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Thr Regenerative Edge-Advanced Platelet Rich Fibrin And Standard Platelet Rich Fibrin Following Third Molar Surgery

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Abstract:
Background: One of the most frequent minor oral surgical operations is the disimpaction of the mandibular third molar. PRF, or platelet-rich fibrin, is essential for the healing of both soft and hard tissues. PRF comes in a variety of variants that are applied to different surgical locations.
Objectives: The goal of this study is to compare and assess how well Advanced PRF (A-PRF) and Standard PRF (S-PRF) promote the healing of surgical sites following the extraction of mandibular third molars. Changes in mouth opening, discomfort, and edema were assessed.
Materials and Method: 50 patients (25 patients for standard PRF & 25 Patients for Advanced PRF) were chosen to have their unilateral impacted mandibular third molar teeth extracted irrespective of type of impaction. A visual analogue scale (VAS) was used to quantify postoperative pain, the distance between several facial landmarks was used to determine postoperative swelling, and mouth opening was measured inter-incisally on the first, third, and seventh postoperative days, respectively.
Result: Overall, Advanced PRF Group demonstrated significantly lower severity of swelling,pain (p-value < 0.001). compared to Standard PRF Group at all time intervals, indicating better control and faster resolution of swelling in Advanced PRF Group.
Conclusion: When compared to the Standard Platelet rich Fibrin group, the Advanced Platelet rich Fibrin group displayed reduced swelling, discomfort, and increased mouth opening.

Keywords: A-PRF, S-PRF, impacted third molar surgery, Platelet rich Fibrin, pain, swelling.

I. Introduction

Teeth that are fully or partially unerupted because of impediment by neighboring teeth, bone, or soft tissue are known as impacted teeth, and further eruption is uncertain. One of the most common operations in oral and maxillofacial surgery is the surgical extraction of impacted mandibular third molars (1). Raising a mucoperiosteal flap, removing bone, sectioning teeth when necessary, debridement of the socket, and wound closure are typical steps in the surgery. Despite being common, it is linked to postoperative consequences that can impair quality of life, including pain, edema, trismus, alveolar osteitis, delayed wound healing, and patient discomfort.

Although a number of strategies have been used to reduce postoperative morbidity, it is still challenging to completely eradicate these issues. In order to improve healing following third molar surgery, the utilization of autologous biological materials has drawn a lot of interest (2). Choukroun et al. created Platelet-Rich Fibrin (PRF), a second-generation platelet concentrate made from autologous blood without the use of biochemical additives (2,3).

PRF creates a fibrin scaffold that is rich in platelets, leukocytes, growth factors, and cytokines. These components are essential for wound healing, angiogenesis, tissue regeneration, and immunological control.PRF's fibrin matrix, which permits the gradual release of growth factors like Platelet-Derived Growth Factor (PDGF), Transforming Growth Factor-β (TGF-β), Vascular Endothelial Growth Factor (VEGF), Epidermal Growth Factor (EGF), and Insulin-Like Growth Factor (IGF), is largely responsible for its therapeutic potential. These growth factors enhance soft tissue repair, angiogenesis, bone regeneration, extracellular matrix production, cell proliferation, and epithelialization (3). PRF has been demonstrated to improve tissue remodeling, increase neovascularization, lower infection rates, and speed up wound closure (4).

Different PRF formulations, such as Standard PRF (S-PRF) and Advanced PRF (A-PRF), have been developed as a result of improvements in centrifugation methods. Because A-PRF is made with slower centrifugation rates, platelets and leukocytes are distributed more evenly throughout the fibrin matrix. Compared to S-PRF, this arrangement for the prolonged release of growth factors and may improve healing results. S-PRF, on the other hand, has a lower cellular content in the upper PRF layers since it is processed at higher centrifugation times and speeds.PRF has been extensively utilized in regenerative dentistry, implantology, and oral surgery. Its efficacy in lowering postoperative pain, edema, trismus, and healing issues after mandibular third molar surgery has been shown in a number of investigations (5).

II. MATERIAL & METHOD

The current study was carried out at the Maharana Pratap College of Dentistry and Research Center in Gwalior, Madhya Pradesh, at the Department of Oral and Maxillofacial Surgery. Following a thorough history, patients underwent a clinical examination and were informed about the procedure, its complications, and the study's follow-up period. Before the procedure, informed consent was obtained.

FIGURE 1&2 : Remediolife Centrifigation machine,copper motor,Acryonitrile Butadiene Styrene model and Centrifugation tubes(red cap) with Platelet rich fibrin

- **INCLUSION CRITERIA**
- ➢ Patient age 18 to 60 years.
- ➢ Patient either male or female.
- ➢ Patient is free of significant systemic disease.

- **EXCLUSION CRITERIA**
- Poor oral hygiene
- Medically compromised patient
- Pregnant or lactating women.
- HIV infection/HBsAg infection
- History of irradiation in head and neck

III. PROCEDURE-

The same surgeon carried out all procedures in a uniform manner while under local anesthesia.Each patient's me dial cubital vein was used to draw about 10 ml of venous blood, which was then placed in sterile vacutainer tube s devoid of any anticoagulant.
The samples were centrifuged right away.Povidine-
iodine mouthwash was given to the patient for one minute before to the surgical operation.
1:80,000 adrenaline and 2% lignocaine hydrochloride were used to produce inferior alveolar nerve block anesth esia.Using a No. 15 blade, a conventional Ward's incision was made during the procedure, and a full thickness mucoperiosteal flap was reflected.Using a No. 702 bur in a straight handpiece and extensive saline irrigation, bo ne guttering was carried out. **According to Group A:**

- The surgical site was irrigated thoroughly with normal saline, followed by placement of A-PRF in the extraction socket(Centrifugation speed is 1500 rpm for
  14 minutes).Wound closure was done using 3-0 interrupted sutures.

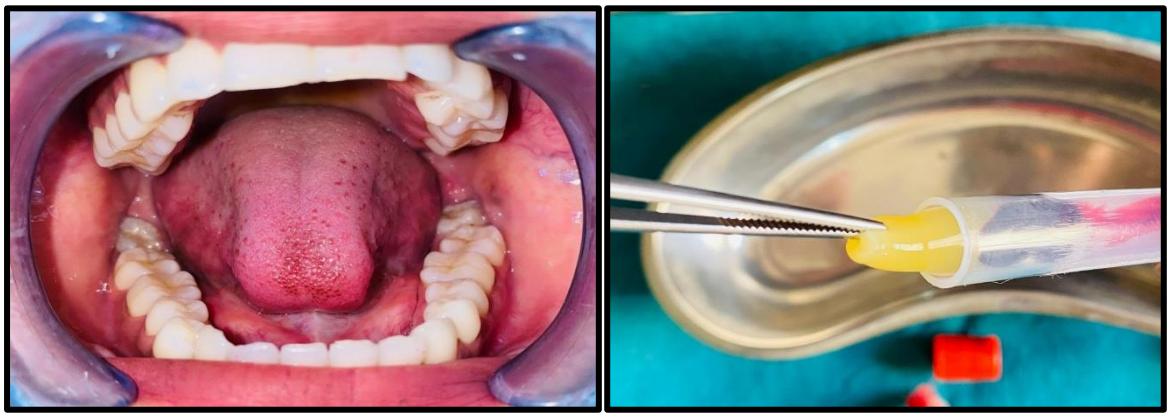

FIGURE 3&4: Pre-Operative Intraoral Photograph showing Mesio-angular Impacted Third Molar

FIGURE 5,6&7: Standard Ward's Incision is given & Extraction of Mandibular Third Molar has been performed& Placement of Advanced Platelet rich fibrin into the extraction socket and Wound Closure is done by using 3-0 silk suture.

According to Group B:

- The surgical site was irrigated thoroughly with normal saline followed by placement of S-PRF in the extraction socket (Centrifugation speed is 3000 rpm for 10 minutes).

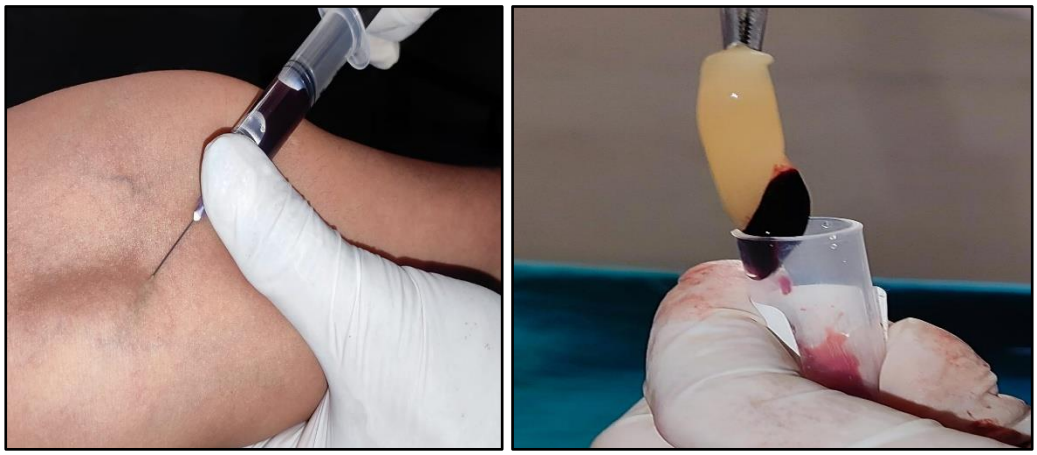

FIGURE 8& 9: Collection of whole venous blood from medial cubital vein & after centrifugation, Standard platelet rich fibrin (S-PRF) prepared.

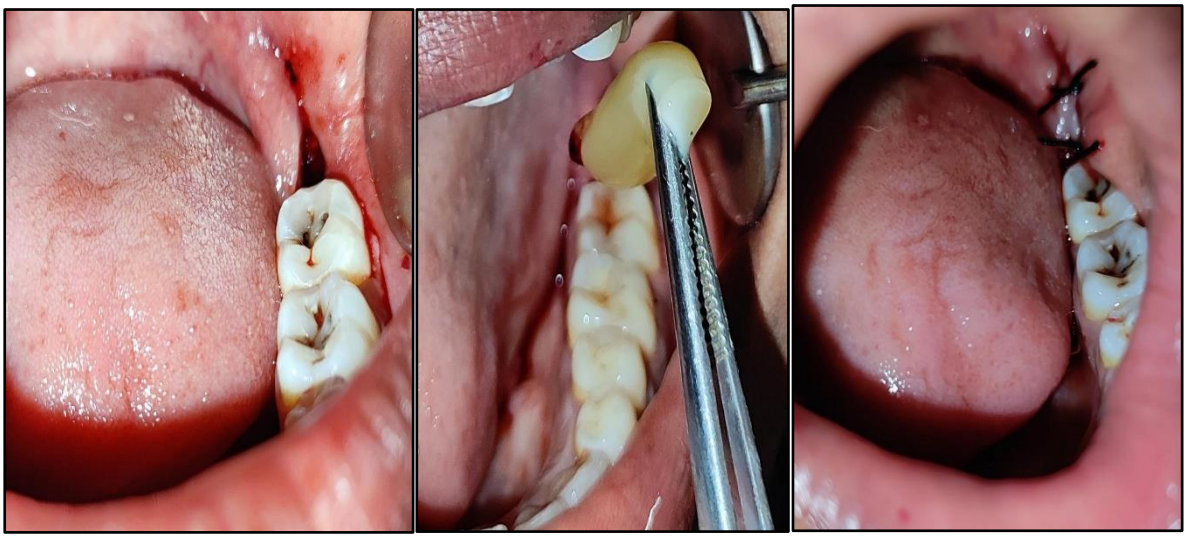

FIGURE 10,11& 12: Extraction of mandibular third molar was performed, after extraction, placement of standard rlatelet rich fibrin in extraction socket& Wound Closure is done by using 3-0 silk suture.

FIGURE 13&14: Follow up of patient with Advanced PRF& Follow up of patient with Standard PRF

Postoperative instructions given to the patient. Patient is medicated for five days and follow up done-1ST day,3Rd day and 7Th day postoperatively in terms of pain, swelling and mouth opening evaluation. While follow up Radiographical assessment will be done after one month and three months to check healing process.

IV. RESULTS

Data were analysed using **SPSS** (Statistical package for social Sciences).Intergroup comparision of continuous variables was done using independent t test. Intragroup comparision of continuous variables was done using paired t test. Intergroup comparision of categorical variables was done using Mann- Whitney U test and Chi -sqaure test. The mean standard deviation age of subjects in Group A was 31.6+/- 8.669) and in Group B was 30.8+/- 7.304**(Table 1).**The number of subjects in Group A male and female and in Group B male and female ,there is no significant difference between them in baseline**(Table 2)**

Table 1. Inter-group comparison of age of the study subjects.

Age (in years)	Group A	Group B	T-value	p-value
Mean ± standard deviation	31.6 ± 8.669	30.8 ± 7.304	.318	.752

Independent t test.

Table 2. Inter-group comparison of the gender of the study subjects.

Gender	Group A	Group B	Total	Chi-square value	df	p-value
Male	11	15	26	1.282	1	.258
	44.0%	60.0%	52.0%			
Female	14	10	24			
	56.0%	40.0%	48.0%			
Total	25	25	50			
	100.0%	100.0%	100.0%			

Chi-square test.

PAIN

The difference remained statistically significant (Z = -4.318, p < 0.001). Overall, pain scores were significantly lower in Group A compared to Group B at all time intervals, indicating better pain control in Group A throughout the follow-up period.

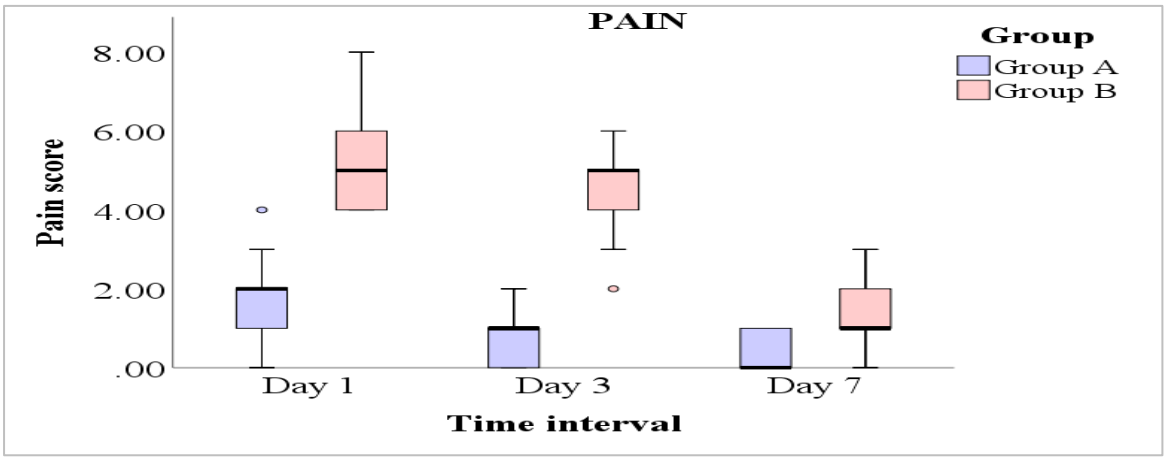

Figure 15. Pain score at different time intervals among Group A and Group B subjects.

SWELLING Overall, Group A demonstrated significantly lower severity of swelling compared to Group B at all time intervals, indicating better control and faster resolution of swelling in Group A. The difference remained statistically significant (p-value = 0.005).

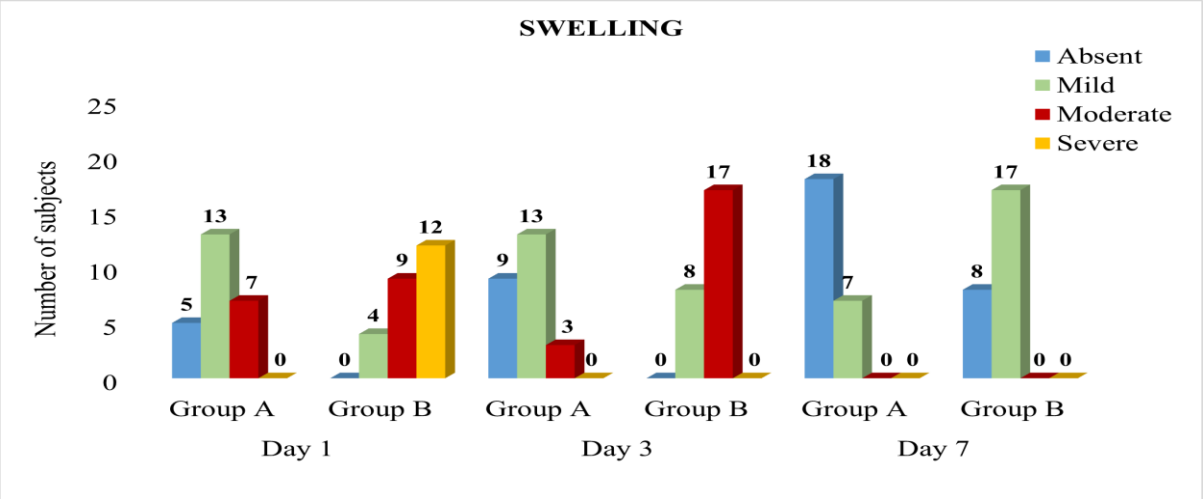

Figure 16. Distribution of study subjects based on severity of swelling.

MOUTH OPENING Overall, Group A showed significantly greater mouth opening at all time intervals compared to Group B, indicating better improvement in trismus and faster recovery in Group A.

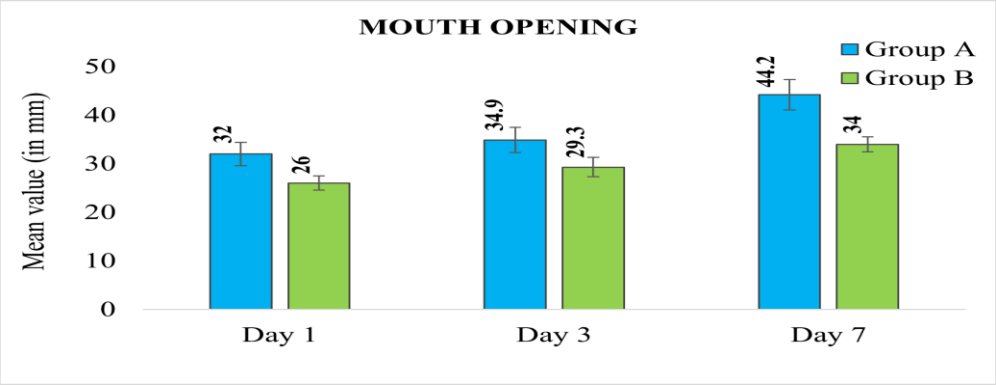

Figure 17. Mouth opening in Group A and Group B.

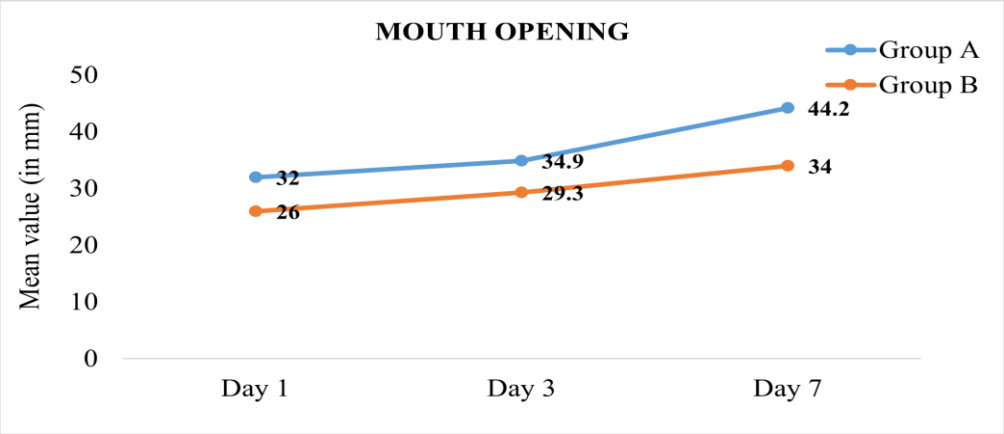

Figure 18. Mouth Opening at different time intervals.

RADIOGRAPHIC FINDINGS

LAMINA DURA

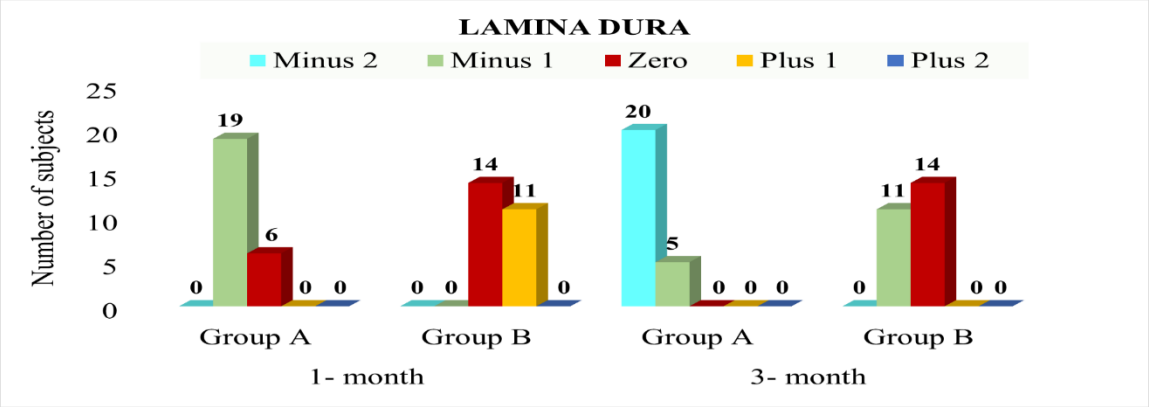

Figure 19. Lamina dura at different time intervals in Group A and Group B.

RADIOGRAPHIC FINDINGS (TRABECULAR PATTERN)

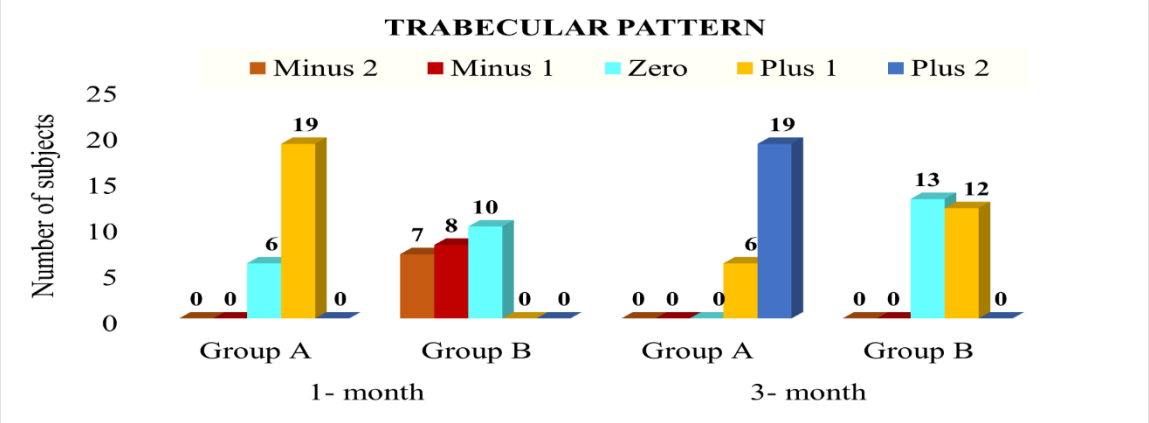

Figure 20. Trabecular pattern at different time intervals in Group A and Group B.

RADIOGRAPHIC FINDINGS (BONE DENSITY)

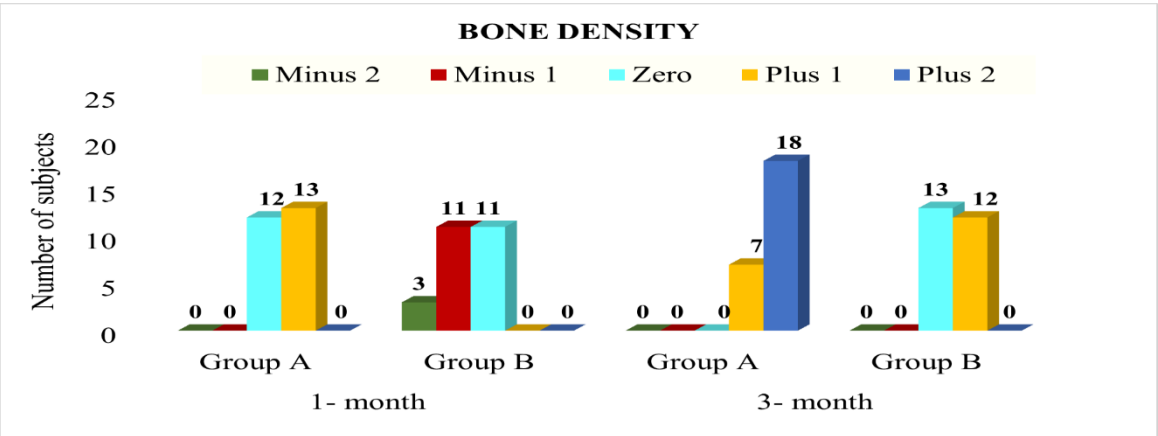

Figure 21: Bone density at different time intervals in Group A and Group B.

V. Discussion

This study evaluated the efficacy of APRF in lowering postoperative complications following surgical extractio n of an impacted mandibular third molar.After lower third molar surgery, APRF's antiinflammatory qualities can greatly lessen pain, swelling, and trismus. Additionally, A-PRF's immune-
regulating action lessens the negative effects of inflammation.

In comparison to Standard Platelet Rich Fibrin, the results of this study show that Advanced Platelet Rich Fibrin lowers inflammation following Impacted Mandibular Third Molar Surgery because of its immune regulatory ac tions and post-operative sequelae.

Lowering the centrifugation speed results in more effective cell and cytokine uptake during centrifugation by cre ating a persistent fibrin net, which is how advanced platelet-rich fibrin (A-PRF) is produced. In our study, on the 1^{st} , 3^{rd} & 7^{th} postoperative day, statistically significant improvement in wound healing was observed in the A-PRF group compared to the S- PRF group (5).

Pain

In a 2018 study by Talal M. Zahid and Mohammed Nadershah et al., augmentation of the postextraction socket with APRF clot significantly reduced postoperative pain and swelling within 7 days of surgery, according to the authors (8). Pain was measured using the Visual Analog Scale (VAS) at various followups. Overall, pain scores were significantly lower in Group A compared to Group B at all time intervals, indicating better pain control in t he Advanced PRF Group throughout the followup period.APRF released more total protein, which accumulated for up to ten days, according to Kobayashi et al.'s comparison investigation (12).

According to Choukroun et al., APRF mimics the physiology and immunology of wound healing due to its incre ased concentration of growth factors and its porous nature, which improves endothelial cell penetration and stim ulates angiogenesis (5).Wound healing is aided by platelets' granules, which contain angiogenic, mitogenic, and vascular growth factors (3).Thus, this study suggests that better, quicker healing may result from raising the plat elet concentration iin bone abnormalities.

Swelling

At every stage, Group A showed noticeably less postoperative edema than Group B.

Only Group B experienced severe edema on Day 1; by Day 7, 72% of Group A individuals had no swelling, co mpared to 32% in Group B.These variations were statistically significant ($p < 0.001$), suggesting that Group A's edema resolved more quickly.The statistical significance of the difference persisted.Overall, across all time inter vals, the Advanced PRF Group showed noticeably less severe swelling than the Standard PRF Group, suggestin g improved control and quicker swelling resolution in the Advanced PRF Group.After lower third molar surgery , APRF's antiinflammatory qualities can greatly lessen pain, swelling, and trismus. Additionally, A-
PRF's immune-regulating action lessens the negative effects of inflammation

Mouth opening

The difference remained highly statistically significant ($T = 14.461$, $p < 0.001$). Overall, Advanced PRF Group showed significantly greater mouth opening at all time intervals compared to Standard PRF Group, indicating better improvement in trismus and faster recovery in Advanced PRF Group in throughout the follow up periods. APRF, is a three-dimensional scaffold that replaces the extracellular matrix in cell regeneration and newly formed vessels. Platelets trapped between fibrin fibres, B and T lymphocytes, monocytes, stem cells and neutrophils, as well as secreted growth factors such as Transforming Growth Factor-1, Platelet Derived Growth Factor, and Vascular Endothelial Growth Factor, play a role in healing. (8).

Regeneration of soft tissue and Bone

In our research indicates Bone regeneration betterment with Advanced PRF as compared to Standard PRF in terms of Lamina dura, Trabecular pattern and Bone density in one month and three month follow up periods. Lamina Dura Advanced PRF Group A demonstrated significantly better improvement in lamina dura scores compared to Standard PRF Group B at both 1-month and 3-month follow-ups, indicating superior radiographic healing in

Advanced PRF Group A. Trabaecular pattern there was a superior radiographic bone healing in Advanced PRF Group A as compared to Standard PRF Group B. Bone Density- Advanced PRF Group A demonstrated significantly greater improvement in bone density compared to Standard PRF Group B at both 1-month and 3-month follow-ups, indicating superior bone healing in Advanced PRF Group A.

VI. Conclusions

In contrast to plateletrich plasma, plateletrich fibrin (PRF) offers a sustained release of growth factors for up to1 4 weeks, improving the healing process following surgical procedures such as impacted mandibular third molar extraction. Advanced PRF (APRF), prepared using slower centrifugation without anticoagulants or additives, off ers improved growth factor release, reduced postoperative pain, swelling, and trismus, and enhanced soft- and h ardtissue healing.PRF is frequently utilized in regenerative dentistry for bone regeneration, periodontal healing,a nd extraction defect repair because of its autologous nature, which eliminates the possibility of cross-infection or allergic reactions.

Research indicates that both regular PRF and APRF efficiently promote wound healing and osseous regeneratio n, with APRF exhibiting greater regenerative potential due to its extended biological activity and immunomodul atory effects.

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