AJDS LAZHAR Al-Azhar Journal of Dental Science
Vol. 27- No. 2- 217:223- April 2024
Print ISSN 1110-6751 | online ISSN 2682 - 3314
https://ajdsm.journals.ekb.eg
Oral Biology, Medicine & Surgical Sciences Issue *(Oral Biology, Oral Pathology, Oral Periodontology, Medicine, Oral & Maxillofacial Surgery)*

EVALUATION OF PLATELET RICH FIBRIN ON HEALING OF IMPACTED LOWER THIRD MOLAR EXTRACTION SOCKETS

Saad Mohammed Saad El-Mahmoudy[1*], Mansour Mohammed Hussiene[2], Ahmed Ahmed Hussin El-fekey[3]

ABSTRACT

Objective: The aim of this study is to evaluate the effectiveness of PRF on bone tissue healing in terms of postoperative pain, postoperative swelling, and the quality of bone healing at the mandibular third molar socket. **Subjects and methods:** A clinical study will be done on patients reporting to the Department of oral and maxillofacial Surgery, faculty of dental medicine, boys, Cairo, Al-Azhar University requiring dis-impaction of bilateral mesio angular impacted mandibular third molars in 10 patients. **Results:** The present prospective clinical study evaluates the effect of PRF in healing of mandibular third molar extraction sockets. There was no difference in the age gender and type of impaction between the two groups as the mean postoperative pain score (visual analog scale) was lower for the PRF group (Group A) at all points of time when compared with the control (Group B), and this was statistically significant ($P < 0.05$). The mean percentage swelling was lower for the PRF group (Group A) at all points of time when compared with the control (Group B),and there was an increase in bone density in both study and control groups, but this increase in bone density was greater in the study group(group A) than in the control group(group B). **Conclusion:** The results of the present study suggest that application of autologous PRF gel has a beneficial effect on the healing of extraction sockets after third molar surgery.

KEYWORDS: Split-mouth technique, platelet-rich fibrin, lower impacted third molars

INTRODUCTION

In oral surgery, the operation of the impacted third molar is one of the most common surgical procedures performed by oral and maxillofacial surgeons [(1)]. After the impacted third molars are removed in the early post- operative stage, patients usually present complications such as pain, swelling, and trismus [(2, 3)]. These inflammatory complications are crucial for patients and surgeons in order to develop the customized strategy for reducing the risk of complications and improving post- operative healing [(4)].

Several attempts using platelet-rich plasma administration, preoperative and postoperative antibiotics, cryotherapy, wound draining, the use of different kinds of flaps, and osteotomy using high or low speed rotary instruments, postoperative ice packs, analgesics, corticosteroids, and laser have been made to reduce the postoperative outcome of the removal of the third molar post-surgery [(5-9)].

1. Masters Candidate
2. Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dental Medicine, Boys, Cairo Al-Azhar University.
3. Assistant Professor, Department of Oral and Maxillofacial Surgery, Faculty of Dental Medicine, Boys, Cairo Al-Azhar University.

• ***Corresponding author*:** dentistsaad6@gmail.com

DOI: *10.21608/AJDSM.2022.140057.1340*

Platelet-rich fibrin (PRF) is a novel strategy for concentrating the platelets (the preparation process without thrombin), which can be used for the enhancement after tooth extraction and residual cyst bone formation and promotion of the wound epithelialization[10-14]. The PRF originates from the slow, gradual polymerization occurring during centrifugation[15]. This is the second generation of immune platelet concentrate, collected as single fiber membrane protein components of the blood sample. These components are utilized for healing and immune regulation, especially, fibrin matrix in which, growth factors (vascular endothelial growth factor (VEGF), transforming growth factor (TGF)-A1, platelet- derived growth factor (PDGF)-AA, and insulin-like growth factor 1, leukocytic cells, and their cytokines such as, interleukin (IL)-4, IL-6, IL-1A, and tumor necrosis factor (TNF)) are enmeshed[10-14]. PRF is an autologous graft of platelets on a fibrin mesh that easy to obtain and is inexpensive[16]. PRF acts as better space filler and has advantages over bone grafting materials as autologous, indispensable in tissue wound healing[17].

Therefore, the purpose of this study was to evaluate the effect of PRF alone in healing of impacted lower third molar extraction sockets in terms of pain swelling and the bone healing. The hypothesis was that the use of PRF has a significant effect on decreasing postoperative pain swelling and increasing bone healing.

SUBJECTS AND METHODS

This study involved 20 surgical extractions of lower third molars in 10 patients (4 male,6 female with age range range18-50 years and mean age 27 years,). Patients who had similar bilaterally impacted lower third molars were recruited from the outpatient clinics of Oral and Maxillofacial Surgery Department, Faculty of Dental Medicine, Boys, Cairo Al-Azhar University, and Sayed Jalal University Hospital.

All patients were divided randomly into groups as the follow:

- **Group A:** Test group: Those in which PRF was placed into the extraction socket
- **Group B:** Control group: Those in which PRF was placed in the extraction socket.
- In every patient, one side served as Group A and the other as Group B.
- In every odd patient, PRF was placed in the left socket. In every even patient, PRF was placed in the right socket.

- **Patient Selection:**

Selection of patients based on specific inclusion and exclusion criteria as the follow:

A. Inclusion Criteria:

Bilateral Mesioangular impacted mandibular third molars planned for extraction, patient aged 18 to 50 years old and a willingness to cooperate with the study protocol and follow-up program.

B. Exclusion Criteria:

Uncontrolled systemic disease which could affect the bone healing, the patient who is treated with radiotherapy for head and neck area and unwillingness to return for the follow-up examinations.

- **Ethical Consideration:**

This study was carried out after approval of ethical committee, Faculty of Dental Medicine, Al-Azhar University, Cairo, Boys, approval number 5011228.

- **Patient Consent:**

Each patient signed an informed consent having details about the whole surgical procedure before starting of the study. After getting informed consent from the patient, the treatment was done.

- **Preoperative Preparation:**

Prior to surgery, a complete medical, dental and drug history as well as patient's data (name, gender and age) were recorded. After, preoperative radiography and measurements, each patient was appointed for surgery [18].

- **Platelet Rich Fibrin (PRF) Preparation:**

The protocol for PRF preparation was single stage centrifugation performed in the absence of bovine thrombin (anti-coagulant). Blood specimen was collected or drawn from the patient just prior to surgery by taken 10 ml intravenous blood into a syringe and collected in a sterile glass test tube (10ml) without anti-coagulant. The collected blood specimen was placed in the centrifuge and was allowed to spin immediately in centrifugation machine (LC-04R electric centrifuge. Wincom CO. China) for 12 min at 3000 revolutions per minute (rpm). Following this the blood sample settles into various three layers because of differential densities of the formed layers. The middle portion containing the fibrin clot was then picked up with forceps and was scrapped off from the lower part containing the red blood cells. Then, the resulted PRF will be transferred into a sterile dish until use [18,19]

Surgical Procedures:

Using a standardized surgical protocol, all patients were treated under local anesthesia by inferior alveolar nerve block, lingual and long buccal nerve block using a solution of 2% lignocaine hydrochloride with adrenaline in 1:80000 concentrations.

In study group, just after the local anesthesia gave its action and before placing the incision, the surgical access was performed via a standard pyramidal flap, which was done by an incision with blade No 15, mounted on B.P scalpel handle No 3.

Buccal and distal guttering was done to facilitate delivery of the third molar using a surgical round bur. If necessary, sectioning of crown and roots was performed with a fissure bur and the tooth was delivered out of the socket.

After extraction, the socket was irrigated with abundant sterile saline solution to remove any debris, hemostasis was achieved. Finally, the mucoperiosteal flap was repositioned and sutured in place with simple interrupted sutures given using 3/0 non-absorbable silk suture. After surgery; a written information about the post-operative instructions and the necessary follow-up care was provided to the patient. Suture was removed after 1 week later **(Figure 1)**.

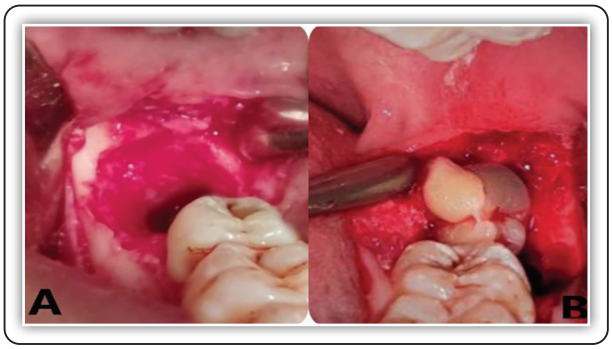

FIG (1) A clinical photographs showing extraction socket after removal of impacted lower right third molar without placement of PRF(A), and extraction socket after removal of impacted lower left third molar and platelet rich fibrin after preparation placed in extraction socket (B)

- **Postoperative Assessment:**

Postoperatively, patients were evaluated bilaterally for:

Pain – 1st, 3rd, 7th, and 14th postoperative day.

Swelling – 1st, 3rd, 7th, and 14th postoperative day

Bone healing – on 4th week and 12th week

CBCT scanning was performed 4 weeks after surgery and after three months to measure the bone density.

Statistical Analysis

Data were collected, tabulated, and statistically analyzed using SPSS® Statistics Version 25 for Windows to detect whether significant differences existed between the means of the various studied groups.

RESULTS

- **Intraoperative and postoperative complications**

Minimal amount of bleeding was noticed intra and postoperatively. Proper wound healing was noticed without wound dehiscence in the study group. Postoperative pain and swelling were manageable. Postoperative infection was absent. No alveolar nerve injury was detected in the lower jaw.

- **Pain and swelling scores:**

For both scores, there was statistically significant difference between the study group and control sides. Study sides showed a significant lower pain than control sides after 1st, 3rd, 7th, and 14th At day 14, there was a statistically non-significant difference between study and control sides postoperative day from the surgery.

TABLE (1) Comparison between study and control according to pain in each time

	Study (n = 10)	Control (n = 10)	t	p
Pain				
day 1	7.10 ± 0.70	9.30 ± 0.79	6.736*	<0.001*
day 3	5.90 ± 1.43	7.60 ± 1.10	3.016*	0.015*
day 7	2.80 ± 1.23	4.30 ± 1.30	3.308*	0.009*
day 14	0.0 ± 0.0	0.30 ± 0.42	2.250	0.051

TABLE (2) Comparison between study and control according to swelling in each time

	Study (n = 10)	Control (n = 10)	t	p
Swelling				
day 1	14.36 ± 1.69	15.0 ± 1.35	0.989	0.348
day 3	15.06 ± 1.37	16.10 ± 0.81	2.011	0.075
day 7	14.24 ± 1.70	14.91 ± 1.38	1.134	0.286
day 14	13.60 ± 1.96	13.60 ± 1.70	0.000	1.000

Bone density

The statistical analysis of postoperative bone density of study group after the 3th months of follow-up revealed that; the difference between study group and control group was statistically significant as indicated by One-way ANOVA test. The PRF treated group showed the highest bone density than control sides **(Table 3)**.

TABLE (3) Comparison between bone densities after 4th and 12weeks in the study and control groups.

	Study (n = 10)	Control (n = 10)	t	p
Bone density				
4 weeks	378.0 ± 41.31	295.0 ± 28.38	6.262*	<0.001*
12 weeks	772.6 ± 44.26	654.8 ± 72.35	5.228*	0.001*
Increase	394.6 ± 40.06	359.8 ± 74.60	1.913	0.088

DISCUSSION

In the present study the usefulness of PRF in wound healing was evaluated in 10 patients of extraction of bilaterally impacted mandibular third molars. All of them were radiological diagnosed to have bilaterally impacted mandibular third molar. Ten patients were divided randomly by split mouth in to twenty case which separated into two equal groups. Group with placement of PRF and another without placement of PRF. Parameters such as age, gender, pain, swelling, and bone healing were recorded.

In the present study, both study and control sides showed a statistically significant decrease in mean pain and swelling at day 1, 3, 7, and 14. At day 1, 3, and 7, study sides showed significant lower pain and swelling than control sides, while at day 14, there was a statistically non-significant difference between study and control sides. Both study and control sides showed a statistically significant increase in mean bone density after 12 weeks. At 4 week and 12 weeks, study sides showed a significant

higher bone density than control sides. Study sides showed a significant lower Bone density increase than control sides but not significant.

In accordance with our results, Dar et al.[20] evaluated the effectiveness of PRF on soft-tissue healing and bone tissue healing in terms of postoperative pain, postoperative swelling, soft tissue healing, and the quality of bone healing at the mandibular third molar socket. There was no difference in the age gender and type of impaction between the two groups as the mean postoperative pain score (visual analog scale) was lower for the PRF group (Group A) at all points of time when compared with the control (Group B), and this was statistically significant. The mean percentage swelling was lower for the PRF group (Group A) at all points of time when compared with the control (Group B). Evaluating the effect of treatments (with or without PRF) on lamina dura score shows that in both the groups at different time periods, significant difference was observed on lamina dura score. They concluded that application of autologous PRF gel has a beneficial effect on the healing of extraction sockets after third molar surgery.

Fiero-Serna et al.[21] in their study also found that patients reported less pain on the side which received plasma rich in growth factors. Our results were also supported by Gawande and Halli .[22]. The reason for this statistical difference in pain seems to be because of the accelerated growth factor release from the PRF which causes enhanced repair at the surgical site. Overall, in our study, PRF did make difference to the swelling, our results showed at day 1, 3, 7, and 14, there was a statistically non-significant decrease in swelling in study than control sides they were supported by Singh et al.[23] who found that swelling was less on the PRF sides.

In the present study, both study and control sides showed a statistically significant increase in mean bone density after 12 weeks. At 4 week and 12 weeks, Study sides showed a significant higher Bone density than control sides. Girish Rao et al.[24] in their study found a definite improvement in the regeneration of bone after third molar surgery in cases treated with PRF as compared to the control group postoperatively. The enhanced bone density increase is because of the three most important growth factors from the PRF are PDGF, insulin-like growth factor-I, and transforming growth factor-β (TGF–β). Numerous studies, have shown that these factors cause chemotaxis and mitogenesis of osteoblast precursors, and they also have the ability to stimulate osteoblast deposition of the collagen matrix of wound healing and of bone. In addition, TGF-β inhibits osteoclast formation and bone resorption, thus favoring bone formation over resorption.[25]

In addition, this is in accordance with the findings of Gassling et al.[26], who proved in their study that PRF with its intrinsic cytokines helps in wound healing by moderating the inflammation Regarding the bone density, starting from the first to the third month post-operatively, there was slightly denser bone in the study group than in the control group. This is in agreement with the findings of Singh et al.[23], who found in their study that PRF has significantly improved soft tissue healing, bone regeneration and increase in bone density in extraction sockets.

On the other hand, Baslarli et al.[27] investigated the healing potential of bone by comparing PRF-treated and non-PRF-treated extraction sockets. In conclusion PRF-treated extraction sockets did not demonstrate any difference in bone regeneration than non PRF-treated extraction sockets post-operatively after 4 and 12 weeks.

CONCLUSION

This study examined the effect of PRF gel on postoperative pain, swelling, and bone regeneration potential on third molar extraction sockets. The results of the present study suggest that the application of autologous PRF gel has a beneficial effect on the healing of extraction sockets after third molar surgery.

REFERENCES

1. Mantovani E, Arduino PG, Schierano G, Ferrero L, Gallesio G, Mozzati M, et al. A split-mouth randomized clinical trial to evaluate the performance of piezosurgery compared with traditional technique in lower wisdom tooth removal. J Oral Maxillofac Surg 2014; 72(10):1890-7.
2. Lee CT, Zhang S, Leung YY, Li SK, Tsang CC, Chu CH. Patients' satisfaction and prevalence of complications on surgical extraction of third molar. Patient Prefer Adherence 2015; 9:257-63.
3. Gelesko S, Long L, Faulk J, Phillips C, Dicus C, White RP. Cryotherapy and topical minocycline as adjunctive measures to control pain after third molar surgery: an exploratory study. J Oral Maxillofac Surg 2011; 69(11): e324-32.
4. Osunde OD, Adebola RA, Omeje UK. Management of inflammatory complications in third molar surgery: a review of the literature. Afr Health Sci 2011; 11(3):530-7.
5. Ogundipe OK, Ugboko VI, Owotade FJ. Can autologous platelet-rich plasma gel enhance healing after surgical extraction of mandibular third molars? J Oral Maxillofac Surg 2011; 69(9):2305-10.
6. Barone A, Marconcini S, Giacomelli L, Rispoli L, Calvo JL, Covani U. A randomized clinical evaluation of ultrasound bone surgery versus traditional rotary instruments in lower third molar extraction. J Oral Maxillofac Surg 2010; 68(2):330-6.
7. Koyuncu B, Zeytinoğlu M, Tetik A, Gomel MM. Effect of tube drainage compared with conventional suturing on postoperative discomfort after extraction of impacted mandibular third molars. Br J Oral Maxillofac Surg 2015; 53(1):63-7.
8. Pouchain EC, Costa FW, Bezerra TP, Soares EC. Comparative efficacy of nimesulide and ketoprofen on inflammatory events in third molar surgery: a split-mouth, prospective, randomized, double-blind study. Int J Oral Maxillofac Surg 2015; 44(7):876-84.
9. Romeo U, Libotte F, Palaia G, Tenore G, Galanakis A, Annibali S. Is erbium: yttrium-aluminum-garnet laser versus conventional rotary osteotomy better in the postoperative period for lower third molar surgery? Randomized split-mouth clinical study. J Oral Maxillofac Surg 2015; 73(2):211-8.
10. Choukroun J, Diss A, Simonpieri A, Girard MO, Schoeffler C, Dohan SL, et al. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part V: histologic evaluations of PRF effects on bone allograft maturation in sinus lift. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; 101(3):299-303.
11. Choukroun J, Diss A, Simonpieri A, Girard MO, Schoeffler C, Dohan SL, et al. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part IV: clinical effects on tissue healing. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; 101(3): e56-60.
12. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, et al. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part III: leucocyte activation: a new feature for platelet concentrates? Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; 101(3): e51-5.
13. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, et al. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part II: platelet-related biologic features. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; 101(3): e45-50.
14. Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J, et al. Platelet-rich fibrin (PRF): a second-generation platelet concentrate. Part I: technological concepts and evolution. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2006; 101(3): e37-44.
15. He L, Lin Y, Hu X, Zhang Y, Wu H. A comparative study of platelet-rich fibrin (PRF) and platelet-rich plasma (PRP) on the effect of proliferation and differentiation of rat osteoblasts in vitro. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009; 108(5):707-13.
16. Jahan SS, Ahmad S, Mohammad M, Younis M, Gul S, Bhat MA. Comparative analysis of platelet-rich fibrin and hydroxyapatite in management of periapical inflammatory lesions: A clinical and radiographic analysis. Int J Contemp Res. 2018;5: B1-B3.
17. NaiK B, Karunakar P, Jayadev M, Marshal VR. Role of Platelet rich fibrin in wound healing: A critical review. J Conserv Dent. 2013; 16:284-93.4. Sreedevi P, Varghese N, Varugheese JM. Prognosis of periapical surgery using bonegrafts: A clinical study. J Conserv Dent. 2011; 14:68-72.
18. Moneem SA, Kamel HM, Asker NA. Effect of biphasic bone graft material (bgm) in combination with autologous platelet-rich fibrin (PRF) on bone regeneration in an odontogenic maxillary cyst: a randomized controlled clinical trial. EDJ. 2020; 66: 830- 36.
19. Choukroun J, Adda F, Schoeffler C, Vervelle A. An opportunity in paro-implantology: the PRF. Implantodont. 2001; 42:55-62.

20. Dar MM, Shah AA, Najar AL, Younis M, Kapoor M, Dar JI. Healing Potential of Platelet Rich Fibrin in Impacted Mandibular Third Molar Extraction Sockets. Ann Maxillofac Surg 2018; 8(2):206-13.

21. Fierro-Serna VM, Martínez-Rider R, Hidalgo-Hurtado JA, Toranzo-Fernández JM, de Jesús Pozos-Guillén A. Colocación de plasma rico en factores de crecimiento postextracción de terceros molares inferiores: Reporte de un caso. Rev Odontol Mex 2011; 15(2):109-14.

22. Gawande PD, Halli R. Efficacy of platelet rich plasma in bone regeneration after surgical removal of impacted bilateral mandibular third molars: pilot study. J Maxillofac Oral Surg 2009; 8(4):301-7.

23. Singh A, Kohli M, Gupta N. Platelet rich fibrin: a novel approach for osseous regeneration. J Maxillofac Oral Surg 2012; 11(4):430-4.

24. Girish Rao S, Bhat P, Nagesh KS, Rao GH, Mirle B, Kharbhari L, et al. Bone regeneration in extraction sockets with autologous platelet rich fibrin gel. J Maxillofac Oral Surg 2013; 12(1):11-6.

25. Carlson NE, Roach RB. Platelet-rich plasma: clinical applications in dentistry. J Am Dent Assoc 2002; 133(10):1383-6.

26. Gassling V, Douglas T, Warnke PH, Açil Y, Wiltfang J, Becker ST. Platelet-rich fibrin membranes as scaffolds for periosteal tissue engineering. Clin Oral Implants Res 2010; 21(5):543-9.

27. Baslarli O, Tumer C, Ugur O, Vatankulu B. Evaluation of osteoblastic activity in extraction sockets treated with platelet-rich fibrin. Med Oral Patol Oral Cir Bucal 2015; 20(1): e111-6.9. Kao ST, Scott DD. A Review of Bone Substitutes. Oral and Maxillofac Surg Clinics of North America. 2007; 19:513-21.