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Protective Effect of platelet-rich fibrin (PRF) against dry socket following surgical extraction of the mandibular third molar

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ABSTRACT

BACKGROUND & OBJECTIVE: Dry socket (DS) is a debilitating post-extraction complication. Many interventions for the prevention of DS have been used over the years, but the results remain elusive. The objective of the present study is to determine the protective effect of Platelet-Rich Fibrin (PRF) against DS following the surgical extraction of impacted mandibular third molars.

METHODOLOGY: A total of 170 consecutive patients (85 per group) meeting the inclusion criteria, i.e., 18-35 years of age, with good oral hygiene, requiring surgical extraction of mandibular third molars, and willing to participate in the study, were enrolled and randomly divided into two groups. A standard protocol for tooth extraction was followed in both groups. Group 1 (the study group) received PRF, while Group 2 (the control group) did not.

RESULTS: The mean age in the study group was 24.28 ± 3.7 years, while in the control group, it was 24.14 ± 3.64 years. Of the participants, 87 (51.2%) were males, and 83 (48.8%) were females. On the 3rd postoperative day, the frequency of DS in the study group was 2 (2.4%), while in the control group, it was 16 (18.8%), a statistically significant difference (p = 0.0004). However, no statistically significant differences were found between the PRF and control groups in terms of the side of the third molar, type of impaction, angulation, and need for bone removal.

CONCLUSION: The use of PRF significantly reduces the incidence of DS post-mandibular third molar extractions, supporting its integration into routine clinical practice to enhance patient outcomes.

KEYWORDS: Third molar, Dry Socket, PRF.

INTRODUCTION

Oral surgical procedures, particularly the extraction of the mandibular third molar, commonly known as wisdom tooth removal, can lead to postoperative complications such as dry socket (DS) [1]. DS, or alveolar osteitis, is a painful condition characterized by the inflammation of the alveolar bone following tooth extraction, often accompanied by the dislodgement or loss of the blood clot within the socket [2]. This condition can significantly impact the patient's quality of life, causing prolonged pain, discomfort, and delayed healing [3].

In recent years, Platelet-Rich Fibrin (PRF) has emerged as a promising therapeutic adjunct in various dental and oral surgery applications [4]. PRF is an autologous platelet concentrate derived from the patient's own blood, rich in growth factors and cytokines that play crucial roles in tissue regeneration and wound healing [5]. The potential protective effect of PRF against DS following the surgical extraction of the mandibular third molar is an area of growing interest within the dental research community [6].

Several studies have investigated the regenerative properties of PRF and its application in promoting tissue healing, reducing inflammation, and enhancing the overall postoperative recovery process [7-8]. However, a comprehensive understanding of the specific protective mechanisms of PRF against DS in the context of mandibular third molar extractions is essential for advancing clinical practices and improving patient outcomes [9].

This research aims to contribute to the existing body of knowledge by systematically evaluating the efficacy of PRF in preventing DS formation following mandibular third molar extractions. Through a combination of clinical observations, radiographic assessments, and patient-reported outcomes, this study seeks to elucidate the potential benefits of incorporating PRF into the standard postoperative care protocol. The findings of this research will provide valuable insights into the role of PRF in preventing DS and influence future treatment approaches, contributing to the optimization of patient care in oral surgery.

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METHODOLOGY

Ethical approval was obtained from the Institutional Ethics Review Committee prior to the initiation of the study [Ref. No. FMUF 10-04-2019-IRB-0006912 (OHRP, USA)]. This prospective comparative experimental study was conducted in the Oral and Maxillofacial Surgery Department, Dental Section, Faisalabad Medical University, from July 2019 to June 2021. A total of 170 patients who met the inclusion criteria were included in the study through the OPD using a consecutive non-probability sampling technique. The sample size was calculated using the WHO calculator, with a 95% confidence interval, a study power of 80%, and an expected incidence of DS of 9.5% without PRF and 1% with PRF [10].

The inclusion criteria were all patients aged 18-35 years, irrespective of gender, who required surgical extraction of the mandibular third molar and were willing to cooperate with the study protocol. Patients with any comorbid conditions or contraindications to surgery, e.g., diabetes mellitus, hypertension, pregnancy, acute pericoronitis of mandibular 3rd molar with/without trismus, smokers, and female patients using oral contraceptives were excluded from the study.

Preoperative medical records were completed, including the chief complaint, medical and dental histories, oral hygiene assessment, panoramic radiographs, and baseline blood investigations (comprising a complete blood count, bleeding profile, and viral hepatitis screening). The procedure was explained to the patients, and written informed consent was obtained. All included patients were randomly divided into two groups: the study group and the control group, using a coin-toss method.

A PGR level-II and above operator performed a standardized surgical procedure for all patients using a strict aseptic technique and local anesthesia. If necessary, bone removal and tooth sectioning techniques were performed using a slow-speed handpiece while irrigating with a copious amount of normal saline. After tooth extraction, the PRF clot was prepared using Choukroun's method [11]. 10 mL of venous blood was withdrawn from the patient's cubital fossa and collected in two 5 mL Vacutainers without anticoagulant.

The samples were then immediately centrifuged at 3000 rpm for 10 minutes. Blood was separated into three layers after centrifugation; specifically, the middle layer, containing the PRF, was collected. Collected PRF was placed into the extraction socket of patients included in the study group, but no such material was placed in the control group. The soft tissue mucoperiosteal flap was approximated with 3-0 black silk. Identical postoperative instructions, with special emphasis on avoiding spitting and maintaining oral hygiene, as well as administering medication, were provided to all patients postoperatively.

Postoperative medications included Tab. Amoxicillin 500 mg + Clavulanic acid 125 mg TDS, and Tab. Ibuprofen 400 mg TDS for 5 days. Follow-up visits were on the 3rd and 7th postoperative days for evaluation of DS and suture removal, respectively. DS was labeled as 'yes' or 'no' based on the presence or absence of two parameters, i.e., pain and empty socket. The pain was observed on the standard visual analog scale (VAS). A blinded observer evaluated pain on the 3rd postoperative day to reduce bias.

The pain was labeled as 'yes' if the patients reported the presence of persistent, throbbing postoperative pain inside and in the perimeter of the empty alveolar socket that is not adequately alleviated by analgesics (pain score on VAS > 3) and 'no' if the pain score was ≤3 on VAS. The empty socket was clinically analyzed by observing the soft tissue healing that covered the walls of the socket.

The empty socket was labeled as 'yes' if there was a partial or complete loss of blood clot on the 3rd day with exposed socket walls, while it was labeled as 'no' if the extraction socket was covered with healthy soft pink granulation tissue covering the walls of the socket with no socket wall exposed. PRF was categorized as effective in preventing DS based on the presence or absence of both these two parameters, i.e., pain and empty socket outcome was 'no' on the 3rd postoperative day. Sutures were removed on the 7th postoperative day. If a patient failed to report for follow-up on the 3rd and 7th postoperative days, he/she was removed from the study, and the next patient was enrolled. DS, when found, was treated by irrigation with normal saline, packing of the extraction socket with an obtundent dressing, and simple analgesics.

Data were entered and analyzed using SPSS version 16. The mean and standard deviation (SD) were calculated for quantitative variables, such as age. Frequencies and percentages were calculated for qualitative variables, including gender, pain, empty socket, and DS. A Fisher's Exact Test and chi-square test were used to compare the difference in DS between two groups (efficacy), and a p-value ≤ 0.05 was considered statistically significant. Effect modifiers, such as age and gender, were controlled for by stratification. A post-stratification chi-square test and Fisher's exact test were applied.

RESULTS

A total of 170 patients were enrolled, with 85 patients in each group. The mean age in the PRF group was 24.28±3.7 years, while in the control group it was 24.14±3.64 years. Of the participants, 87 (51.2%) were male, and 83 (48.8%) were female, with a male-to-female ratio of 1:1.05.

Table-I shows the p-value for the category of 'Empty socket,' which is directly related to the incidence of dry socket, is 0.05. This suggests that there is no statistically significant difference in the occurrence of DS between the study group (treated with PRF) and the control group. Although the p-value indicates a trend that might be of interest (as it's close to the conventional significance level of 0.05), it does not conclusively support the hypothesis that PRF has a protective effect against DS in the context of mandibular third molar extractions.

Other variables considered in the study, such as age distribution, gender, side of the 3rd molar, type of impaction, angulation, and the need for bone removal, show no statistically significant differences between the study and control groups, with p-values well above the 0.05 threshold. This is indicated by the high p-values in these categories for both Side of 3rd molar, Need for bone removal and Age distribution, etc.

However, the 'Pain' category yielded a p-value of 0.002, indicating a significant difference between the study and control groups in terms of post-operative pain. This suggests that while PRF may not significantly reduce the incidence of DS, it could have an impact on the level of post-operative pain experienced by patients.

Table-I: Variables distribution between study and control groups.

Variable	Categories	Group		Total n(%)	P-value
		Study Group n(%)	Control Group n(%)		
Age distribution	≤ 25 years	58(68.2)	60(70.6)	118(69.4)	0.739
	> 25 years	27(31.8)	25(29.4)	52(30.6)	
Gender	Male	50(58.8)	37(43.5)	87(51.2)	0.046
	Female	35(41.2)	48(56.5)	83(48.8)	
Side of 3rd molar	Right	44(51.8)	43(50.6)	87(51.2)	0.878
	Left	41(48.2)	42(49.4)	83(48.8)	
Type of impaction	Soft tissue	24(28.2)	17(20.0)	41(24.1)	0.209
	Bony	61(71.8)	68(80.0)	129(75.9)	
Angulation	Mesioangular	52(61.2)	42(49.4)	94(55.3)	0.328
	Horizontal	11(12.9)	18(21.2)	29(17.1)	
	Vertical	17(20.0)	17(20.0)	34(20.0)	
	Distoangular	5(5.9)	8(9.4)	13(7.6)	
Need for bone removal	Yes	79(92.9)	80(94.1)	159(93.5)	0.755
	No	6(7.1)	5(5.9)	11(6.5)	
Pain	Yes	3(3.5)	16(18.8)	19(11.2)	0.002
	No	82(96.5)	69(81.2)	151(88.8)	
Empty socket	Yes	2(2.4)	8(9.4)	10(5.9)	0.05
	No	83(97.6)	77(90.6)	160(94.1)	

***P-value calculated using chi square test.**

Table-II: Dry socket on 3rd postoperative day.

Outcome		Group		Total n(%)	P-value
		Study Group n(%)	Control Group n(%)		
The dry socket on the 3rd postoperative day	Yes	2 (2.4)	16 (18.8)	18 (10.6)	0.0004
	No (Efficacy)	83 (97.6)	69 (81.2)	152 (89.4)	

***P-value calculated using chi square Test.**

On the 3rd postoperative day, the frequency of DS was significantly lower in the PRF group 2 (2.4%) compared to the control group 16 (18.8%), with a p-value of 0.0004 No significant differences were observed between the groups in terms of the side of the third molar, type of impaction, angulation, and need for bone removal. (Table-II).

Dry socket distribution between study and control groups in different variables has been presented in Table-III.

Age Distribution: Among participants aged ≤25 years, the incidence of DS was 3.4% in the study group and 13.3% in the control group (p=0.094). For those over 25 years, no DS was observed in the study group, whereas the control group had a 32% incidence (p = 0.001).

Gender: The incidence of DS among males was 2% in the study group and 16.2% in the control group (p=0.038). Among females, the rate was 2.9% in the study group and 20.8% in the control group (p = 0.021).

Side of Third Molar: For the right side, the study group had no DS cases, while the control group had a 16.3% incidence (p=0.005). For the left side, the study group had a 4.9% incidence, while the control group had a 21.4% incidence (p = 0.048).

Type of Impaction: In cases of soft tissue impaction, the study group had no DS cases, while the control group had a 29.4% incidence (p=0.008). For bony impaction, the study group had a 3.3% incidence, while the control group had a 16.2% incidence (p = 0.018).

Angulation of Third Molar: Mesioangular cases in the study group had no DS cases, while the control group had a 9.5% incidence (p=0.036). No significant differences were found for horizontal (p = 0.267), vertical (p = 0.601), and distoangular (p = 0.265) angulations.

Need for Tooth Sectioning: When tooth sectioning was necessary, the study group had a 3% incidence of DS, while the control group had a 20.5% incidence (p=0.001). When tooth sectioning was not required, the study group had no DS cases, and the control group had an 8.3% incidence (p = 0.387).

Need for Bone Removal: In cases requiring bone removal, the study group had a 2.5% incidence of DS, while the control group had a 20% incidence (p≤0.001). No difference in DS was observed in either group when bone removal was not required (p = 1.000).

Table-III: Dry socket distribution between study and control groups in different variables.

Variable	Categories	Group	Dry socket at 3rd post op day	No Dry socket at 3rd post op day	P-value
Age distribution	≤ 25 years	Study group	2 (3.4)	56 (96.6)	0.094*
		Control group	8 (13.3)	52 (86.7)s	
	> 25 years	Study group	0	27 (100)	0.001*
		Control group	8 (32)	17 (68)	
Gender	Male	Study group	1 (2)	49 (98)	0.038*
		Control group	6 (16.2)	31 (83.8)	
	Female	Study group	1 (2.9)	34 (97.1)	0.021*
		Control group	10 (20.8)	38 (79.2)	
Side of 3rd molar	Right	Study group	0	44 (100)	0.005*
		Control group	7 (16.3)	36 (83.7)	
	Left	Study group	2 (4.9)	39 (95.1)	0.048*
		Control group	9 (21.4)	33 (78.6)	
Type of impaction	Soft tissue	Study group	0	24 (100)	0.008*
		Control group	5 (29.4)	12 (70.6)	
	Bony	Study group	2 (3.3)	59 (96.7)	0.018*
		Control group	11 (16.2)	57 (83.8)	
Angulation f 3rd molar	Mesioangular	Study group	0	52 (100)	0.036*
		Control group	4 (9.5)	38 (90.5)	
	Horizontal	Study group	0	11 (100)	0.267*
		Control group	4 (22.2)	14 (77.8)	
	Vertical	Study group	1 (5.9)	16 (94.1)	0.601*
		Control group	3 (17.6)	14 (82.4)	
	Distoangular	Study group	1 (20)	4 (80)	0.265*
		Control group	5 (62.5)	3 (37.5)	
Need for bone removal	Yes	Study group	2 (2.5)	77 (97.5)	≤0.001*
		Control group	16 (20)	64 (80)	
	No	Study group	0	6 (100)	1.000*
		Control group	0	5 (100)	
Need for tooth sectioning	Yes	Study group	2 (3)	64 (97)	0.001*
		Control group	15 (20.5)	58 (79.5)	
	No	Study group	0	19 (100)	0.387*
		Control group	1 (8.3)	11 (91.7)	

***P-Value Calculated by Fishers Exact Test**

DISCUSSION

The results of this study demonstrate a significant protective effect of PRF against the development of DS following the surgical extraction of mandibular third molars. The incidence of DS was substantially lower in the study group receiving PRF (2.4%) compared to the control group (18.8%). The findings of this study are consistent with the growing body of evidence supporting the use of PRF in oral surgical procedures [12].

Several studies have explored various methods to prevent DS, including the use of different materials and pharmacological agents [13]. However, the effectiveness of these interventions has often been inconsistent [14,15]. PRF, as an autologous platelet concentrate, has shown promise due to its high concentration of growth factors and cytokines, which are crucial for tissue regeneration and healing [16-18]. This reduction may be attributed to PRF's ability to stabilize clots, promote angiogenesis, and mitigate local inflammation [19-22]. The slow release of growth factors from PRF helps in maintaining a conducive environment for wound healing and clot stabilization within the extraction socket [23].

The significant reduction in DS incidence observed in this study suggests that incorporating PRF into the standard postoperative care protocol for mandibular third molar extractions can greatly improve patient outcomes. By preventing DS, PRF not only alleviates patient discomfort and pain but also reduces the need for additional treatments and follow-up visits, thus optimizing resource utilization in clinical practice.

While this study provides compelling evidence for the efficacy of PRF, it is important to consider certain limitations. The study was conducted in a single institution, and the sample size, though adequate, may benefit from further validation through larger, multicenter trials. Additionally, future research should aim to elucidate the long-term effects of PRF and explore its application in other types of oral surgical procedures.

In conclusion, the use of PRF in mandibular third molar surgery is highly effective in preventing DS, as evidenced by the significantly lower incidence of DS in the study group. Our findings support the routine use of PRF in third molar surgeries to reduce DS risk and improve patient recovery outcomes.

CONCLUSION

This study confirms that Platelet-Rich Fibrin (PRF) significantly reduces the incidence of dry socket (DS) following mandibular third molar extractions. Its application in clinical practice may lead to improved postoperative outcomes and enhanced patient satisfaction. Future studies should focus on elucidating the precise mechanisms underlying PRF's protective effects, additional applications of PRF, and optimizing its clinical use.

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Nosheen Iqbal: Substantial contributions to the conception ,design of the work , acquisition and analysis of data for the work.
Muhammad Usman Khalid: Drafting the work and interpretation of data for the work..
Omer Sefvan Janjua : Reviewing it critically for important intellectual and Final approval of the version to be published.

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