

Comparative Study Of Efficacy Of Advanced Platelet Rich Fibrin And Injectable Platelet Rich Fibrin In Mandibular Third Molar Surgery:

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ABSTRACT

AIM: The aim of this study is to compare and evaluate the effectiveness of Advanced PRF(A-PRF) and Injectable PRF(I-PRF) in the healing process of the surgical sites after the removal of mandibular third molars. Changes in pain, swelling, mouth opening was evaluated.

MATERIALS AND METHODS: 10 patients (3 males, 7 females; 18-35 years old) were selected for the removal of bilateral impacted mandibular third molar teeth. A-PRF and I-PRF was placed in the right side for 5 patients in each group. In both the groups the left side of the patients was taken as the control group. Post-operative pain was evaluated using a visual analogue scale (VAS), postoperative swelling was calculated using the distance between several facial landmarks (Carillo et al method) and mouth opening measured inter-incisally on the 1st postoperative day, 3rd day and the 7th day respectively. SPSS version 26.0 was used for data analysis.

RESULTS: Advanced PRF group recorded significant improvement in pain (p-value = 0.063), swelling (p-value = 0.001) and mouth opening (p-value = 0.013) compared to the Injectable PRF group. There was statistically significant difference between the advanced PRF and injectable PRF group.

CONCLUSION: Advanced PRF group showed decreased pain, swelling and increased mouth opening compared to injectable PRF group.

KEYWORDS: PRF, A-PRF, I-PRF, Impacted third molar surgery, pain, swelling, mouth opening.

INTRODUCTION

The removal of bilateral impacted mandibular third molars is one of the most common procedure in Oral and Maxillofacial surgery. Surgical removal of mandibular third molars is usually accompanied by pain, swelling, trismus and delayed healing of the sockets which may affect the patients quality of life¹. Meticulous surgical technique and scrupulous pre-operative care can reduce the risk of complications and limit their severity. Various medical and/or surgical modifications have been used to improve patients quality of life. These include drug therapies, laser treatment, steroids, ultrasound and modification of flap design. Unfortunately the amount and the intensity of pain, swelling, trismus and delayed soft tissue healing cannot be completely eliminated. Platelet Rich Fibrin (PRF) is a second generation platelet concentrate geared to simplify preparation without biochemical blood handling. It is an autologous soluble biologic material devoid of foreign material which is best suited for the surgical site. PRF was developed by Choukroun et al which comprises of platelet, cytokines, leucocytes and circulating stem cells that are entangled by a complex fibrin matrix². These unique components in PRF makes it a good biomaterial that permits optimal healing. The slow release of cytokines –transforming growth factor, vascular endothelial growth factor, epidermal growth factor and platelet derived growth factor are the key factors which play an important role in neo-angiogenesis, tissue healing makes this particular material very unique. Depending upon the centrifugation speed and time, various sub-types of PRF can be obtained namely Standard PRF (S-PRF), Advanced PRF (A-PRF), Injectable PRF (i-PRF), Titanium PRF (T-PRF), Leucocyte PRF (L-PRF)³.

MATERIALS AND METHODS:

This prospective clinical study was conducted according to the declaration of Helsinki (1975) regarding biomedical research involving human subjects & was carried out in the Department of Oral and Maxillofacial Surgery at Madha Dental College and Hospital (Kundrathur, Chennai, India) after obtaining authorization from the Institutional Ethics Committee (Ref No: 013/MDC/IEC/2019). The study sample consisted of 10 adult patients within the age group of 18-35 years old with bilaterally impacted mandibular third molar indicated for surgical removal. After obtaining detailed case history, patients were examined clinically and the third molars were evaluated radiographically.

INCLUSION CRITERIA:

- Patients who fit into the study requirements including periodic follow-up
- Hale and healthy patients without significant systemic disorders
- Patients with bilateral impacted mandibular third molars.
- Mesioangular, distoangular, horizontal and vertical impacted teeth
- Class I, Class II and Class III(Winter's classification)
- Position A, Position B and Position C(Winter's Classification)

EXCLUSION CRITERIA:

- Smokers and Alcoholics
- Patients with signs of pericoronitis and swelling

All the patients were informed about their nature of the surgical procedures and informed consent was obtained before surgery. The entire procedure was explained in English and in their native language and enough chance was given to clarify all their doubts. Orally further explanation was given about the procedure, study, complications and follow-up period. Patients who were willing to participate in the study without any compulsion were enrolled. All the surgeries were performed by a single operator strictly following the standard operating procedures. The selected patients underwent bilateral surgical removal of impacted mandibular third molars. Under sterile conditions extra-oral and intra-oral regions were painted with Povidine Iodine I.P 5% solution . 2% Xylocaine with Adrenaline Inferior alveolar nerve block was given. Standard Ward's incision was placed with No:15 blade and handle No:3. Full thickness mucoperiosteal flap was raised using Howarth's periosteal elevator, bone guttering was done using No:703 bur in Straight hand piece with copious amount of saline irrigation. At the point of application, using straight elevator the tooth is luxated and removed. The surgical sites in each patient were randomly broadly divided into two study groups. The left side of the patient was the control group(38 region). The right side of the patient was the study group(48 region). These groups were further subdivided into sub-groups namely A-PRF and I-PRF. For 5 patients A-PRF was placed & for the rest of the 5 patients I-PRF was injected in their corresponding sockets respectively after the removal of impacted mandibular third molars wound closure was done using 3-0 black braided surgical silk suture. Patients were explained about the post operative instructions, guidance and periodic follow-up.

Post operative medications included were:

1. Cap Amoxicillin 500 mg thrice daily after food for 5days

2. Tab Combiflam thrice daily after food for 5 days
3. Tab Flagyl 400mg thrice daily after food for 5 days
4. Tab Ranitidine 150mg thrice daily before food for 5 days

METHODS OF PREPARATION OF ADVANCED PRF:

For obtaining A-PRF centrifugation starts with 1500rpm for 14 minutes with counter weight balance. The centrifuged blood was settled at three fractions: the upper fraction contained cellular plasma, the middle fraction contained the advanced fibrin clot and the lower fraction contained red blood cells. The straw coloured cellular plasma was initially removed and the A-PRF clot was dissected from the red blood cells⁴. During dissection adequate care was taken to minimize the number of red blood cells as minimum as possible. The final A-PRF clot thus obtained was placed into the surgical sites.

METHOD OF PREPARATION OF INJECTABLE PRF:

Under sterile conditions 5ml of venous blood was collected from the patient's left ante-cubital fossa and placed in a glass test tube without adding any anti-coagulants. This glass test tube was immediately placed in the centrifuge(REMI C-852, REMIELEKTROTECHNIK LTD, VASAI, INDIA) with counter weight balance at 700 rpm for 3 minutes. The centrifuged blood was settled at three fractions: the upper fraction contained yellow cellular plasma, the middle fraction contained the injectable fibrin and the lower fraction contained red blood cells⁵. The yellow coloured liquid form of platelet rich fibrin was aspirated using a sterile syringe leaving the residual red blood cells at the bottom of the test tube⁶. During aspiration adequate care was taken not to aspirate the red blood cells. The final injectable PRF thus obtained was injected into the surgical site.

PAIN EVALUATION:

Post operative pain was evaluated on the 1st post operative day, 3rd day and 7th day using visual analogue scale (VAS) with end point –marked scores of 0 (no pain) to 10 (the worst pain possible) ⁷.

SWELLING EVALUATION:

Post-operative facial swelling was evaluated by measuring distance from tragus – commissuralabiorum, gonion- commissuralabiorum and tragus –lateral canthus measurements were performed pre operatively and on the 1st post operative day, 3rd day and 7th day using flexible tape proposed by Carrillo et al⁸

MOUTH OPENING EVALUATION:

Pre operatively and post operatively inter incisal distance was measured in both the groups on the 1st post operative day, 3rd day and 7th day using metal ruler in centimeters.

STATISTICAL ANALYSIS:

Statistical analysis was performed using the software program (SPSS 26.0 for window; version 26.0, Armonk,NY: IBM Corp. Released 2019) is used ,significance level is fixed as 5% ($\alpha = 0.05$). To compare pain score values between A-PRF& I-PRF MannWhitney U test is applied. As the study is (split mouth design), to compare pain score values between study & control groups Wilcoxon Signed Rank Sum test is applied. To compare mean values (Swelling & mouth opening)between A-PRF & I-PRF independent samples t -test is used . To compare mean values (swelling& mouth opening) between study & control groups paired t- test is used

Independent Samples T-Test to compare mean Mouth opening value between A - PRF and I - PRF materials in Study and Control groups separately

Group	Time	Mouth opening	N	Mean	Std. Dev	p-value
Control	1 st day	A - PRF	5	19.20	3.271	0.196
		I - PRF	5	16.00	3.873	
	3 rd day	A - PRF	5	30.40	4.099	0.159
		I - PRF	5	26.20	4.438	
	1 st week	A - PRF	5	38.20	3.564	0.663
		I - PRF	5	37.20	3.421	
	1 st day	A - PRF	5	19.00	1.581	0.293
		I - PRF	5	17.20	3.114	
	3 rd day	A - PRF	5	34.60	3.847	0.016
		I - PRF	5	28.00	2.915	
	1 st week	A - PRF	5	44.20	1.304	0.002
		I - PRF	5	40.00	1.581	

Paired Samples T-Test to compare mean swelling value between Study and Control Groups in A - PRF and I - PRF materials separately

PRF	Time	Swelling	N	Mean	Std. Dev	p-value
A – PRF	1 st day	Control	5	11.9320	.56857	0.001
		Study	5	7.2760	.88435	
	3 rd day	Control	5	10.7700	.37537	<0.001
		Study	5	5.9640	.46656	
	1 st week	Control	5	2.7940	.30956	0.004
		Study	5	1.6500	.33541	
I – PRF	1 st day	Control	5	11.9320	.56857	0.002
		Study	5	8.2700	.81077	
	3 rd day	Control	5	10.7700	.37537	0.002
		Study	5	6.6860	.95526	
	1 st week	Control	5	2.7940	.30956	0.002
		Study	5	1.3880	.17936	

Paired Samples T-Test to compare mean Mouth opening value between Study and Control Groups in A - PRF and I - PRF materials separately

PRF	Time	Mouth opening	N	Mean	Std. Dev	p-value
A - PRF	1 st day	Control	5	19.20	3.271	0.847
		Study	5	19.00	1.581	

	3 rd day	Control	5	30.40	4.099	0.083
		Study	5	34.60	3.847	
	1 st week	Control	5	38.20	3.564	0.013
		Study	5	44.20	1.304	
I – PRF	1 st day	Control	5	16.00	3.873	0.261
		Study	5	17.20	3.114	
	3 rd day	Control	5	26.20	4.438	0.295
		Study	5	28.00	2.915	
	1 st week	Control	5	37.20	3.421	0.135
		Study	5	40.00	1.581	

REPARATION



Fig 1f Fig 2



Fig 3

A-PRF

PRE-OPOPG

(

Fig

-4)



Post OP opg (Fig -5)



I-PRF preparation:



Fig -6

7

Fig-8

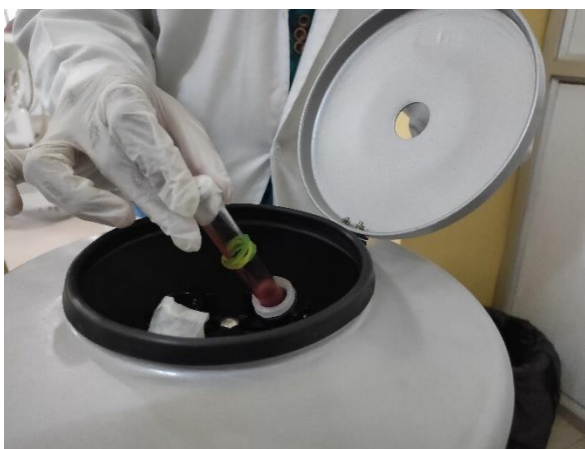


Fig-



Fig-9





I-PRF PRE-OP (Fig -10)

I-PRF POST OP(Fig-11)



Fig-12

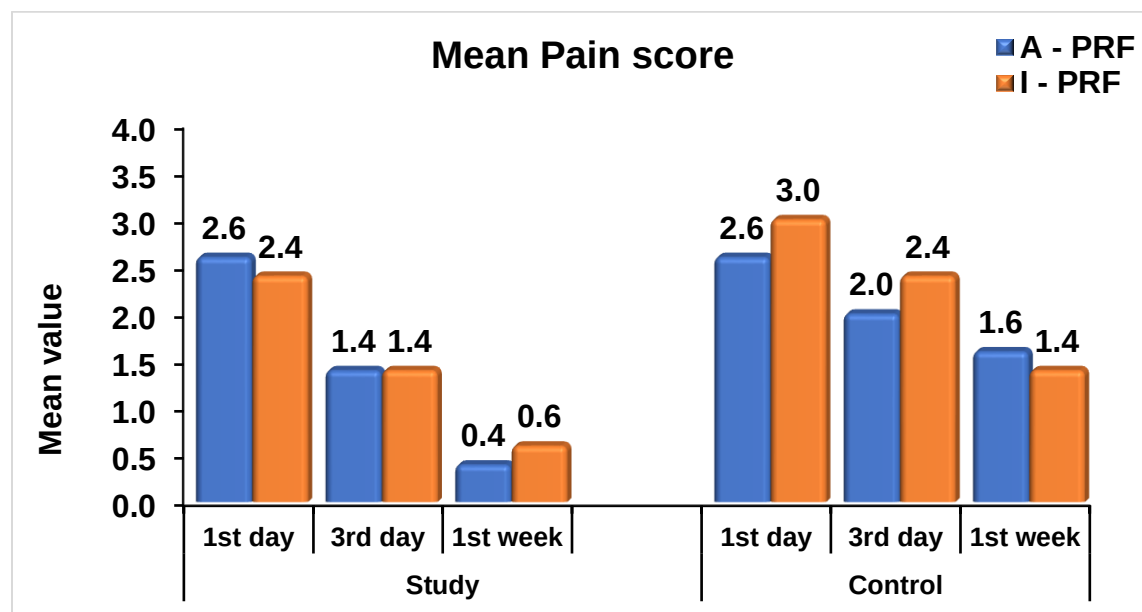


Fig -13

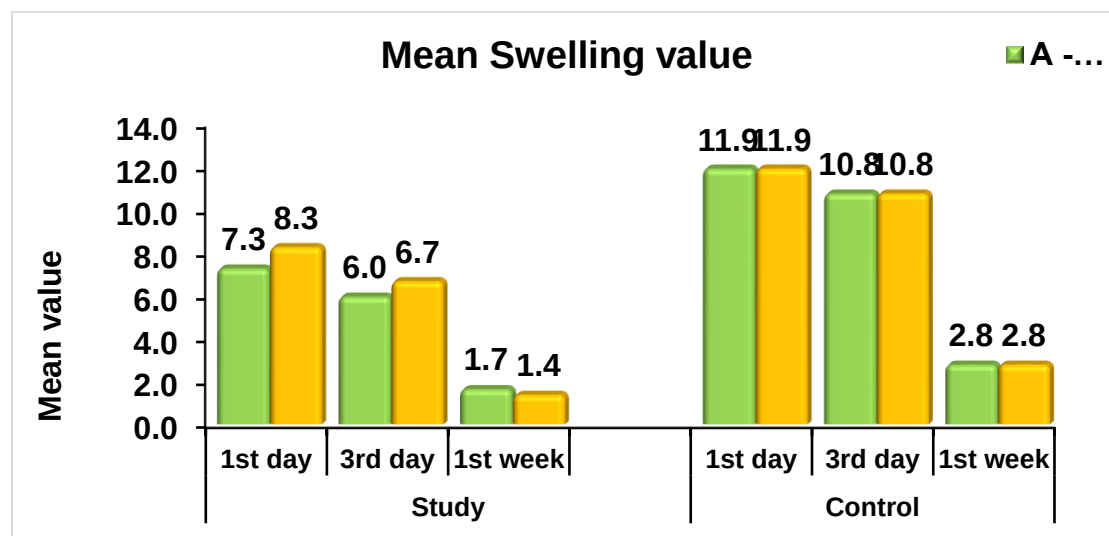
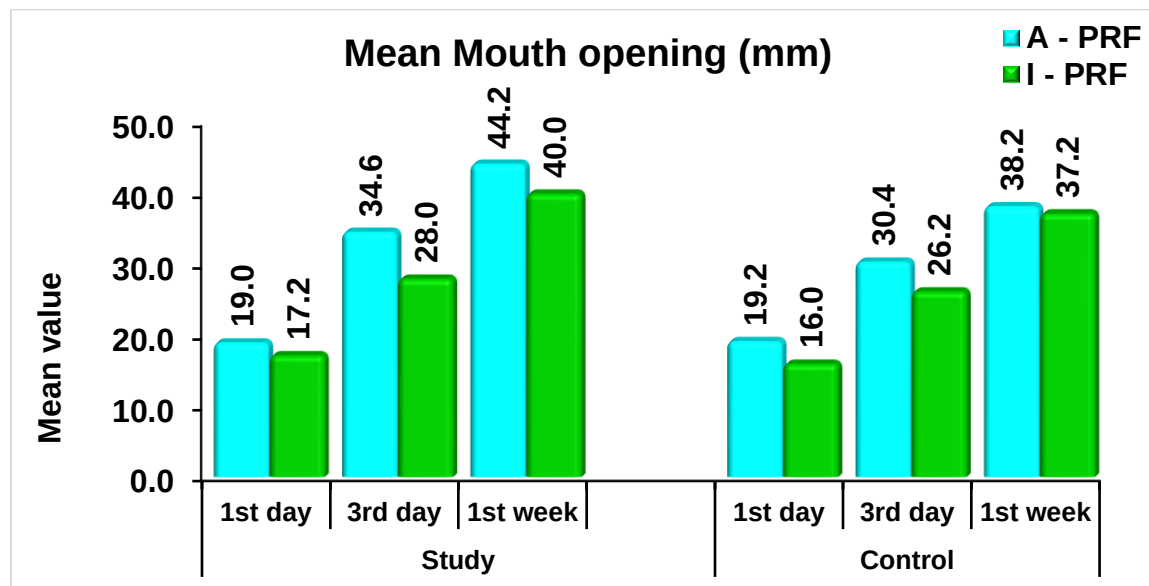


Fig-14



RESULTS:

The study included a total of 10 patients aged 18-35years(mean age- 26.5). In ten patients three were males and seven were females who underwent removal of bilaterally impacted mandibular third molars at different time intervals with A-PRF & I-PRF placed in their corresponding sockets. Advanced PRF group recorded significant improvement in pain (p- value= 0.063) , swelling (p-value =0.001) and mouth opening (p-value =0.013) compared to the Injectable PRF group . There was statistically significant difference between the advanced PRF and injectable PRF group. In the A-PRF group Post-operative pain and swelling was less compared to their control group and correspondingly the same with I-PRF group, but when we compare the intergroup the overall values are in favour of A-PRF group.

DISCUSSION

Surgical removal of impacted mandibular third molars is one of the common procedures in minor oral surgery . Surgical removal may cause trauma of the soft tissues and underlying bony structures in the oral cavity. Post operatives signs and symptoms of pain and oedema might occur due to muscle spasm ⁹. PRF is considered a fibrin bio-material, it permits a rapid angiogenesis and a easier remodeling of fibrin in more resistant connective tissue and protects the growth factors from proteolysis¹⁰. PRF described by Choukuran et al is prepared naturally without the addition of thrombin. PRF releases different kinds of growth factors like transforming growth factors P-1 (TGF), vascular endothelial growth factors (VEGE)

and platelet derived growth factor AB (PDGF-AB). NF- α obtained by simple centrifugation procedure stimulates several biological functions such as angiogenesis, chemotaxis, differentiation, proliferation, modulation and thereby has more rapid and effective regeneration of both hard and soft tissues¹¹. Singh et al in their concluded that use of PRF in bilateral third molar surgeries resulted in decreased pain compared to the control side¹². Thorat MK et al in their study found out that when PRF was used in the treatment of infrabony defects of chronic periodontitis, showed improved wound healing¹³. Lee et al in their animal study found out that when PRF was used for restoration of peri implant defects in rabbit showed improved healing in the site of application¹⁴. The differentiation of monocyte/ macrophages depends on the number of neutrophils which are abundant in leucocyte present in A-PRF¹⁵. A-PRF influences bone & soft tissue regeneration through the presence of monocytes / macrophages & their growth factors. When A-PRF placed in the mandibular 3rd molar socket growth factors are liberated in 10 days which in turn increases angiogenesis, cellular conduction & natural healing of tissues. The potential benefits of fibrin & leucocyte are required, & they are mutual stimulation “troupeurs” in the healing process¹⁶. A-PRF releases higher quantity of growth factors & has increased level of cellular differentiation which results in tissue repair & vessel formation¹⁷. Local vascularisation & tissue repair occurs mainly due to the controlled release of anti inflammatory cytokines namely IL-4, IL-6, IL-1L-10 which in addition has potential antimicrobial effect¹⁸.

i-PRF plays a vital role in host defense mechanism at the wound site by delivering various signaling peptides which attract macrophage cells. Studies have demonstrated that when we use low speed centrifugation concept (LSCC) [10ml; 700 rotations per minute; 3minutes; 60 grams] led to improved characteristics of PRF based matrices. These matrices with enhanced regeneration potential could serve as drug delivery system when combined with bio-materials in guided bone and tissue regeneration¹⁹.

When I-PRF was injected into the mandibular 3rd molar extraction socket it showed higher levels of total prolonged release of PDGF-AA, PDGF-AB, EGF & IGF-1, after 10 days from the time of deposition. I-PRF also has high bio compatibility, higher fibroblast migration & proliferation when compared to the other platelet concentrates. The release of mRNA levels of TGF- β where highest at 7 days, PDGF at 3 days & collagen-1 expression at both 3 & 7 days when compared to other platelet concentrates in the stimulation of tissue regeneration. I-PRF acts as a potential bioactive agent²⁰. Xuzhuwang et al, in their study found out that I-PRF remarkably sway osteoblastic behavior by influencing the migration

,differentiation& proliferation of human osteoblasts when compared to PRP. Additional benefits of using I-PRF was incorporation of more leucocytes as well as fibrin proteins that are awaited to coagulate²¹ .

Prerna Ashok karde et al, in their study found out that the antimicrobial activity against oral bacteria was examined on blood agar using disc diffusion method to quantify the inhibitory effects of I-PRF & concluded that when compared to other platelet concentrates. I-PRF has maximum antimicrobial efficacy²²

I-PRF contains several factors such as compliment binding proteins , antimicrobial protiens& antimicrobial peptides ²³Sharmilajasmin et al, in their study found out that I-PRF exhibited wide spectrum of activity against weak, moderate & strong biofilm producing staphylococcus strains. In the presence of I-PRF there was significant reduction of biofilm formation by all oral biofilm producers²⁴.

The inhibitory & bactericidal activity of I-PRF ,is due to its composition of fibrin, thrombin, fibronectin, platelets,HBD-3peptide myeloperoxidase & inclusion of white blood cell²⁵ . The study done by Jinglun Zhang et al investigated the anti-inflammatory effects of I-PRF on immune response- related cells, especially dendric cells & macrophages & found out that I-PRF reduces pro-inflammatory M1 phenotype of macrophages & activated dentriccells . During regeneration & restoration I-PRF has potential anti-inflammatory role ²⁶. When compared to the injectable PRF, A-PRF has higher amount of platelets which releases a significantly higher quantity of growth factor as TGF- β , PDGF,VEGF & chemotactic molecules due to low speed of centrifugation which can clinically translate into an increased concentration of growth factors & new angiogenic potential ²⁷ .

CONCLUSION:

In our study we found out that when A-PRF was used it decreases the postoperative pain , swelling and increases the mouth opening for patients who underwent removal of bilaterally impacted mandibular third molars when compared to the injectable PRF group .

The routine use of A-PRF is not only restricted to dentistry but is also been used as co-adjuvants in musculoskeletal lesions,in the treatment of chronic ulcers, plastic surgery & even orthopedic surgery. To obtain more good results, future research should use a larger sample with different investigation methods for all variables (i.e , pain , swelling and mouth opening)

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