

Original Research Article

# TO ASSESS THE EFFICACY OF LEUKOCYTE AND PLATELET RICH FIBRIN ON SOFT TISSUE HEALING AFTER SURGICAL EXTRACTION OF IMPACTED MANDIBULAR THIRD MOLAR: A PROSPECTIVE STUDY

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## ABSTRACT

**Background:** Third molar removal is one of the most common treatments performed in oral surgery. One of the current strategies is the implantation of the leukocyte-platelet-rich fibrin (L-PRF) immediately after tooth extraction. Thus, the aim of this study to assess the efficacy of leukocyte and platelet rich fibrin on soft tissue healing after surgical extraction of impacted mandibular third molar tooth.

**Materials and Methods:** This prospective randomized clinical trial was a single-center, controlled study with a split-mouth design to determine if PRF influences the postoperative conditions of patients undergoing third molar extractions. A new socket wound healing scale was introduced in this study to assess the status of post extraction wounds in terms of wound dehiscence, epithelialization, quality of granulation tissue filling the post-extraction socket, and depth between early granulation tissue and wound margin.

**Results:** Mean healing scores for the mucosa over the extraction socket on the 7th, 14th, and 21st days for both the L-PRF group were significantly better than those of the control group. The ratio of alveolar osteitis for the control group was 1:30 and the ratio of postoperative wound infection for the control group was 1:30. There were no cases of alveolar osteitis or postoperative wound infection in the L-PRF group. No prolonged or delayed postoperative bleeding was observed in this study. No adverse events or side-effects for L-PRF group were observed. Age, gender distribution, and total surgery duration in the control and case groups were comparable, and no significant differences were noted among groups.

**Conclusion:** The results of the present study suggest that the use of L-PRF can be a viable option for minimizing postoperative pain and swelling after surgical extraction of impacted third molars.

**Keywords:** L-PRF, Impacted third molar, Healing index, VAS.

## INTRODUCTION

Third molar removal is one of the most common treatments performed in oral surgery.<sup>1</sup> Clinical approaches, such as flap design and osteotomy, have been described since the early 20th century by Kells and Winter.<sup>2,3</sup> Over the past few decades, surgical techniques have been considerably developed to prevent complications from extractions.<sup>1</sup> The most common complications are pain, trismus, edema, surgical site infections, and alveolar osteitis.<sup>4</sup> Several

interventions have been described to limit the occurrence of these complications, including intake of painkillers and corticosteroids to minimize pain, swelling, and trismus. The application of cryotherapy and local chlorhexidine gel decreases the incidence of inflammatory side effects.<sup>4</sup>

One of the current strategies is the implantation of the leukocyte-platelet-rich fibrin (L-PRF) immediately after tooth extraction. Prior studies have demonstrated the effectiveness of this autologous biomaterial in reducing postoperative complications

in third molars.<sup>5,6</sup> This second-generation autologous blood-derived biomaterial contains a dense fibrin mesh with increased contents of platelets and leukocytes, as well as increased concentrations of essential growth factors and cytokines that will assist in tissue repair, especially concerning soft tissue healing.<sup>7,8</sup> Among those, the Transforming Growth Factor Beta (TGF- $\beta$ ), the Platelet-Derived Growth Factor (PDGF), the Vascular Endothelial Growth Factor (VEGF), and the basic Fibroblast Growth Factor (FGF-2) are considered some of the essential mediators produced by leukocytes and platelets in L-PRF membranes. There is strong in vitro evidence of continuous production and release of these mediators by the new autologous biomaterials.<sup>8-10</sup>

PRF offers one main advantage over PRP in that a fibrin scaffold is formed following centrifugation which can then serve as a scaffold to place in the healing socket post-extraction. Furthermore, its inclusion of supra-physiological concentrations of leukocytes allows some immune defence against a potential bacterial invasion. Thus, the aim of this study to assess the efficacy of leukocyte and platelet rich fibrin on soft tissue healing after surgical extraction of impacted mandibular third molar tooth.

## MATERIALS AND METHODS

This prospective randomized clinical trial was a single-center, controlled study with a split-mouth design to determine if PRF influences the postoperative conditions of patients undergoing third molar extractions. This study was conducted at the division of oral surgery department of Jaipur Dental College, Jaipur, Rajasthan, India.

This study included 30 healthy patients (American Society of Anesthesiologists classification, ASA1) aged 16 years or older with four noninfected, impacted, or partially impacted wisdom teeth. The participants were recruited from a routine outpatient clinic without any additional effort. The participants were nonsmokers or light smokers (less than 10 cigarettes a day) with no intake of anticoagulants. The position and level of impaction of the third molars were classified using the classifications proposed by Pell and Gregory<sup>11</sup> and Winter<sup>3</sup>. The level of surgical difficulty was similar on both sides for each patient to ensure comparability. All extracted wisdom teeth were free of cystic lesions and were not infected. Pregnant patients were excluded from this study. Furthermore, patients with immunosuppression or severe underlying diseases, such as diabetes mellitus, immunodeficiency, and advanced systemic disease, were excluded. Patients treated with therapies for diseases that affect bone or soft tissue metabolism (e.g., bisphosphonate therapy or localized radiotherapy) were also excluded.

**Surgical Procedure:** All patients underwent bilateral extraction of impacted lower third molars, which were of the same level of removal difficulty. The teeth were surgically removed in a single appointment. Two sites in the second molar were

selected as experimental units: (1) distobuccal (DB) site and (2) distolingual (DL) site. These two sites were chosen owing to their close proximity to the extracted tooth. Each one of the extraction sites received the biomaterial (A-PRF) while the other acted as a control.

A maxillofacial surgeon carried out all surgical procedures following a standard operating technique. Strict aseptic precautions were undertaken prior to and during the surgery. For local anesthesia, an inferior alveolar nerve block was used, and the long buccal infiltration was administered using scandonest 2% containing 1:200,000 epinephrine. Envelope flap with distal extension was performed. A full-thickness mucoperiosteal flap was raised, and the tooth was extracted using elevators. The socket was then thoroughly irrigated with sterile 0.9% saline. To obtain A-PRF, 2 tubes (10 mL each) of venous blood was drawn. The tubes used were sterile vacuum plain tubes for A-PRF<sup>TM</sup> + and did not contain any additive or anticoagulant. They were then placed in the centrifugation machine for 13 minutes at 1300 rpm. The end products (A-PRFs) were then placed in the PRF Box<sup>®</sup> to preserve the membrane and provide constant thickness. After the A-PRF was placed in the socket, primary closure of both extraction cavities was performed using 3.0 chromic gut sutures.

Postoperatively, all patients were treated with an oral antibiotic (amoxicillin 500 mg, 8 hourly for 3 days) and a non-steroidal anti-inflammatory medication (ibuprofen 600 mg, 8 hourly for 2 days). Postoperative oral hygiene instructions were also given to all patients, and a mouthwash (0.12% chlorhexidine thrice daily) was prescribed for 7 days. Sutures were removed on the 7<sup>th</sup> day.

The primary outcome variables were the healing scores for the mucosa over the extraction socket on the 7<sup>th</sup>, 14<sup>th</sup>, and 21<sup>st</sup> days.

Secondary outcome variables were frequencies of the following postoperative complications: postoperative hemorrhagic complications, alveolar osteitis, and postoperative wound infection.

All postoperative assessments were performed by the second investigator (TA), who was blinded to the patients' group assignments until the study was completed, and did not participate in randomization or operations.

### Evaluation of the Mucosa Healing Over the Extraction Socket

A new socket wound healing scale was introduced in this study to assess the status of post extraction wounds in terms of wound dehiscence, epithelialization, quality of granulation tissue filling the post-extraction socket, and depth between early granulation tissue and wound margin. This new scale is a combination of the gingival healing index of Landry et al,<sup>[12]</sup> and the wound healing scale used by Cervelli et al.<sup>[13]</sup>

Assessments were performed at 7, 14, and 21 days following surgery using a blunt periodontal probe with millimetric markers and scored as a number between 0 (best) and 4 (worst):

- 0-wound covered with keratinized gingiva (tissue colour all tissues pink; response to palpation, no bleeding). Continuous with healthy tissue.
- 1-socket filled with organized granulation tissue (response to blunt palpation, no bleeding). Collapsed to a depth of 0-2mm from the buccal gingival margin.
- 2- socket filled with organized granulation tissue (tissue color  $\geq 25\%$  and  $< 50\%$  of gingiva red; response to blunt palpation, no bleeding). Collapsed to a depth of 2-4 mm from the buccal gingival margin.
- 3- socket filled with unorganized granulation tissue (tissue color  $> 50\%$  of granulation tissue red; response to blunt palpation, bleeding). No evidence of infection.
- 4- socket shows signs of infection or alveolitis; socket filled with foreign materials (food, etc.).

**Evaluation of Postoperative Complications:** Every patient was assessed for signs of prolonged and delayed postoperative bleeding, alveolar osteitis (AO), and postoperative wound infection, and incidents were recorded.

### Statistical Analyses

When the study data were evaluated, the IBM SPSS Statistics 22 program (SPSS IBM, Istanbul, Turkey) was used for statistical analysis. The overall significance of the study was evaluated at  $p < 0.05$ .

## RESULTS

Mean healing scores for the mucosa over the extraction socket on the 7th, 14th, and 21st days for both the L-PRF group were significantly better than those of the control group. [Table 1] The ratio of alveolar osteitis for the control group was 1:30 and the ratio of postoperative wound infection for the control group was 1:30. There were no cases of alveolar osteitis or postoperative wound infection in the L-PRF group. No prolonged or delayed postoperative bleeding was observed in this study. No adverse events or side-effects for L-PRF group were observed. Age, gender distribution, and total surgery duration in the control and case groups were comparable, and no significant differences were noted among groups. [Table 2]

**Table 1: Healing process for the mucosa over the extraction socket on the 7th, 14th, and 21st days**

Healing score	L-PRF group	Control	P-value
7 <sup>th</sup> days	1.67±0.53	2.79±0.56	<0.05*
14 <sup>th</sup> days	1.08±0.59	2.16±0.48	<0.05*
21 <sup>st</sup> days	0.34±0.48	1.68±0.42	<0.05*
P-value	<0.05*	<0.05*	

**Table 2: Demographic profile of patients**

Demographic	L-PRF group	Control	P-value
Mean age (yrs)	22.7±1.92	23.9±2.4	>0.05
Gender	12M:18F	16M:14F	>0.05
Duration of surgery (Min.)	22.3±3.09	29.5±4.15	>0.05

## DISCUSSION

Wound healing after extraction of impacted third molars is a complex process that involves a highly coordinated interaction of cellular, molecular, biochemical, and physiological mechanisms. Various therapeutic measures have been taken to minimize postoperative complications and preserve the distal root of the second molar.<sup>[14]</sup> The application of PRF after surgical extraction of impacted third molars has been shown to be a valid approach to accelerate wound healing and minimize postoperative complications.<sup>[15]</sup>

Platelet concentrates have been used since long to promote healing as they contain high quantities of GFs. 16 Leukocyte-poor or pure PRF is one of the two types of available PRF but has a difficult and time-consuming processing.<sup>[16]</sup> Leukocyte- and PRF (L-PRF), also known as Choukroun's PRF, is a second-generation platelet aggregate rich in leukocytes and PRF biomaterial,<sup>[16]</sup> which helps to promote healing due to the presence of numerous GFs.<sup>[17]</sup> In addition, L-PRF is easy to prepare, requiring lower cost with the use of no chemicals or unnatural conditions for its production.<sup>[16]</sup>

Surgical extraction of a partially impacted M3 leaves a large bone and soft tissue defect behind. Efforts to form a primary closure of the mucosa over the socket wound in the hope of protection of the bone defect from the intraoral environment generally result in wound dehiscence and wound edges collapsing into the socket because of the lack of support under the suture line.

In their study, which compared primary and secondary closure of the surgical wound after removal of impacted mandibular third molars, Pasqualini et al. reported that secondary healing of the surgical wound produces less postoperative swelling and pain than occurs with primary healing (by hermetically suturing the socket). At the check-up on day 7 after surgery, 33% of primary closure group patients had dehiscence distal to the second molar.<sup>[18]</sup> Secondary healing has its own disadvantages. If a loosely organized blood clot is resorbed early and leaves the post extraction socket unprotected, that can lead to complications such as delayed hemorrhage, AO, and wound infection. The literature suggests that both leukocyte and PRF could be effective materials in preventing postoperative complications and enhancing healing.

Concerning the analysis of pain and healing of soft tissue, the present findings are in agreement with previous reports on good outcomes related to the use of L-PRF on extracted dental sockets.<sup>[6,15,19]</sup> L-PRF implanted in the third molar socket improved postoperative discomfort ( $p < 0.05$ ) and significantly enhanced soft tissue healing on the seventh and fourteenth day, a time frame where several other studies also report good clinical results of L-PRF.<sup>[6,15,19]</sup>

The probable cause for pain reduction with the use of PRF could be attributed to reduced inflammation and subsequent edema in the test side. The exact mechanism of pain reduction with the use of PRF would require further biochemical studies. Our results showed pain findings similar to a previous study of Uyanik et al,<sup>[20]</sup> wherein PRF was used in combination with either traditional surgery or piezosurgery and showed a significant reduction in postoperative pain and trismus with a decreased requirement of consuming analgesics.

## CONCLUSION

The results of the present study suggest that the use of L-PRF can be a viable option for minimizing postoperative pain and swelling after surgical extraction of impacted third molars.

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