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# The Use of PRF Gel for Bone Regeneration after Surgical Removal of Bilateral Mandibular 3rd Molars – A Comparative Prospective Study

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## ABSTRACT

**Introduction:** Platelet Rich Fibrin (PRF) is a favourable, absolutely autologous leukocyte and platelet concentrate which is being effectively used in numerous fields of dentistry and medicine.

**Objectives:** Evaluation of the use of PRF gel for bone regeneration after surgical removal of bilateral mandibular 3rd molars – a comparative prospective study.

**Methods:** This study consisting of a total of nine patients requiring bilateral trans alveolar third molar extractions. PRF was used from patient blood and placed in the test group and control group without PRF. After Placing the PRP Gel in the Socket region an Immediate orthopantomogram (OPG) was taken. All patient were recalled at regular intervals of 2nd week, 6th week, 10th week, 16th week and 20th-week post-op to take OPG's. Comparing the bone regeneration results of the participants on the study side and control side with five months follow up were tabulated.

**Results:** The parameter accessed was the bone density of the extraction socket on both the sides for each patient using 3D digital imaging software. There was a significant increase in bone density in test quadrant with PRF compared to the control side.

**Conclusion:** It was concluded that PRF is helpful in the regeneration of bone after third molar surgery.

**Key Words:** Bone, Extraction, Molar tooth, Platelet Rich Fibrin, Regeneration

## INTRODUCTION

The development of surgical additives to increase the healing potential has become one of the greatest challenges in clinical research. A lot of surgical additives have been introduced into the field of Oral and Maxillofacial Surgery with the aim of better soft and hard tissue healing, pain control, reduction of dry socket and control of swelling. Platelet concentrates are blood-derived products used for the prevention of haemorrhages due to serious thrombocytopenia of central origin.<sup>1,2</sup>

The use of platelet-rich plasma in sports medicines was elaborated by various authors. This was introduced into the field of Oral and Maxillofacial Surgery in 1998, Marx being the pioneer came up with the first-generation platelet concentrates also called Platelet Rich Plasma.<sup>3</sup> Platelet Rich Fibrin (PRF) is the recent generation of platelet concentrates. PRF is a favourable, absolutely autologous leukocyte and plate-

let concentrate which is being effectively used in numerous fields of dentistry and medicine.<sup>4</sup>

Third molars, the last teeth to erupt into the human dental arch, are the most frequently impacted teeth in all human ethnicities. The main factors contributing to impaction are an inadequate dental arch space and erratic eruption paths. The impaction surgery done for the removal of the third molars presents itself with a variety of factors which are uncomfortable to the patient. Pain, swelling, trismus, infection, bone loss, pocket formation distal to the second molar being a few factors.<sup>5</sup>

Uneventful and enhanced wound healing is desirable and critical in ascertaining the quality of life after third molar surgery. Various methods have been suggested to enhance socket healing and to minimize the post-operative sequelae after third molar surgery. PRF gel is a biological approach to

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promote the wound healing cascade by releasing growth factors directly to the wound. Thus, we need a study to explore its use in third molar extraction sockets. So, the objective of the study is to evaluate the effects of PRF Gel on bone regeneration after mandibular third molar extractions.

## MATERIALS AND METHODS

Study sample consisting of a total of nine patients requiring bilateral trans alveolar third molar extractions were included with one side considered as case and the other side as control.

### Inclusion Criteria

Patients willing to be part of the study, Patients above 18 years of age, Patients indicated for surgical removal of bilateral mandibular third molars, Patients with a blood concentration of thrombocytes within the normal range (1.5-3.5 lakh cells/cubic mm) and In areas where primary closure is possible.

### Exclusion Criteria

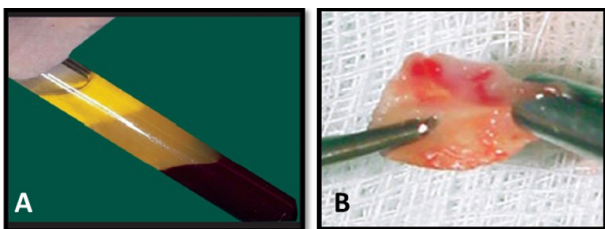
Presence of uncontrolled diabetes, immune disease or other contraindicating systemic conditions, radiotherapy or chemotherapy in 12 months period earlier to the proposed therapy, uncontrolled periodontal disease, Presence of any acute local infections, Smoker, Pregnant women, children, elderly (>60 years), physically or mentally challenged, terminally and seriously ill, and unwillingness to commit to a long-term post-therapy maintenance program.

### Study Design

Ethics clearance was obtained from the Institutional ethics committee and the ethical principles were followed throughout the study. Subjects for the study were selected randomly if they satisfied the inclusion criteria with no discrimination based on sex, caste, religion or socioeconomic status. The examination was preceded by a thorough medical and dental history of the patients.

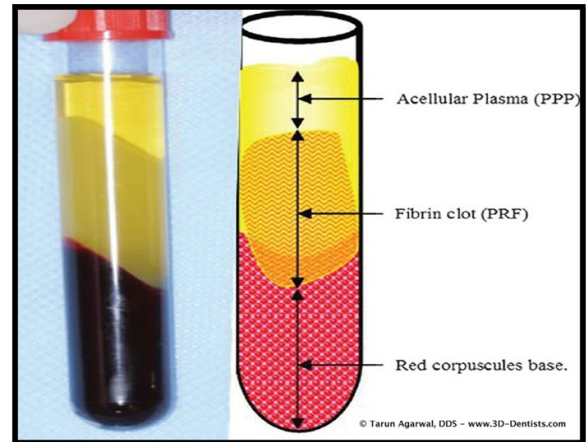
### Preparation of Platelet Rich Fibrin (PRF)

The blood specimen is collected or drawn from the patient and placed in the centrifuge and is allowed to spin immediately for 10 minutes at 3000 rpm. Following this, the blood sample settles into three layers (Figure 1).



**Figure 1:** A. Blood sample collected in the test tube; B. PRF ready to be mixed with CaCl<sub>2</sub>

The PRF contain the following layers the lower fraction containing the RBC, the middle fraction containing the fibrin clot, the upper fraction containing the straw-coloured acellular plasma (Figure 2). Later the middle portion containing the fibrin clot was removed and scrapped off from the lower part containing the red blood cells.



**Figure 2:** Three layers formed after centrifuge.

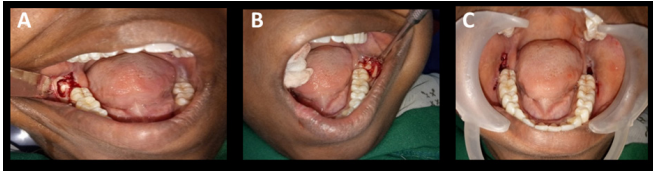
### Surgical Procedure

Bilateral trans alveolar extraction of mandibular third molars. The procedure was performed with proper aseptic precautions. A single operator carried out all the procedures. Standard scrubbing and painting procedures were done with betadine. Standard draping procedures were followed. Intra orally inferior alveolar nerve block was given along with lingual and buccal nerve block using 2% Lignocaine with adrenaline 1:80,000.

A standard mandibular third molar incision (Ward's incision) was placed distal to the second molar continued over the alveolar crest (if the tooth is completely embedded)/ along the buccal gingival sulcus of the third molar, up to the distal aspect. The distal releasing incision is started from the distal-most point of the third molar across the external oblique ridge into the buccal mucosa.

Anteriorly the incision was extended up to the distal of first molar if needed for better exposure. A full-thickness mucoperiosteal flap was raised and the crown of the third molar exposed. With the help of a micro motor, straight handpiece and using 703 burs sufficient bone was removed forming a gutter on the mesial, buccal and distal aspects of the tooth. The tooth was elevated with gentle elevation. In some cases, the tooth was sectioned and retrieved. The socket was carefully examined for remnants of tissue and then the follicular tissue if the present was curetted out from the socket. The socket was irrigated with saline and betadine. A combination of PRF and calcium chloride (CaCl<sub>2</sub>) was placed in the post-extraction socket of one side of the patients as a study

group and the other socket left empty as the control group and finally, both the sockets were sutured (Figure 3).

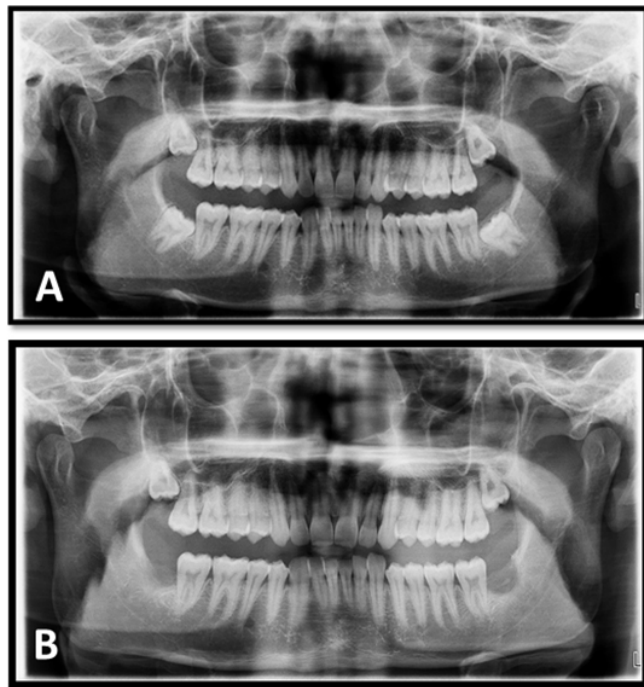


**Figure 3:** Impacted tooth exposed to 48. Impacted 48 extracted and impacted 38 PRF placed on 48 and sutured 38 sockets left empty and suture.

### Postoperative Instruction

All the patients were given routine post-operative instructions. They were given Cap. Amoxicillin 500 mg TDS, Tab. Metronidazole 400 mg TDS, Tab. Prednisolone 10 mg BD, Tab. Diclofenac 50 mg BD and Tab. Ranitidine 150 mg BD for 5 days.

The patient is to be reviewed and radiographically assessed at the time intervals of 2nd week, 6th week, 10th week, 16th week and 20th week (Figure 4).



**Figure 4:** A) Preoperative radiograph showing bilateral impaction; B) radiograph after five-month.

### Radiographic analysis

After Placing the PRP Gel in the Socket region an Immediate OPG was taken. The patient was recalled at regular intervals of 2nd week, 6th week, 10th week, 16th week and 20th-week post-op to take OPG's. The radiolucency of the socket region

was measured using the 3D digital imaging Software. A person blinded of the PRF primary closure marked the size of the residual cavity using the software. Comparing the bone regeneration results of the participants on the study side and control side with five months follow up were tabulated.

## RESULTS

This study consisted of a total of nine patients who underwent surgical removal of impacted mandibular third molars bilaterally, followed by placement of PRF mixed with calcium chloride in the post-extraction sockets of one side (study group), and the sockets of the contralateral side (control group) were left empty.

In five patients 48 was considered as a study group and in the remaining four patients 38 was study group. In two male patients and three female patients 48 was taken as a study group and in three male patients and one female patient 38 was taken as the study group. All the nine patients fall under the age group from 25 to 35 years and out of the nine patients five were male patients and four were female patients.

The parameter accessed was the bone density of the extraction socket on both the sides for each patient using 3D digital imaging software. A person blinded of the PRF primary closure marked the size of the residual cavity using the software. Comparing the bone density of each patient after 20 weeks mean and standard deviation (S.D) were calculated. Using t-test calculation p-value was calculated (Table 1).

**Table 1: Mean and standard deviations with t-test**

Group	Mean	Standard deviation	P-value
Control	131.17	34.47	0.073
Study	158.5	25.31	

### Statistical analysis

3D digital imaging software was used to calculate the bone density of the extraction socket in OPG.

Concept of p-value

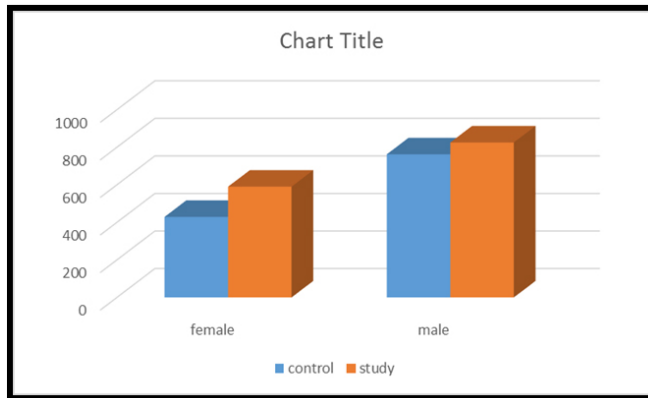
- According to t-test, p-value is 0.07
- In the majority of analyses, an alpha of 0.05 is used as the cut-off for significance
- If the p-value is greater than 0.05, our result is statistically not significant

### Comparing the bone density between male and female patients

Comparing the bone density between male and female patients the results turn out to be more bone regenerative ability in male patients when compared to female patients (Table 2 and Graph 1).

**Table 2: Comparing the bone density between male and female patients**

Group	Male	Female
Control	762.5	429
Study	825.5	590



**Graph 1:** Comparing the bone density between male and female patient.

## DISCUSSION

The regenerative capacity of platelets and their role in the healing of the wound is well known.<sup>6</sup> Growth factor  $\beta$  present in platelet is important in primary wound healing. Alpha granules release from activated platelets upon tissue contact during injury or surgery.<sup>6</sup> Thus, secreted active proteins bind to transmembrane receptors of the target cells to activate intracellular signalling proteins. This results in expression of a gene sequence that guides collagen synthesis, cellular proliferation, and osteoid production.<sup>7</sup>

Third molar extractions are commonly used as an evaluating method for comparing surgical treatments that usually do not present with multiple confounding factors (e.g., systemic pathologies, multiple medications). Hence, even in this study third molar extractions have been used to compare the surgical treatment outcomes between the two groups.<sup>5,6</sup> In the present study, non-invasive radiographic techniques were used to arrive at the outcome of the surgical procedures. Even though bone histology studies could have provided additional information, taking into account the invasive nature of the analysis, it was avoided.

In our study using case and control group, bone density was recorded in cases compared to controls at all the time intervals (2<sup>nd</sup>, 6<sup>th</sup>, 10<sup>th</sup>, 16<sup>th</sup> and 20<sup>th</sup> week) with OPG. However, the difference in the mean recorded between the two groups was not statistically significant ( $P > 0.05$ ). This study indicated a definitive improvement in the wound healing and increase in bone density, which signifies and highlights the use

of PRF and calcium chloride, certainly as a valid method in inducing and accelerating bone regeneration.

The preparation of PRF is a simple, chair-side procedure, safe, cost-effective and is made in the preoperative period and demonstrates good results. An added benefit of PRF noted in the present study is its ability to form a biological gel that provides clot stabilization. Currently, researches have been carried out to know the benefits of PRF as a means of local delivery of antibiotics (metronidazole) and analgesic (diclofenac) to improve local wound healing and also to cut down on systemic delivery of drugs. The present study was done in extraction sockets with a follow up of five months, further clinical trials with a longer duration and in different sites, in apicoectomy, and other bone defects should be done to get more affirmative and conclusive results.

## CONCLUSION

In present study shows that there was a significant improvement in the regeneration of bone after third molar surgery in cases treated with PRF as compared to the control group. Further study on a larger sample size is necessary.

**Conflict of interest:** Nil

**Source of funding:** Self

### Authors contribution

1. Dr. Venkata Krishnan- Investigation
2. Dr. Saravanan Kandasamy- Data collection
3. Dr. Reena John- Analysis
4. Dr. Manoj Chandrasekhar- Manuscript writing

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