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PRF-BOON OR BANE?

Dr. RIAZ RAHIM

Research Scholar, Department of Oral and Maxillofacial Surgery, Bharath Institute of Higher Education & Research, Chennai. Corresponding Author: E-mail: riazcmfs.rr@gmail.com

Dr. MENSUDAR RADHAKRISHNAN

Professor and HOD, Department of Conservative Dentistry and Endodontics, Sri Balaji Dental College & Hospital, Chennai.

Dr. JAYAVELU P

Professor, Department of Oral and Maxillofacial Surgery, Madha Dental College, Chennai.

Abstract

Aim: This study aims to compare the effectiveness and outcomes of various subtypes of PRF such as Advanced PRF (A-PRF), Injectable PRF (I-PRF), and Standard PRF (S-PRF) in the healing process following third molar surgery. **Materials and Methods:** Seventy five patients in the age group between 18 and 35 years old with bilaterally impacted mandibular third molar teeth which requires surgical removal were included in this study. Right side was taken as the study group for placing A-PRF, I-PRF and S-PRF. The left side was taken as the control group. A-PRF was placed for 25 patients (7 males, 18 females; Tooth number-48), I-PRF was placed for 25 patients (9 males, 16 females; Tooth number-48) and S-PRF was placed for 25 patients (6 males, 19 females; Tooth number-48). On the first and third days, postoperatively, the swelling was calculated by measuring the distance between several facial landmarks, the pain was evaluated with the use of a visual analog scale (VAS), and mouth opening was assessed by measuring inter-incisal and soft tissue healing by Turnbell et al method. **Results:** The mean pain score was higher on the first day for A- PRF over I-PRF and S-PRF, while after 1 week the pain score lowered for A-PRF over I-PRF and S-PRF. The swelling was more in I-PRF over A-PRF and S-PRF, while after 1 week the swelling regressed for A-PRF over I-PRF and S-PRF. The mouth opening was more in I-PRF over A-PRF and S-PRF, while after 1 week the mouth opening improved for A-PRF over I-PRF and S-PRF. **Conclusion:** From this study, we conclude that the platelet rich fibrin showed better effects on healing process after third molar surgery. Out of which, Advanced PRF group showed decreased pain and swelling, increased mouth opening, and improved soft tissue healing as compared to other subtypes used in this study.

Keywords: Wound Healing, Platelet Rich Fibrin, Third Molar, Mouth Opening, Swelling, Pain

INTRODUCTION

Third molar surgery is the procedure that is carried out the most frequently in oral and maxillofacial surgery. Trismus, dry socket, pain, swelling, and infections are possible side effects of third molar surgery. An unpleasant sensory or emotional experience is considered painful. It is significant because it appears during wound recovery and acts as a red flag for tissue injury. It might have something to do with tissue damage that has already happened or could happen [1, 2]. The release of these compounds from injured tissues causes pain and this chemical release peaks on the first postoperative day [3]. Nonsteroidal anti-inflammatory drug is the best option for treating pain after third molar surgery. Healing is the process in which restoring of diseased or damaged tissue takes place [4]. Following third molar surgery, soft and hard tissues recuperate in a normal

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manner. Several procedures are necessary for the third molar to heal following surgery. Blood clot formation is the first step in the process resulting in a matrix which controls the movement of mesenchymal cells and growth factors to initiate proliferation. After seven days, a transitory matrix is created, producing transient connective tissue with collagen synthesis and angiogenesis. This is followed by differentiation and synthesis activity.

Lamellar bone begins to form 30 to 180 days later, followed by bone tissue at 14 to 30 days, and bone marrow at 60 to 180 days [5]. Numerous methods available to enhance soft and hard tissue recovery after third molar surgery and maintain tissue volume [6]. Numerous investigations [7, 8] have demonstrated the advantages of socket preservation methods using grafts, growth factors, and resorbable or non-resorbable membranes. Autografts are linked to a high incidence of donor site morbidity, whereas allografts are linked to a risk of disease transmission. Doctors are therefore interested in autologous materials such as platelet-rich fibrin (PRF) and platelet-rich plasma (PRP) [9]. Growth factors, which are necessary for the healing process, are present in significant amounts in platelet-rich fibrin (PRF) and platelet-rich plasma (PRP) [8]. Immunological rejection is prevented during clinical application because PRF is made from the patient's own venous blood. It serves as an autologous growth factor, has a healing function and is related to the early organization of bone material. It is jam-packed with components like platelets, fibrin, growth factors, white blood cells, and cytokines. Because PRF contains all the blood components that release a range of immune regulation-related cytokines, it is promising that it is helpful for reducing local inflammatory reactions and promotes healing. Cells involved in repair are affected by PRF in terms of their proliferation, development, and mortality [10].

Platelet-derived growth factor (PDGF), transforming growth factor-b1 (TGF-1), and vascular endothelial growth factor are three growth factors generated by PRF (VEGF). It also discharges a significant coagulation glycoprotein (thrombospondin-1). Additionally, it has a naturally occurring fibrin framework that shields growth factors from being degraded by proteases. Because PRF distributes growth factors gradually and slowly, it remains active for a considerable amount of time [11, 12]. In addition to acting as a scaffold for cell growth, fibrin gels also aid in regeneration of bone by promoting the formation of new bone tissue in PRF [13]. The use of a PRF membrane in a third molar socket following surgery has been shown to promote local soft tissue healing as well as reduce postoperative discomfort [9, 10, and 14].

Depending upon the centrifugation speed and time, various sub-types of PRF can be obtained, namely, leucocyte PRF (L-PRF), standard PRF (S-PRF), advanced PRF (A-PRF), injectable PRF (I-PRF), and titanium PRF (T-PRF).PRF, however, is known as advanced platelet-rich fibrin and contains more white blood cells (A-PRF). A new avenue for the practicality of platelet concentrates has been made possible by his inventive breakthrough in the field of PRF, such as I-PRF. It affects osteoblastic behavior by massively releasing growth factors either by themselves or in conjunction with a bone transplant. High potential for tissue regeneration; the ability to regenerate tissue

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vascularization and thereby a successful dental treatment and the ability to accelerate the development of bone and gingival tissues are the main benefits and characteristics of I-PRF.

The best way to manage pain following dentoalveolar surgery is still up for debate, however, the current study looked at the possibility that using injectable PRF and standard PRF would be useful as a better treatment modality for healing after dentoalveolar surgery. Our study's objective is to compare the effects of advanced PRF, injectable PRF and standard PRF on soft tissue healing and pain following third molar surgery and to offer dental professionals how to employ PRF in their clinical practice for managing pain and to improve healing following third molar surgery.

MATERIALS & METHODS

This study was done after obtaining authorization from the Institutional Ethics Committee, Sree Balaji Dental College & Hospital (SBDCH/IEC/08/2017/4). The study sample consisted of seventy five adult patients within the age group of 18-35 years old. Patients with bilaterally impacted mandibular third molar which requires surgical removal were included in this study. The sample size for the study was calculated in G* Power software. After obtaining detailed case history, clinical and preoperative evaluation of the patient with radiograph was done. This study was carried out between June 2019 and June 2020. IBM SPSS Version 26.0 was used for statistical analysis in this study.

Inclusion Criteria

Patients accepting for periodic follow-up

Hale and healthy patients

Patients with no systemic disorders

Winter's classification - Class II, Class III, Position B and Position C

Exclusion Criteria

Patients with smoking and alcohol history

Pregnant and lactating women

Pericoronitis

Surgical Procedure

All the patients participating in the study were informed about the surgical procedure to be carried out for removal of impacted mandibular thired molars. Informed consent was obtained from all the patients before surgery. The entire procedure was explained in Patient's own language and enough time was given to clarify all their doubts. Orally further explanation was given about the study, procedure, complications, and follow-up period. Following the standard operating procedures, all the surgeries were done by a single surgeon. Bilaterally, the impacted mandibular third molars were surgically removed

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for the selected patients. Under sterile conditions, intraoral and extraoral regions were painted with Povidone Iodine solution. 2% Xylocaine with Adrenaline nerve block was given. No: 15 blade and handle No: 3 was used to place standard Ward's incision. Following which the full thickness mucoperiosteal flap was raised using Molt's periosteal elevator. Bone guttering was made using No: 703 bur connected to straight hand piece. Copious amount of saline irrigation was done during the time of guttering. At the imaginary point of application, a straight or a coupland's elevator was used to luxate and remove the tooth. A-PRF, I-PRF, and S-PRF were placed into the respective sockets. The wound closure was then achieved with 3-0 braided silk suture. Patients were explained about the postoperative instructions and periodic follow-up. The surgical sites of the study group were randomly divided into three. The left side was taken as the control group (Tooth Number-38) and the right side of the patient was taken as the study group (Tooth Number-48). These groups were further subdivided into sub-groups namely A-PRF, I-PRF, and S-PRF. For 25 patients (both males and females) on the study site (Tooth Number-48), followed by the removal of impacted mandibular third molars, A-PRF was placed. For another 25 patients (both males and females) on the study site (Tooth Number-48), I-PRF was placed and for the remaining 25 patients (both males and females) on the study site (Tooth Number-48), S-PRF was placed after the removal of impacted mandibular third molars.

Methods of Preparation of Advanced PRF

5ml of venous blood was collected from the patient's left ante-cubital fossa (Figure *1*) under sterile conditions without adding any anti-coagulants and placed in a sterile glass test tube. This glass test tube was immediately placed in the centrifuge REMI C-852 as shown in figure *2*. For obtaining A-PRF, centrifugation started at 1500rpm with the counterweight balance for 14 minutes. The centrifuged blood was settled at the fractions: the upper fraction consisted of cellular plasma, the middle fraction contained the advanced fibrin clot and the lower fraction composed of red blood cells. Straw-colored plasma was removed initially. Then the A-PRF clot was obtained by dissecting from the red blood cells. Adequate care was taken during dissection inorder to minimize the number of red blood cells as minimal as possible. The final obtained A-PRF clot was then placed into the surgical sites. Figure *3*, shows the prepared A-PRF.

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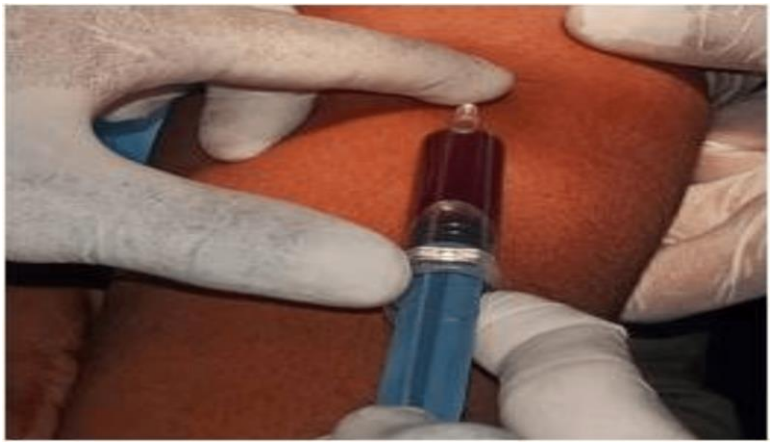

Figure 1: Method of Collecting Blood

Figure 2: Centrifugation Process

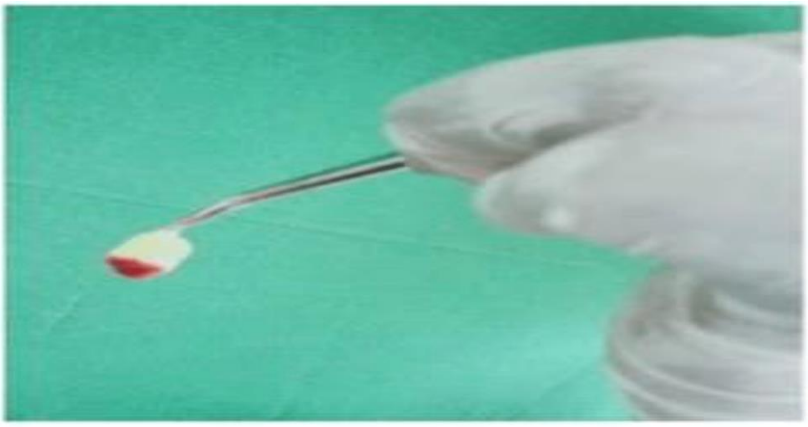

Figure 3: Obtained A-PRF

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Method of Preparation of Injectable PRF

5ml of venous blood was collected from the patient's left ante-cubital fossa (Figure *1*) under sterile conditions without adding any anti-coagulants and placed in a sterile glass test tube. This glass test tube was then placed in the centrifuge REMI C-852 (Figure *2*) at 700 rpm with a counterweight balance for 3 minutes. The centrifuged blood was settled in three fractions: the upper fraction consisted of yellow cellular plasma, the middle fraction contained the fibrin clot and the lower fraction composed of red blood cells. Using a sterile syringe, the yellow-colored liquid form of platelet-rich fibrin was then aspirated while leaving the residual red blood cells at the bottom of the test tube. Adequate care was taken during aspiration so that the red blood cells are not aspirated. The obtained injectable PRF was then injected into the surgical site. Figure *4*, shows the prepared I-PRF.

Figure 4: Obtained I-PRF

Methods of Preparation of Standard PRF

Following sterile conditions, 5 ml of venous blood was collected from the patient's left ante-cubital fossa (Figure *1*) and placed in a glass test tube without adding any anti-coagulants. This was immediately placed in the centrifuge REMI C-852 (Figure *2*) at 3000 rpm with counter volume for 10 minutes. The centrifuged blood was settled at three fractions: the lower fraction comprising red blood cells, the middle fraction containing the standard platelet-rich fibrin, and the upper fraction containing yellow cellular plasma. At the bottom of the test tube, the yellow-colored form of PRF was then dissected from the residual red blood cells which are present. During dissection, adequate care was taken so that the red blood cells are not included. The final S-PRF clot thus obtained was placed into the surgical site. Figure *5*, shows the prepared S-PRF.

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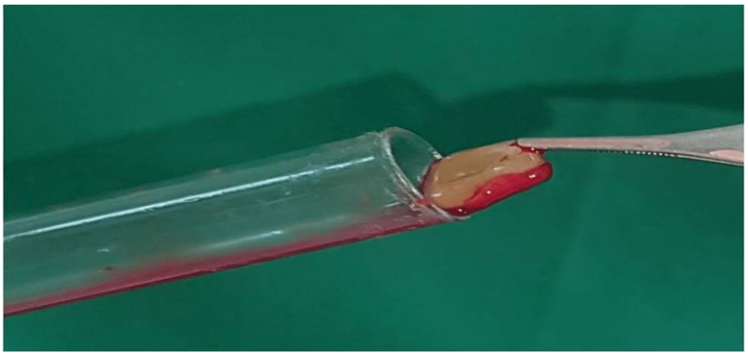

Figure 5: Obtained S-PRF

Pain Evaluation

Postoperatively, the pain was evaluated with using visual analog scale (VAS) consisting of endpoint-marked scores from 0 (no pain) to 10 (worst pain).

Swelling Evaluation

Postoperative facial swelling was evaluated by measuring the distance from the gonion-labial commissure of the mouth, tragus-labial commissure of the mouth, and tragus-lateral canthus preoperatively and postoperatively, all the measurements were made using a flexible ruler.

Mouth Opening Evaluation

Preoperatively and postoperatively interincisal distance were measured in all the three groups.

RESULTS

A total of 75 patients in the age group of 18-35 years (mean age-26.5) were evaluated in this study out of which 22 patients were males (29%) and 53 patients were females (71%).

Figure *6*, shows the mean pain score of the individuals after treatment with A-PRF, I-PRF, and S-PRF. The pain decreased over time for all the groups but the score was higher on the first day for I-PRF (2.6) over A-PRF (2.4) and S-PRF (2.2). While after 1 week, the pain score lowered for A-PRF (0.4) followed by I-PRF (0.6) and S-PRF (0.8) which was statistically not significant.

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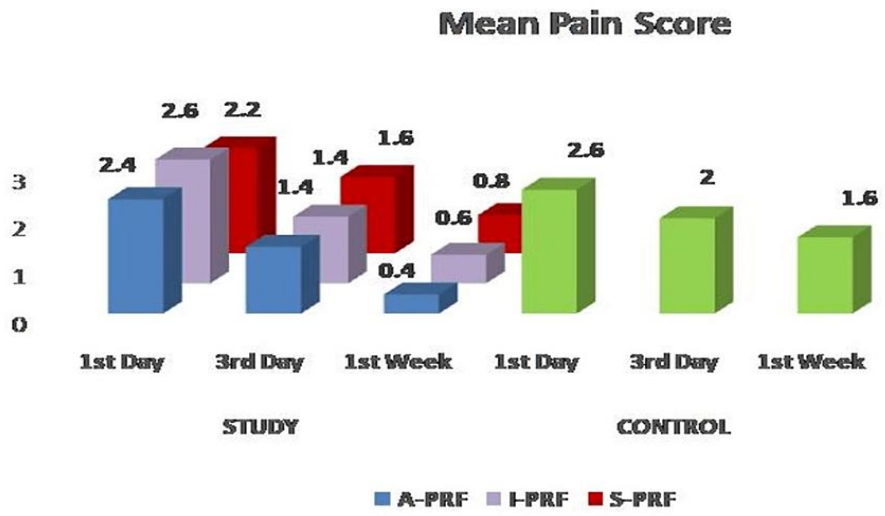

Figure 6: Mean Pain Score

Mean pain score of patients with A-PRF, I-PRF, and S-PRF where the X-axis represents Time Duration and the Y-axis represents mean pain score. Blue color represents A-PRF, Violet color represents I-PRF, Red color represents S-PRF, and Green color represents the Control group respectively.

Figure *7*, shows the mean swelling score of the individuals after third molar extraction and treatment with A-PRF, I-PRF, and S-PRF. The swelling score shows that the swelling progressively decreased in 1 week after 3rd molar extraction. Comparatively, the swelling was more in the I-PRF group (8.3) over A-PRF (8.0) and S-PRF group (7.8) on the first day but after 1 week the swelling regressed but it was higher for S-PRF (1.7) over I-PRF (1.4) and A-PRF (1.2) after 1 week which was statistically not significant.

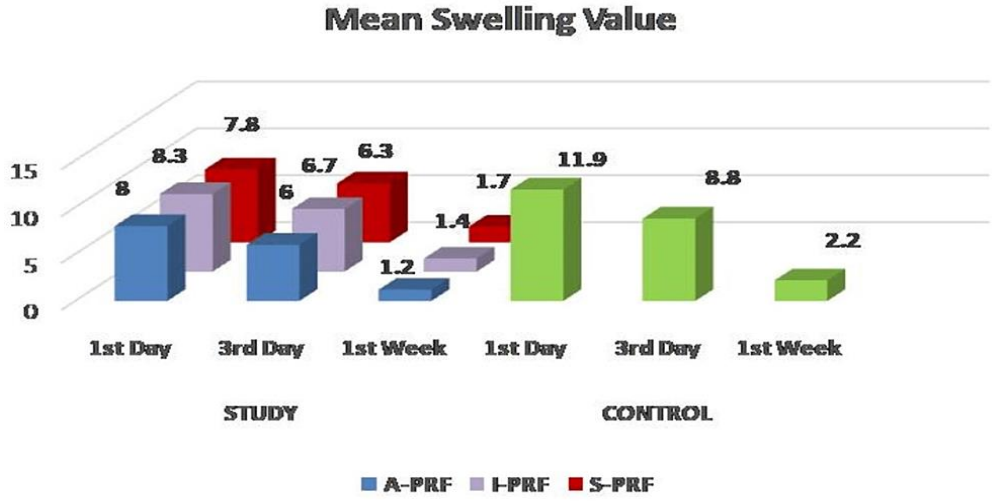

Figure 7: Mean Swelling Value

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Mean swelling value of patients with A-PRF, I-PRF, and S-PRF where the X-axis represents Time Duration and the Y-axis represents mean swelling value. Blue color represents A-PRF, Violet color represents I-PRF, Red color represents S-PRF, and Green color represents the Control group respectively.

Figure *8*, shows the mean mouth opening score of the individuals after third molar extraction and treatment with A-PRF, I-PRF, and S-PRF. The mouth opening score shows that the mouth opening progressively increased in 1 week after 3rd molar extraction. Comparatively the mouth opening was less in the S-PRF group (15.0) over A-PRF (19.0) and I-PRF group (20.0) on the first day but after 1 week the mouth opening increased for A-PRF (44.2) over I-PRF (40.0) and S-PRF (35.0) after 1 week which was statistically not significant.

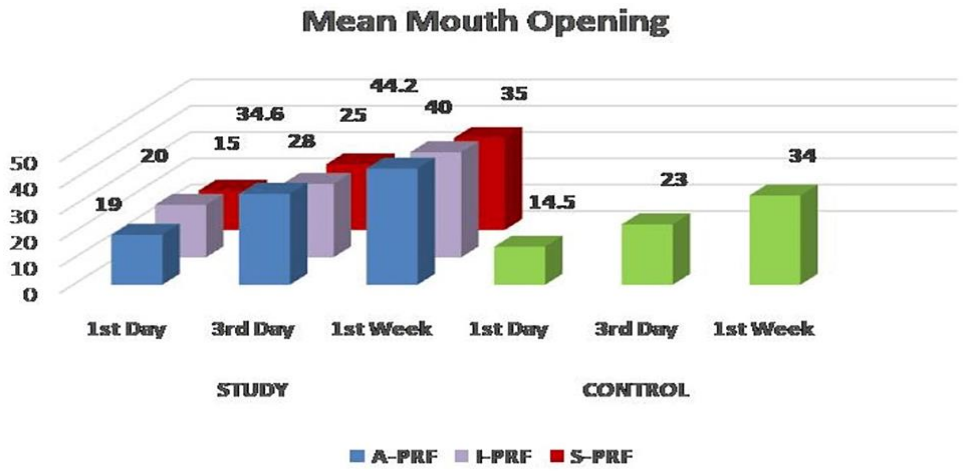

Figure 8: Mean Mouth Opening

The mean mouth opening of patients with A-PRF and I-PRF and S-PRF where the X-axis represents Time Duration and the Y-axis represents mean mouth opening. Blue color represents A-PRF, Violet color represents I-PRF, Red color represents S-PRF, and Green color represents the Control group respectively.

The results of our present study showed that the mean pain score was higher on the first day for A- PRF over I-PRF and S-PRF, while after 1 week the pain score lowered for A-PRF over I-PRF and S-PRF. The swelling was more in I-PRF over A-PRF and S-PRF, while after 1 week the swelling regressed for A-PRF over I-PRF and S-PRF. The mouth opening was more in I-PRF over A-PRF and S-PRF, while after 1 week the mouth opening improved for A-PRF over I-PRF and S-PRF.

DISCUSSION

Surgical extraction of impacted teeth is a traumatic procedure that causes bleeding, pain, and swelling. Many studies have been done to improve healing and reduce postoperative complications. The healing process consists of three phases such as inflammation,

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fibroplasia, and maturation. These phases are governed by various growth factors that migrate and infiltrate the injured site during healing. The application of growth factors accelerates the healing process by accelerating granulation tissue establishment and enriching epithelialization. PRF was prepared naturally without the addition of thrombin as described by Choukroun, and it is stated that PRF has a natural fibrin framework which protects the growth factors from undergoing proteolysis [11, 12]. During the first 7 days, the PRF releases higher quantities of the following growth factors which include platelet-derived growth factor AB, transforming growth factor β-1, vascular endothelial growth factor, and an important coagulation matricellular glycoprotein (thrombospondin-1, TSP-1). PRF also secrete EGF, FGF, and the three most important pro-inflammatory cytokines namely IL-1b, IL-6, and TNF-α, to stimulate several biological functions including angiogenesis, proliferation, modulation, chemotaxis, and differentiation thereby representing a possible therapeutic device for more effective and rapid regeneration of soft and hard tissues. The use of PRF in the oral cavity has been incorporated into different procedures such as extraction socket preservation, sinus augmentation, sinus lift procedures, intrabony defects, implant placement, root coverage procedures, bone augmentation, and healing in donor sites with positive results [15].

In the current study, the effects of advanced PRF, injectable PRF, and standard PRF on healing, pain, and mouth opening following third molar surgery were compared. The results of the study showed that postoperative pain and swelling were less in the A-PRF group followed by I-PRF and S-PRF groups as compared to their control group. The results were not statistically significant. Jang. et.al. in the study stated that S-PRF is unique because of the slow and gradual release of growth factors from one week to four weeks [16]. This could be the reason for the gradual reduction in pain, swelling, and improvement in mouth opening in patients placed with S-PRF. Local vascularization & tissue repair occurs mainly due to the controlled release of anti-inflammatory cytokines which in addition has a potential antimicrobial effect [17]. Caruana et. al., in their study, stated that I-PRF has a potential anti-inflammatory role during regeneration and restoration but A-PRF has a higher amount of platelets which releases a significantly higher quantity of growth factors such as VEGF, PDGF, TGF-β, & chemotactic molecules due to angiogenic potential and low speed of centrifugation. This could be the reason for the better performance of A-PRF compared to I-PRF and S-PRF in wound healing, pain, and mouth opening [18]. Thorat MK et al [19] in their study showed improved wound healing when PRF was used in the treatment of infrabony effects of chronic periodontitis. Similarly, Lee et al [20] in their animal study found improved healing at the site of application when PRF was used for the restoring peri-implant defects in. I-PRF contains several factors such as antimicrobial proteins, antimicrobial peptides and complement binding proteins [21]. Sharmila et al, in their study, concluded thatt here was a significant reduction in biofilm formation by all oral biofilm producers in the presence of I-PRF [22]. The bactericidal & inhibitory activity of I-PRF is due to its composition of HBD-3 peptide myeloperoxidase, thrombin, fibrin, fibronectin, platelets, and the inclusion of white blood cells [23].

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CONCLUSIONS

The efficacy of subtypes of PRF such as A-PRF, I-PRF, and S-PRF on pain, edema, and mouth opening in mandibular third molar surgery were evaluated in this study. We observed a reduction in pain and swelling with improvement in the interincisal opening on the study side within the limitation of this study. Within A-PRF, I-PRF, and S-PRF, the former performed better followed by I-PRF and S-PRF. From this study, we conclude that the platelet rich fibrin showed better effects on healing process after third molar surgery. Out of which, Advanced PRF group better effects as compared to other subtypes used in this study. Further clinical studies with better assessment modalities and with larger sample sizes should be required to evaluate and assess the applications of various subtypes of PRF in Oral and Maxillofacial surgery to achieve the best outcome in the future.

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