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Comparison of Healing of Transalveolar Extraction Socket with and Without Placement of Autologous Platelet Rich Fibrin: An Experimental Study

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Abstract

Background: Trans-alveolar extraction of the tooth is a routine procedure in the field of oral and maxillofacial surgery and the role of Platelet Rich Fibrin (PRF) in regulating alterations in alveolar dimensions following tooth extraction is one potential area of study. The study plans to evaluate the efficacy of autologous PRF in healing of trans-alveolar extractions of mandibular molars by evaluating the pain, swelling through comparison soft tissue markings and wound dehiscence on day 1, 3, 7 and 14. **Material & Methods:** This randomized controlled study was conducted among 24 patients aged 18 to 40 years requiring trans-alveolar mandibular molars extraction with normal hematologic profile, fulfilling ASA 1 and 2 criteria with good oral hygiene and surgical site free of active infection. The study Group (12) received a-PRF after trans-alveolar extraction along with routine surgical management while control Group received routine surgical care. **Results:** The presence of wound dehiscence was lower in the study group as compared to control but it was not statistically significant. The mean (SD) pain score was lower in the study Group on Day 1, 3, 7 and 14 as compared to Control Group and it was found to be statistically significant ($p<0.001$). There was statistically significant reduction in swelling in study Group patients on Day 1, 3, 7 and 14 as compared to Control Group patients ($p<0.001$). **Conclusions:** The PRF treatment group has significantly lower pain and swelling on day 1,3,7 and 14. PRF can act as an accelerating factor in wound healing and maybe utilized in other maxillofacial surgical procedures for enhanced healing.

Keywords:- Autologous, Platelet Rich Fibrin, Trans-alveolar Extraction.

INTRODUCTION

Trans-alveolar extraction of the tooth is a routine procedure in the field of oral and maxillofacial surgery. Patients most commonly experience pain, edema, delayed bone healing, and a dry socket following the treatment. In order to restore the anatomic and functional integrity of the wounded tissues, a complex combination of molecular, cellular, biochemical,

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and physiological processes mediates healing of the extraction socket.[1,2]

The fundamental component of all injuries is wound healing. Wound healing occurs more quickly in the oral and maxillofacial region due to its higher vascularity than in other parts of the body.[3] The coordination of several physiological processes, mostly involving molecular signals mediated by growth factors and cytokines, is necessary for complex tissue remodeling.[4]

Platelets contain various growth factors and cytokines that play a central role in inflammation and bone healing.[5] Over the past 15 years, the use of platelet concentrates has grown in popularity due to these physiological characteristics. Platelet concentrate technology was originally developed in 1996, and it allowed for the development of more efficient and streamlined production processes for a novel platelet-rich plasma (c-PRP) that was concentrated on fibrin glue. Platelet-rich fibrin (PRF), a second-generation platelet concentrate, was released in France five years later.[6] PRF predominantly consists of a fibrin matrix rich in platelet, leukocyte cytokines and growth factors.[7]

A number of methods have been used to improve the regeneration process in the extraction socket and lessen dimensional changes in alveolar bone. These methods include filling sockets with autogenous bone grafts or bone substitutes, using different bone-promoting molecules like enamel matrix derivative, recombinant growth and differentiation factors, and autologous platelet concentrates.[8] Platelet concentrates—particularly PRF—may promote the regeneration of soft and osseous tissue while simultaneously lowering pain, inflammation, and unfavourable side effects.[9,10] PRF is a gold standard graft material that is strictly autologous and readily available because it is prepared from the patient's own blood. It resolves all legal concerns without requiring the addition of any chemicals.[11]

The role of PRF in regulating alterations in alveolar dimensions following tooth extraction is one potential area of study. While some studies have found insufficient evidence for PRF's efficacy in bone regeneration, others have demonstrated positive effects of the material on the maintenance of the alveolar ridge following tooth extraction.[12,13,14]

In this randomized clinical trial, we evaluated how PRF can contribute a significant effect on the acceleration of the healing phase after trans-alveolar extractions of mandibular molars. Based on the available knowledge in the literature, we hypothesized that PRF can act as an accelerating factor in wound healing, and possibly be used in other extraction sockets to receive the implant comparatively earlier, as well as be utilized in other maxillofacial surgical procedures for enhanced healing. Hence this study plans to evaluate the efficacy of autologous platelet rich fibrin in healing of trans-alveolar extractions of mandibular molars by evaluating the pain, swelling through comparison soft tissue markings and wound dehiscence on day 1, 3, 7 and 14.

MATERIAL AND METHODS

This randomized controlled study was conducted from October 2022 to January 2023 in the Department of Oral and Maxillofacial

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Surgery, in a Centre for Dental Studies and Research Institution in North India. Patients aged 18 to 40 years requiring trans-alveolar mandibular molars extraction with normal hematologic profile, fulfilling ASA 1 and 2 criteria with good oral hygiene and surgical site free of active infection, and consenting for the study were included in the study. Patients who were medically compromised, having acute peri-apical pathology, smokers or tobacco users, pregnant and lactating mothers were excluded from the study.

Sample size calculation: Taking a mean ±SD pain score on third day of 0.50 ±0.938 in group I and 2.20 1.864 in other group and at 95% confidence level with a power of 80 % the calculated sample size was found to be 12 in each group.[15]

Recruitment and randomisation: A total of 24 patients were selected consecutively for this study following the predetermined inclusion & exclusion criteria. Patients were randomly divided into two groups of 12 patients each using computer generated random number technique. Group A (study group): Included 12 patients who would receive a-PRF after trans-alveolar extraction and Group B(control group): Included 12 patients who would not receive a-PRF after trans-alveolar extraction. Blinding or masking was not executed. All participants underwent routine blood investigations.

Preparation of PRF: Under aseptic conditions, 10 ml of venous blood was withdrawn from the antecubital region and collected into a sterile glass test tube without the addition of any anticoagulant. It was immediately centrifuged in a bench-top centrifuge at 2700 RPM for 12 min. Completion of centrifugation produced three distinct layers in the test tube: RBCs clot at the base, whitish yellow coloured clot (2 ml) in middle, and clear straw-coloured acellular plasma at the top layer [Figure 1]. This middle clot is known as PRF which is a predominant combination of platelets and WBCs collected in a fibrin matrix.[16] In the absence of any anticoagulant, blood starts coagulating as it comes in contact with the glass surface of the test tube. Consequently, rapid collection and immediate centrifugation of blood is the key to successfully prepare PRF.

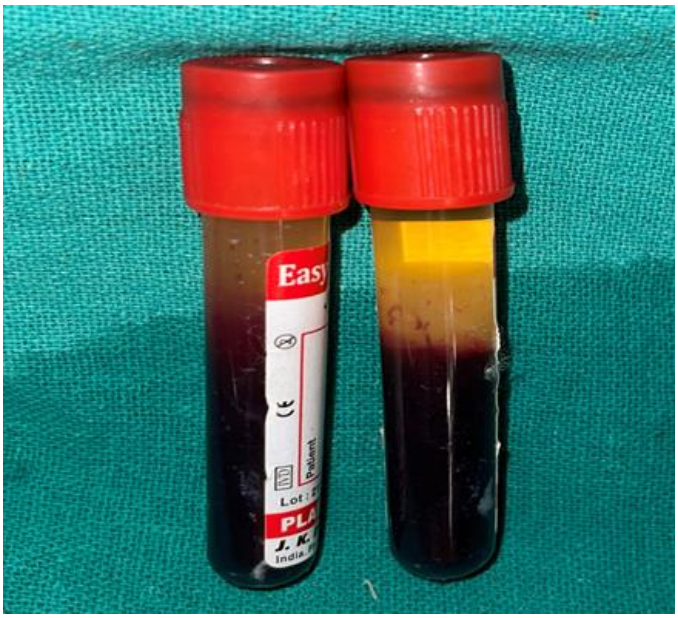

Figure 1: Showing PRF preparation

Operative technique: All patients with normal hematologic values and coagulation profile were taken up for the procedure. Three facial measurements were taken respectively from tragus of the ear to the corner of mouth [Figure 2] the lateral canthus to the tragus [Figure 3], and the tragus of ear to the soft tissue pogonion [Figure 4]. The arithmetic sum of these measurements (preoperative facial swelling or FS) worked as the baseline data for calculation

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of post-operative swelling. Preparation of PRF preceded the surgical procedure in group A. Therefore, we utilized the preparation time (12 minutes) by initiating the extraction procedure.

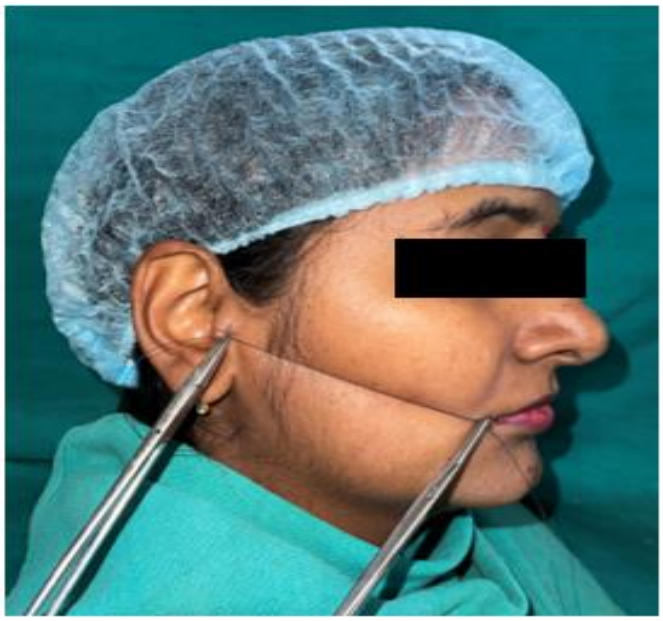

Figure 2: From tragus of the ear to the corner of mouth

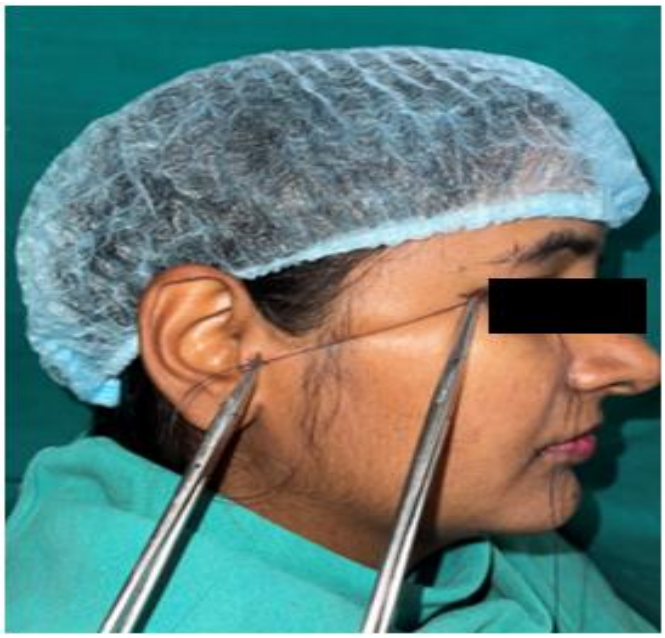

Figure 3: From the lateral canthus to the tragus

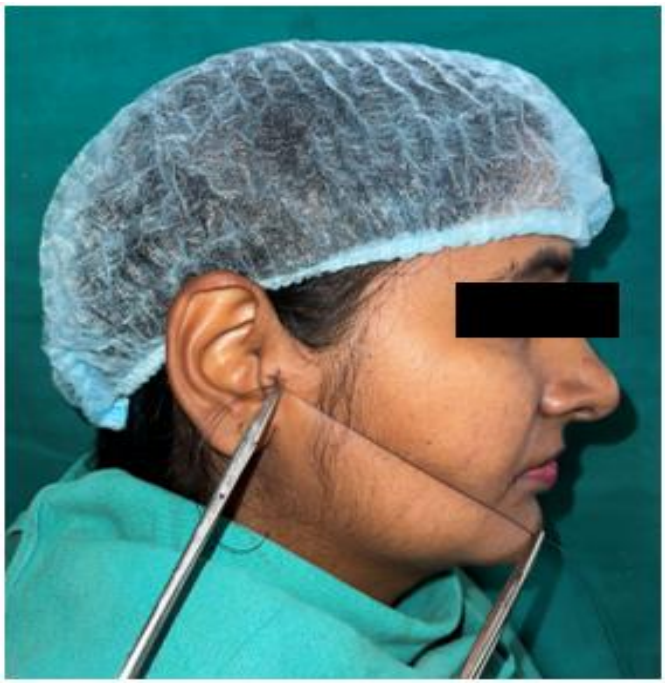

Figure 4: Fromthe tragus of ear to the soft tissue pogonion

Figure 5: Bone guttering with Normal saline irrigation(0.9%w/v)

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Figure 6: Tooth removal

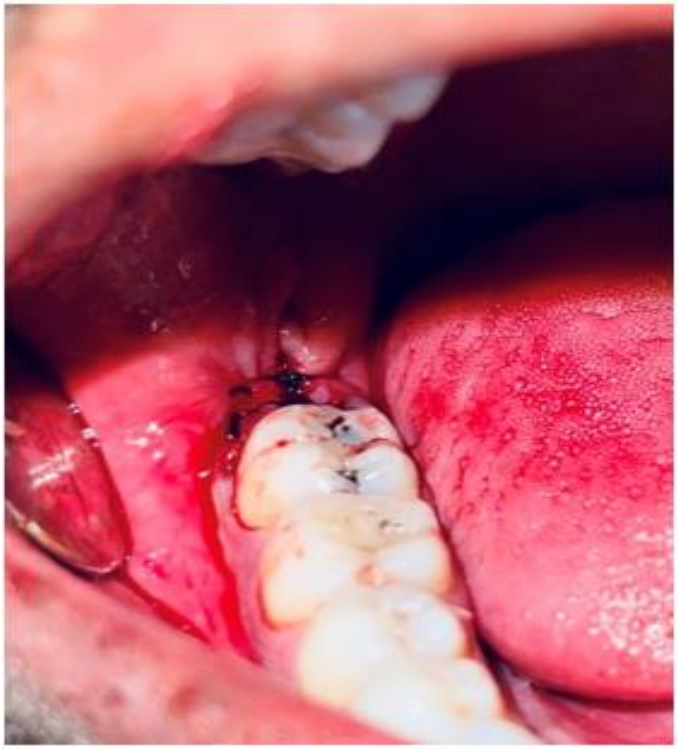

Figure 7: Primary closure of mucoperiosteal flap

Under LA, A trapezoidal flap was raised and transalveolar extraction of mandibular molars was performed by a single operator. Surgical procedure included mucoperiosteal flap reflection, bone guttering under with normal saline (0.9% w/v) irrigation and tooth removal [Figure 5&6], tooth sectioning (if required), PRF placement (only in group A extraction sockets) and primary closure of mucoperiosteal flap with 3-0 black braided silk suture with simple interrupted technique. [Figure 7]

Follow up: Pain and swelling on were evaluated on 1st, 3rd, 7th, and 14th post-operative day using the method of Schultze et al,[17] modified by Ogundipe OK et al.[1] Pain was evaluated using 10-point visual analogue scale (VAS), with a score of "0" equals "no pain" and "10" equals "very severe pain." Presence of wound dehiscence was also checked .All the evaluations were carried out by investigators other than the operating surgeon. Facial swelling percentage was calculated as the difference of pre-operative and post-operative facial measurements divided by the pre-operative facial measurement and multiplying it to 100.

Statistical analysis: For the presentation of quantitative data percentages, proportions, mean value ± standard deviation was used. Fischer's exact test/chi-square test, t-test were performed for statistical analysis. A p-value <0.05 was taken as the level of significance.

Ethical issues: Approval for the study was obtained from the Institutional Ethics Committee. Informed consent was taken from all participants and strict confidentiality was maintained for all collected data.

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RESULTS

A total patient of 24 patients were recruited with females constituting a higher proportion (15, 62.5%). The patient were divided into two groups: Group A of 12 (twelve) patients constituting the study group and Group B of 12(twelve) patients the control group. Females constituted a higher proportion in both group A (8, 67%) and group B (7, 58%). The age of the patients ranges from 26 to 40 years with a mean (SD) age of 34.6(4.0) years and median age of 35 years. Taking the median age the patients were group into two age group. The distribution of the participants in the two age groups were almost similar.

There was no statistically significant difference between the two groups by age (p=0.673) or gender (p=0.500) at the baseline [Table 1].

Table 1: Showing comparison by gender and age groups in the two groups (N=24)

Variable		Group A N(%)	Group B N(%)	p-value
Gender	Female	08(53.3)	07(46.7)	0.673
	Male	04(44.4)	05(55.6)	
Age group	<35 yr	05(45.5)	06(54.5)	0.500
	≥35 yr	07(53.8)	06(46.2)	

Table 2: Showing comparison of occurrence of wound dehiscence in the two groups (N=24)

Wound Dehiscence	Group A N(%)	Group B N(%)	p-value
Present	01(25.0)	03(75.0)	0.0590
Absent	11(55.0)	09(45.0)	

*Fisher's Exact Test

The presence of Wound dehiscence which was found to be higher in group B (3, 25%) as compared to group A (1, 8.3%) but the difference was not statistically significant (p=0.059).

Table 3: Showing comparison of Post-operative VAS score of the two groups using t-test (N=24)

Post-operative day	VAS score (Mean±SD)		p-value
	Group A (N=12)	Group B(N=12)	
Day 1	4.83±0.72	6.50±0.52	<0.001*
Day 3	2.92±0.66	4.8±0.83	<0.001*
Day 7	1.42±0.51	3.17±0.57	<0.001*
Day 14	0.42±0.51	1.17±0.57	<0.003*

Table 4: Showing comparison of Post-operative swelling of the two groups using t-test (N=24)

Post-operative day	Swelling (Mean±SD) mm		p-value
	Group A (N=12)	Group B(N=12)	
Day 1	13.84 ±0.82	16.19 ±0.72	<0.001*
Day 3	11.99 ±1.04	14.39 ±0.65	<0.001*
Day 7	06.67 ±1.87	10.48 ±0.57	<0.001*
Day 14	01.55 ±1.19	06.73 ±1.61	<0.001*

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In group A, the mean postoperative pain score (VAS) was highest at post-operative day 1 which was 4.83±0.72 and which gradually reduced over the 3rd, 7th and least at the 14th day which was 0.42±0.51. In group B the mean post-operative score (VAS) was highest in day 1 which was 6.50±0.52 which gradually reduced over the 3rd, 7th and least at the 14th day which was 1.17±0.57. The mean (SD) pain score was lower in Group A on Day 1, 3, 7 and 14 as compared to Group B and it was found to be statistically significant ($p<0.001$) [Table 3].

In group A, the mean (SD) facial swelling was highest at Day 1 postoperative day which was 13.84 ±0.82mm and gradually reduced over 3rd, 7th postoperative days and least on the 14th post-operative day which was 01.55 ±1mm. In group B, the mean (SD) facial swelling was highest at Day 1 postoperative day which was 16.19 ±0.72 mm and gradually reduced over 3rd, 7th postoperative days and least on the 14th post-operative day which was 06.73 ±1.61mm. There was statistically significant reduction in swelling in Group A patients on Day 1, 3, 7 and 14 as compared to Group B patients ($p<0.001$) [Table 4].

DISCUSSION

Wound healing is an orchestrated complex sequence of physiological and biochemical mechanisms at cellular and molecular levels. Choukron J et al,[16,18,19] introduced PRF in dentistry for the first time in an implant case and today PRF is an accepted and most extensively worked upon biological material with immense regenerative potential by other disciplines of clinical dentistry.[6,11,20,21] Su CY et al opined that if PRF clots are squeezed between sterile cotton gauze as promoted by Choukroun group,[16] to prepare a membrane then that membrane should be put to use immediately over surgical sites as the release of growth factor is found to be maximum for first 60 min and for this they advocate to expose surgical site first before obtaining PRF in order to save time.[22,23] In this study, we have evaluated the healing efficacy of PRF by applying it in the transalveolar extraction sockets.

In available literature, conflicting points can be observed on the effect of platelet-rich fibrin, applied to the alveolus, on pain intensity after surgical removal of third lower molars by using the Visual Analogue Scale (VAS) for pain assessment.[24,25,26,27,28] As reported by Thong et al,[29] Hjermstad et al,[30] Fereira-Valente et al,[31] VAS and NRS scales can be used interchangeably due to the high correlation of the scores. In the present study, patients who had platelet-rich fibrin injected into the alveolus after trans-alveolar extraction reported significantly less pain on days 1, 3,7 and 14 compared to participants in the control group. A study by Asutay et al, reported no differences in pain perception were observed after both six and twelve hours.[26] Similar findings were reported by Gülsen and Sentürk.[27]

Edema develops 48 to 72 hours following the surgical evacuation of the tooth. In order to accurately determine its accretion in the days following surgery, a sufficient observation period is necessary.[32,33,34] In the present study, the value of the measured swelling was significantly different on day 1, 3, 7 and day 14 between the groups with the study group receving PRP showing significantly lesser swelling. The results of Özgül et al,[35] and Kumar et al,[36] showed a significant effect of platelet-rich fibrin on reducing swelling after

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surgical removal of the impacted lower third molar also measured lesser swelling after the 1st, 3rd, and 7th postoperative day using a flexible ruler.[35] Jaw physiotherapy was advised to the patients and were performed during the recovery period which significantly affected muscle relaxation, resulting in decreased trismus.

Although the proportion of wound dehiscence was only 25% in the study group as compared to 75% in the control group in the present study, there was no significant difference in the wound dehiscence. Mucosal margins come together naturally if there is no tissue irritation and sufficient soft tissue surrounds the removed socket. Wound dehiscence is a possibility even in this state. In a research by Jakse et al,[37] 10% of 60 fully soft tissue-covered mandibular third molars experienced wound dehiscence while using the modified triangle flap design. In the postoperative phase, mucosal closure under strain will result in wound dehiscence. Failure to remove the sulcular epithelium surrounding the wisdom teeth and a lack of bone support below the suture line are two other variables that can promote wound dehiscence. In a study done by U. Yolcu and A. H. Acar,[38] concluded that a lingually based triangular flap reduces the incidence of wound dehiscence. It is similar to the present study in which the trapezoidal flap lead to the closure without tension and wound dehiscence was less in both groups. Such dehiscences could heal secondarily without any additional discomfort or may favour the development of alveolar osteitis or soft tissue abscesses as well as long-term discomfort.[37]

The limitations of our study is that it was done on a small group and the assessment of pain was based on a VAS scale which may be subjective. Nevertheless the study findings endorses the a innovative technique that can alleviate discomfort, or edema enables a less traumatic and quicker healing process after non-infectious tooth extraction which will facilitate a quick recovery and a return to an active lifestyle. Patients readily accept PRF since it is autologous, inexpensive, simple to procure, and does not trigger allergic responses or rejections.

CONCLUSIONS

The PRF treatment group has significantly lower pain and swelling on day 1,3,7 and 14. PRF can act as an accelerating factor in wound healing, hence further research is essential in order to assess the usefulness of PRF in other oral and maxillofacial surgical procedures and to increase the use of this economical practical material in standard clinical practice.

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