., 2011 ***[34]***, and Fereira-Valente et al., 2011 ***[35]*** used visual analogue scale (VAS) with numerical rating scale (NRS) interchangeably due to the highly correlated scores.

Initially, in this study, we included patients without pain on their 3rd lower molar (NRS=0.0). Thus, participants had PRF with suture after the extraction showed significantly reduced pain on 1st and 3rd postoperative day in comparison to patients without PRF/suture. Following NRS of zero value preoperatively; conclude no significant increased pain in the groups.

In 2017 studies on their 3rd molar extraction using PRF into the post-extraction alveolus, same pain intensity rate was found between control and study groups by Gül ̧sen, et al. ***[36]*** and Asutay et al. ***[8]***. These non-significant correlations in pain development in patients after extraction were in agreement with other records ***[21,37]***.

Facial swelling that most commonly results from surgical trauma is another postoperative discomfort after tooth extraction which can reach the highest level on the 2nd/3rd days after surgery and decreased gradually to normal level on 4th day and usually totally overcome on 7th day ***[38]***. In our study, we found highest swelling score on day 3 after surgery in all groups, without significant correlation between them. Regarding the trismus, also no significant consideration was found between groups and a decreased mouth opening was seen in all groups after surgical process, which coincide with Asutay et al., 2017 ***[8]*** and Gürler et al., 2016 ***[39]*** who reported that PRF utilization not significantly reduced the intensity of trismus.

Conclusions

We concluded that utilizing PRF with/without suture had no significant effects on postoperative complications such as pain, swelling, and trismus following removal of partially impacted third molars. However, PRF application with suture fasten and reduced traumatic process but PRF without suture shorten the operation time. The main limitations of the present study were the small sample size, short duration of follow-up, and non-split mouth study. Thus, larger sample size, longer follow-up and double blinded split-mouth study; with a related degree of strain of impacted lower third molars are recommended for future studies.

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