Effects Of Platelet-Rich Fibrin on Pain, Edema, and Trismus After Surgical Extraction of Impacted Mandibular Third Molars

Gömülü Mandibular 3. Azı Dişlerin Çekiminden Sonra; Çekim Soketine Trombositten Zengin Fibrin Uygulanmasının Ağrı, Ödem ve Trismus Üzerine Etkisi

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ABSTRACT

Introduction: In this study, we aimed to evaluate the post-operative pain, facial swelling and trismus with or without applying PRF(Platelet-Rich fibrin) to the region of attraction after the withdrawal of the impacted third molars.

Methods: Forty patients(23 male,17 female) ranging from 16-30 years age who provide the inclusion criteria were selected on this study. Patients were divided into two main groups. In the control group (20 patients), irrigated the socket by saline and in the experiment group socket filled with PRF. Patients were reclaimed 1. 3. 7. days after surgery. Post-operatively pain were evaluated with VAS(0-100), facial swelling evaluated with horizontal and vertical guide and trismus degree evaluated with maximum mouth opening quantity. These variants were also evaluated on postoperative 1. 3. 7 days.

Results: Evaluations showed definite differences between the control group(without PRF) and the experiment group(PRF) in pain parameter, but no statistically significant difference was found between the other two parameters.

Discussion and Conclusion: Using of PRF showed statistically significant diferrence between groups for pain, but not for edema and trismus.

Keywords: *Platelet-Rich fibrin (PRF), impacted third molar, pain, edema, trismus*

ÖZET

Giriş ve Amaç: Bu çalışmada, gömülü yirmi yaş dişlerinin çekimi yapıldıktan sonra cerrahi bölgelere trombositten zengin fibrin (TZF) uygulanan hastalarda postoperatif ağrı, şişlik ve trismus değerlendirilmiştir.

Yöntem ve Gereçler: Çalışmaya dahil edilme kriterlerini karşılayan 16-30 yaş arasındaki 40 hasta (23 erkek, 17 kadın) değerlendirildi. Hastalar iki gruba ayrıldı. Kontrol grubunda (20 hasta), soket serum ile yıkandı ve deney grubunda soket PRF ile dolduruldu. Hastalar cerrahi işlemden sonra 1, 3 ve 7 günlerde değerlendirildi. Postoperatif ağrı VAS skalası (0-100) kullanılarak değerlendirildi, yüz şişmesi yatay ve dikey cetveller kullanılarak ölçüldü ve trismus, maksimum ağız açma kabiliyetini postoperatif 1, 3 ve 7. günlerde kaydederek değerlendirildi.

Bulgular: Kontrol ve deney grupları ağrı açısından anlamlı farklılık gösterdi, ancak diğer iki parametre açısından farklılık bulunamadı.

Tartışma ve Sonuç: PRF kullanımı ağrı için gruplar arasında istatistiksel olarak anlamlı farklılık gösterdi, ancak ödem ve trismus için farklılık bulunamadı.

Anahtar Kelimeler: *Trombositten Zengin Fibrin (TZF), Gömülü üçüncü molar, diş, ağrı, ödem, trismus*

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INTRODUCTION

Third molars as the latest erupted teeth have a prevalence of being impacted of 33 to 58,7 %. The removal of impacted third molars is common oral surgical procedure[1,2] and after the removal of impacted third molars, patients generally complain of pain, trismus and swelling.[3,4] The pain reaches maximum intensity at 3–5 h after surgery, continuing for 2–3 days, and gradually diminishing until the 7th day.[4,5] Swelling reaches peak intensity within 12–48 h, resolving between the 5th and 7th days postoperatively.[6] The impact of third molar surgery on quality of life has been reported to show a three-fold increase in patients who experience pain, extraoral swelling, and trismus, alone or in combination, compared to those who are asymptomatic.[7] Therefore, many clinicians have emphasized the necessity for better control of pain, swelling, and trismus in patients who undergo third molar surgery.

These inflammatory complications remain an important factor for patients and surgeons are responsible for developing a strategy to reduce the risk of complications and improve postoperative healing.[8] To minimize the inflammatory response and complications after extraction surgery many attempts have been made to reduce postoperative outcomes following third molar surgery, including platelet-rich plasma or platelet-rich fibrin (PRF) administration[9,10], cryotherapy[11], preoperative and postoperative antibiotics[12], osteotomy using high or low speed rotary instruments[13], the use of different kinds of flaps [14], postoperative ice packs[15], and laser.[16] In addition, numerous pharmacologic methods have been introduced in this surgery, including corticosteroids (eg, dexamethasone), nonsteroidal anti-inflammatory drugs (eg, indomethacin), growth factors (eg, platelet-derived growth factor, transforming growth factor, and fibroblast growth factor), and so on.[17] However, the exact solution has not yet been found.

Autologous platelet concentrates have been used to improve healing and enhance bone generation by releasing growth factors. Platelets contain high quantities of key growth factors, such as platelet-derived growth factor, vascular endothelial growth factor, and transforming growth factor b 1 and b 2, which are able to stimulate cell proliferation and enhance angiogenesis.[18,19] PRF, a second-generation platelet concentrate geared to simplified preparation without biochemical blood handling.[20] It has been shown to have a more sustained release of growth factors.[21] Unlike other platelet concentrates, PRF does not dissolve quickly after application and platelets are activated during the process, leading to substantial embedding of platelet and leukocyte growth factors into the fibrin matrix. Many studies have shown that application of PRF can reduce inflammation, pain, and unwanted side effects following surgery.[22,23]

Extraction sockets would heal more quickly and pain would be reduced if autogenous platelet concentrate was applied to the area. We hypothesized that local application of PRF in lower third molar extraction would improve treatment outcomes. The specific aim of the study was to compare pain, swelling and trismus after the extraction of an impacted lower third molar between the PRF and non- PRF groups.

MATERIAL AND METHODS

Institutional ethics committee's approval was obtained for the protocol of the study in Cumhuriyet University, Faculty of Dentistry ethic committee. (approval protocol No: 2016-09.03 date 27.09.2016)

All surgiries were performed in Oral and Maxillofacial Surgery Department according to the guidelines of Cumhuriyet University and all patients who agreed to participate voluntarily signed an informed consent.

This study was applied on 40 patients who were treated at the Department of Oral and Maxillofacial Surgery, Faculty of Dentistry in Cumhuriet Universty 'Sivas' from July to December 2016, which required the removal of impacted mandibular third molars. Exclusion criteria were patients with immuno-depression, pregnancy or women in the lactating period, smokers, patients taking oral contraceptives, patients in the use of epinephrine is contraindicated and allergics to NSAIDs.

After preoperative evaluation and obtaining written informed consent, total of 40 patients (23 male, 17 female) ranging from 16-30 years age who could follow postoperative instructions were selected for the study.

Clinical inclusion criteria were as follows:

1) Mandibular bilateraly full impacted third molars which have the same degree of surgical difficulty comparing one side with the other (Fig. 1).
2) No preexisting medical conditions or no use of medication that would influence or alter wound healing
3) No active pathology associated with the third molars would affect the pain sensation after surgery.

Patients (23 male, 17 female) who met the inclusion criteria were selected to participate in this study. Pell and Gregory classification was used to determine the difficulties of the patients included in the study. Of these 40 patients distribution of the classification was as: 16 horizontal, 14 mezioangular, 10 vertical. PRF and the technique were explained to patient and informed consent was taken from all patients.

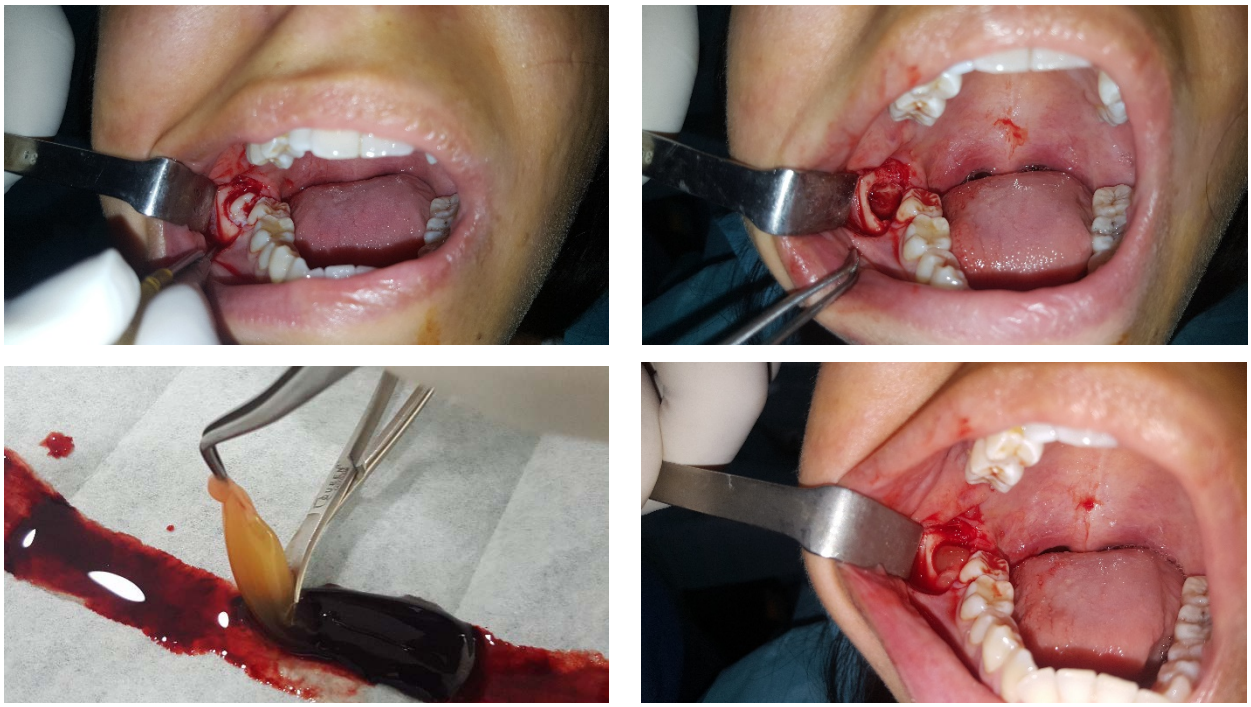

Figure 1.

PRF Preparation

Prior to the extractions, 10 ml of venous blood was collected from each patient by a surgical nurse and was placed in glass-coated plastic tubes. Tubes were transferred to a centrifuge device and centrifuged for 10 min at 3000 rpm according to Choukroun et. al.[23] We discarded the platelet-poor plasma that accumulated at the top of the tubes and collected the PRF from roughly 2 mm below its contact point with the red corpuscles to include any remaining platelets. A clot of PRF, which was produced in a 10 ml tube, was enough to fill the socket of each patient.

Surgical Procedure

A standardized surgery procedure was carried out by a single operator for all patients after appropriate preoperative evaluation. All patients underwent bilateral removal of mandibular impacted third molar in single appointment that were the same degree of surgical difficulty.

Patients underwent surgical treatment in accordance with the rules of antisepsis and asepsis. Mandibular and buccal blocks were administered using articaine containing 1:200,000 epinephrine (Ultracain DS; Aventis, Istanbul, Turkey). Vertical and horizontal incisions were carried out and a full-thickness mucoperiosteal flap was raised. The tooth was exposed with a round bur, after which buccal guttering was performed using a straight fissure bur. Tooth sectioning was performed as deemed necessary after preoperative radiographic evaluation and the tooth was delivered with elevators. After tooth extraction, the socket was thoroughly irrigated and freed from pathologic tissue (eg, granulation tissue), follicular remnants, and bony spicules.

In the case group after the tooth was delivered, 5 mL of venous blood was drawn and centrifuged at 3,000 rpm for 10 minutes and PRF was obtained. The PRF was inserted into the extraction socket and then closure was performed using 3-0 silk sutures.

In the control group (20 patients), irrigated the socket by saline and primary closure was performed using 3-0 silk sutures. The average operative time from incision to suturing was 10 to 30 minutes.

Postoperatively, all patients were started on a 5-day course of amoxicillin 500 mg twice daily, metronidazole 400 mg twice daily, paracetamol twice daily, and chlorhexidine for mouthwashing twice daily. All patients were given instructions on the importance of maintaining oral hygiene and jaw physiotherapy postoperatively. Suture removal was performed on postoperative day 7.

Evaluation

We evaluated post-op pain using a visual analogue scale (VAS) (0: no pain to 100: severe pain), and enrolled taken the number of analgesic tablets. We evaluated trismus by measuring the distance between the mesial incisal corners of the upper and lower right incisors

during maximum mouth opening as described by Üstün et. al.[24] and recorded swelling using the modified method by Gabka and Matsumara. Five references points and three preoperative measurements: tragus to soft tissue pogonion, lateral corner of the eye to the angle of the mandible, and tragus to the outer corner of the mouth were repeated on postoperative days 1, 3, and 7th. The sum of the 3 preoperative measurements was taken as the baseline for that side, and the difference between each postoperative measurement and the baseline gave the value for facial swelling and trismus on that days 1, 3, 7 daily changes were recorded as a value. The surgery time was considered to be the period between the first incision and end of suturing. Patients were seen on each of the 3 postoperative days, and all measurements were assessed by the same person.

Statistical analysis

Statistical analysis was performed using the software program SPSS 22.0 (SPSS 22.0 for Windows; SPSS Inc., Chicago, IL, USA),.Kolmogorov-Smirnov test was used when the parametric test assumptions are fulfilled in evaluating the data, the significance test of the differences between the two means was used in the independent groups, Variance analysis and Bonferroni was used in repeated measurements; Mann-Whitney U, Friedman and Wilcoxon tests were used when parametric test assumptions were not met.

RESULTS

Pain:

When the individuals in both groups were compared in terms of pain, the difference between the groups was found significant ($p<0,05$). In the group without PRF (control group) the pain score is higher. The difference between day 1 and day 3, day 1 and day 7, and day 3 and day 7 were significant in the two groups. Pain in both groups was observed at the highest level on day 3 ($p<0,05$). (Table 1)

Facial Swelling:

Five references points and three preoperative measurements: tragus to soft tissue pogonion, lateral corner of the eye to the angle of the mandible, and tragus to the outer corner of the mouth, were repeated on postoperative days 1, 3, and 7th.The difference between the groups with and without PRF was not significant. ($p>0,05$).Differences were found to be significant when comparing the distances measured in groups on two different days (0 to 1, 0 to 3, 0 to 7, 1 to 3, 1 to 7, 3 to 7) ($p<0,05$). Especially on the 3rd day there is an increase in swelling. (Table 2, Table 3, Table 4)

Table 1. Pain

		Mean	Std Deviation	Minimum	Maximum	Result p
Pain 1Day	PRF	14,07	12,90	,00	50,00	0,041*
	Control	19,4000	12,71744	,00	55,00	
Pain 3Day	PRF	31,0750	14,70982	,00	65,00	0,038*
	Control	37,6500	15,62797	,00	75,00	
Pain7Day	PRF	5,8250	5,58334	,00	20,00	0,013*
	Control	10,4500	8,49419	,00	30,00	

Table 2. Measurement of Lateral corner of the eye to the angle of the mandible

		Mean	Std. Deviation	Minimum	Maximum	result t	p
0	PRF	100,4000	5,50897	89,00	115,00		
	Control	100,4000	5,50897	89,00	115,00		
1.Day	PRF	106,8000	7,82894	94,00	130,00	1,35	0,180
	Control	109,3500	8,98874	94,00	136,00		
3.Day	PRF	114,9000	8,56289	97,00	135,00	1,91	0,059
	Control	118,8750	9,91551	104,00	142,00		
7.Day	PRF	101,8000	5,73429	92,00	115,00	1,70	0,092
	Control	104,1750	6,66752	92,00	119,00		

Table 3. Measurement of Tragus to the outer corner of the mouth

Tragus to	theouter corner of the mouth	Mean	Std. Deviation	Minimum	Maximum	result t	p
0.Day	PRF	118,4000	5,15802	100,00	128,00		
	Control	118,4000	5,15802	100,00	128,00		
1.Day	PRf	122,9000	5,61956	110,00	135,00	0,96	0,340
	Control	124,1250	5,78321	110,00	137,00		
3.Day	PRF	127,5250	6,08060	112,00	140,00	1,53	0,128
	Control	129,5750	5,83925	114,00	142,00		
7.Day	PRF	119,1000	5,36274	100,00	130,00	1,3 0	0,197
	Control	120,6500	5,28932	102,00	132,00		

Table 4. Measurement of Tragus to SoftTissue Pogonion

		Mean	Std. Deviation	Minimum	Maximum	result t	p
0. Day	PRF	153,7250	5,39224	145,00	162,00		
	Control	153,7250	5,39224	145,00	162,00		
1.Day	PRF	157,1500	5,96808	145,00	168,00	0,72	0,470
	Control	158,1250	6,03489	148,00	170,00		
3.Day	PRF	160,6000	5,80362	148,00	172,00	1,33	0,186
	Control	162,3500	5,93793	152,00	175,00		
7.Day	PRF	154,0500	5,43941	145,00	163,00	1,91	0,365
	Control	155,1500	5,34718	147,00	165,00		

Duration:

There was no significant difference in operating time among the groups. In the control group: Extractions took a mean of 12.37 minutes (SD= 2.68) and in PRF group 12.32 minutes (SD= 2.64) (p= 0,993).(Table.5)

Trismus:

The difference between the groups with and without PRF was not significant. (p>0,05). Differences were found to be significant when comparing the distances measured in groups on two different days (0 to 1, 0 to 3, 0 to 7, 1 to 3, 1 to 7, 3 to 7) (p<0,05). Especially on the 3rd day there is an increase in swelling.(Table.6)

Table 5. Duration

	Mean (Minutes)	Std. Deviation	Minimum	Maximum	result t	p
Control Group	12,3750	2,68603	8,00	17,00	0,08	0,993
PRF Group	12,3250	2,64466	8,00	18,00		

Table 6. Mouth Opening Distance

		Mean	Std. Deviation	Minimum	Maximum	result t	p
0 Day	PRF	37,9750	3,56254	28,00	44,00		
	Control	37,9750	3,56254	28,00	44,00		
1 day	PRF	35,9000	3,90135	25,00	41,00	0,88	0,382
	Control	35,1000	4,21110	24,00	41,00		
3 Day	PRF	33,4250	4,07549	20,00	39,00	1,37	0,173
	Control	32,1000	4,52798	19,00	39,00		
7 Day	PRF	37,7750	3,77228	28,00	44,00	1,96	0,336
	Control	36,9500	3,85606	25,00	44,00		

DISCUSSION

PRF is the second generation of platelet concentrates. It is characterized by slow polymerization during preparation, which produces a fibrous protein network similar to the natural cells in order to enhance cell migration and proliferation. As a reservoir of platelets, cytokines, leukocytes, and immune cells, PRF allows a sustained release of cytokines such as VEGF, PDGF, TGF, and epidermal growth factor (EGF) that play a key role in vascular and tissue healing and scarring. PRF also enhances angiogenesis, supports immunity, and increases the coverage of the injured tissue by enhancing the positive effects on epithelial cells and fibroblasts.[25] In the oral and maxillofacial region, PRF has been widely used as the sole grafting material or in combination with an allograft or a xenograft.[23] It has been used in different procedures such as extraction socket preservation, intrabony defects, sinus augmentation, bone augmentation and root coverage procedures. Local signs of inflammation, including pain, swelling, and trismus, usually follow the extraction of impacted mandibular third molars and the clinical efficacy of PRF in oral surgical procedures is debated as contrasting results have been reported in different clinical procedures.[26,27,28] The objective of this study was to analyse the effectiveness of local application of PRF to control the postoperative complications after the extraction of an impacted lower third molar. We hypothesized that local application of PRF during lower third molar extraction would be able to reduce and relieve the postoperative complications. In the literature, there are few studies which show the effect of PRF for the control of pain, swelling, and trismus following the extraction of mandibular third molars. The results of this study confirm the hypothesis that local application of PRF during lower third molar extraction reduce postoperative complications.[29]

Relief of postoperative pain is an essential criterion in the overall success of tooth extraction. In addition, most of the potential postoperative complications are in fact manifested as pain. In the present study, the degree of pain was measured using the VAS scale. This study revealed that PRF significantly reduced postoperative pain following surgical removal of impacted third molars. This agrees with other studies.[30,31] There are many authors, indicated in their studies that, using PRF is effective in reducing pain, in their studies, patients were recorded to either have no severe pain, significantly less pain or even no pain. Kumar et. al.[31] reported that, according to VAS results, patients treated with PRF had significantly less pain than those in the control group the day after impacted mandibular third molars had been removed. In an another study, Singh et. al.[32] reported that PRF usage after third molar surgery decreased pain in the first, third, and seventh days postsurgery; however, this finding was not statistically significant. Bilginaylar et. al.[33] reported that PRF usage decreased pain values significantly on the first, third, and seventh days post-surgery. Uyanık et. al.[34] extracted impacted third molars bilaterally and reported that PRF usage in impacted third molar surgery reduced pain significantly on the first, second, third, and seventh days post-surgery. As contrary results, Kim et. al.[35] reported that the use of PRF had no effect on pain following the surgical removal of impacted mandibular third molars and Singh et. al.[32] also reported that PRF had no effect on pain following removal of mandibular third molars. In another study, Asutay et. al.[36] reported that no significant differences were observed between the PRF and control groups at all intervals due to improvement of pain and swelling values. Gülşen et. al.[37] involved 30 patients who underwent bilateral third molar surgery in the same session and they reported that using or not using PRF to reduce postoperative pain in third molar surgery was equally successful.

Various methods have been used to measure facial swelling. Our method was modification of tape measuring method of Gabka and Matsamura which was described by Üstün et. al.[24] It is a noninvasive, simple, cost-effective and timesaving method, which provides us with numeric data for determination of soft tissue contour changes. In a study of 31 patients Kumar et. al.[31] reported that PRF usage decreased pain and swelling values significantly on the first control day post surgery. Gürler et. al.[38] reported that Leukocyte PRF application to the impacted mandibular third molar extraction sockets in 40 patients was not found statistically significant in terms of edema. In a multicenter study with a large sample Özgül et. al.[39] reported that using PRF after third molar extraction significantly decreased horizontal swelling on the first and third day post-surgery. Bilginaylar et al[33] found no significant differences in swelling values on the first day post-surgery. They also specified that no significant differences were found on the third and seventh days post-surgery. Uyanık et. al.[34] found no significant differences were found regarding swelling, which was evaluated via tape measurement. Gülşen et. al.[37] involved 30 patients who underwent bilateral third molar surgery in the same session. Using or not using PRF to reduce postoperative edema in third molar surgery was equally successful.

Most surgical procedures result in a certain amount of oedema or swelling, leading to trismus. In studies on this subject, there were no significant differences regarding trismus between the PRF and non-PRF groups. The results of this study also showed similar results.[31,33,34]

There are some limits to our study; the present study was conducted on bilaterally removed third molars at the same session the results of pain might have been influenced by the control side.

CONCLUSION

The process of PRF preparation is simple and cost effective, and the local application of PRF showed good

results. Our study showed that local application of PRF after impacted lower third molar extraction is a valid method for relieving pain and 3-day postoperative swelling. Particularly for patients undergoing complicated surgical extraction of impacted lower third molars, PRF might be recommended for local application into the sockets.

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