Original Article

Evaluation of effects of platelet-rich fibrin on treatment outcomes after impacted mandibular third molar surgery: A randomized controlled clinical study

ABSTRACT

Background and Objective: Impaction of the third molar teeth is a common disorder which often necessitates their removal. After third molar surgery, the common postoperative sequelae are pain, trismus, and buccal swelling. Our study sought to evaluate the effect of platelet-rich fibrin (PRF) on postoperative pain, swelling, trismus after surgical extraction of impacted mandibular 3rd molars.

Materials and Methods: Over a period of 22 months (December 1, 2016–September 30, 2018), 44 patients in the age group of 18–40 years, who required surgical extraction of impacted third molar and met the inclusion criteria were recruited. After surgical extraction of the third molar, only primary closure was performed in the control group (22 Group), whereas PRF was placed in the socket followed by primary closure in the study group (22 patients). The outcome variables were pain, swelling, and maximum mouth opening were measured with a follow-up period of 1 week.

Results: The application of PRF in the study group lessens the severity of immediate postoperative sequelae such as pain, swelling, and trismus compared to the control group.

Conclusion: The treatment outcomes and postoperative sequel were better in the PRF group as compared to other control group on days 1, 3, and 7 postoperatively.

Keywords: Impacted 3rd molar, pain, platelet-rich fibrin, postoperative complications, swelling, trismus

INTRODUCTION

Impaction of the third molar teeth is a common disorder which often necessitates their removal. After third molar surgery, the common postoperative sequelae are pain, trismus, and swelling.[1] The incidence and severity of these complaints varies from patient to patient.[2] An indication for extraction of impacted lower wisdom teeth reported in studies, includes pericoronitis; caries and its sequelae involving the mandibular 2nd and 3rd molar.[3,4]

The use of fibrin glue or platelet concentrate platelet-rich plasma (PRP) during surgical procedures accelerates wound healing and tissue maturation. Platelet concentrates are classified into four main families, based on their fibrin architecture and cell content: Pure PRP, Leukocyte-and PRP; pure platelet-rich fibrin (PRF); Leukocyte-and PRF.[5]

Choukroun's PRF, a second-generation platelet concentrate, was defined as an autologous leukocyte and PRF biomaterial. It permits rapid angiogenesis and an easier remodeling of fibrin in a more resistant connective tissue. It is an immune and platelet concentrate collecting on a single fibrin

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membrane, containing all the constituents of a blood sample which are favorable to healing and immunity.

This study has been designed to evaluate the efficacy of PRF in the reduction of postoperative complications after surgical removal of impacted mandibular 3rd molars.

MATERIALS AND METHODS

This study was carried on 44 patients randomly reporting to the Department of Oral and Maxillofacial Surgery, seeking surgical extractions of impacted mandibular 3rd molar. This study was conducted from 2016-2018 as part of my thesis and ethical clearance was given from ethical committee members of Rajiv Gandhi College with reference no Srgcds/2016/492-93.

Statistical data

Based on the results of the pilot study and analysis of variance test results, effect size calculated was 0.41 assuming 93% power, 5% level of significance, to estimate the above-mentioned difference; the required sample size is 20 in each group. To compensate for losses during the study a 10% increase was considered.

Method of collection of data

- Duration of study: December 1, 2016–September 30th 2018
- Sampling technique: Random
- Sample size: 44
- Total number of groups: 2
- Number of patients in each group: 22.

Surgical technique

Standard precaution for asepsis was carried out for all patients and the affected impacted lower 3rd molar [Figure 1] was surgically extracted under local anesthesia using 2% lignocaine with adrenaline (1:80,000). Wards incision was given, and full-thickness mucoperiosteal flap elevated. Bone guttering was done on the buccal and distal aspect stopping short of the bone on the lingual aspect, and tooth removal was done. The socket was thoroughly debrided to remove granulation tissue and copiously irrigated with normal saline solution. In the control group, the socket was left empty after the surgical extraction and closure done with simple interrupted sutures using 3-0 black braided silk. In the study group, the prepared autologous PRF was separated from blood [Figure 2] by holding it with sinus forceps and cut with surgical scissors, then it was placed in extraction socket [Figure 3] and the closure was done with simple interrupted sutures using 3-0 black braided silk [Figure 4].

Evaluation

- Pain intensity will be assessed using a 10-point visual analog scale, with the patient placing a mark on the scale to indicate an intensity range from no pain "0" to severe/unbearable pain "10"
- Trismus will be evaluated by measuring the distance between the edges of the upper and lower right central incisors at the maximum opening of the jaws [Figure 5] preoperatively and on days 1st, 3rd, and 7th after the surgery
- The degree of facial swelling will be determined by a modification of the tape measure method described by Gabka and Matsumara. Three measurements will be made between four reference points [Figure 6]:
  1. The distance between the lateral corner of the eye and angle of the mandible (C-A)
  2. The distance between the tragus and soft-tissue pogonion (T-P)
  3. The distance between the tragus and the outer corner of the mouth (T-C) [Figure 6].
- The mean of these three measurements will be calculated.
  1. Measurements will be taken preoperatively
  2. Postoperatively on the 1st, 3rd, and 7th days.

RESULTS

A total of 44 patients with 22 in each group in the age range of 18–40 years with mean age 28.73 ± 5.17 in group 1 and 30.09 ± 5.32 in group 2 were included in the study.

Pain

There was pain in 40 out of 44 patients preoperatively. The mean postoperative pain in the study group was 88.665 and that in the control group was 55.578. On the 1st postoperative day, pain was 4.91 ± 1.51 and 7th postoperative day 1.73 ± 0.63 in the control group and 4.86 ± 1.78 and 0.68 ± 0.57 in the study group [Table 1 and Figure 7].

Swelling

There was swelling in 8 out of 44 patients preoperatively. The mean postoperative swelling in the control group was 94.282 mm and that in the study group was 141.099 mm. On the 1st postoperative day, swelling was 352.36 ± 23.2 mm and 7th postoperative day, it was 353.18+_25.7 in the control group and 349.5 ± 23.1 mm and 348.8 ± 26.1 in the study group [Table 2 and Figure 8].

Trismus

In 5 out of 44 patients, there was restriction in mouth opening preoperatively. The mean preoperative mouth opening in the study group was 34.351 mm and that in the control group was 52.328 mm. On the 1st postoperative day, mouth opening was

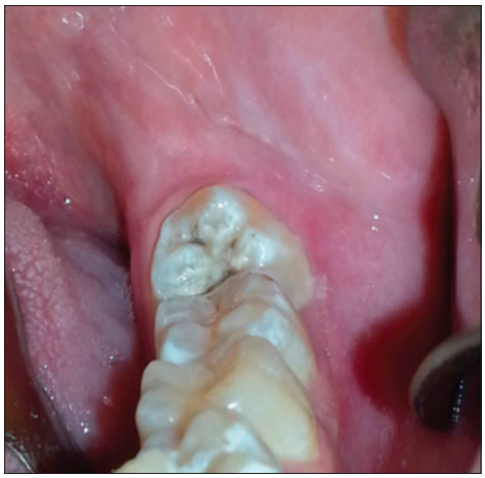

Figure 1: Impacted tooth

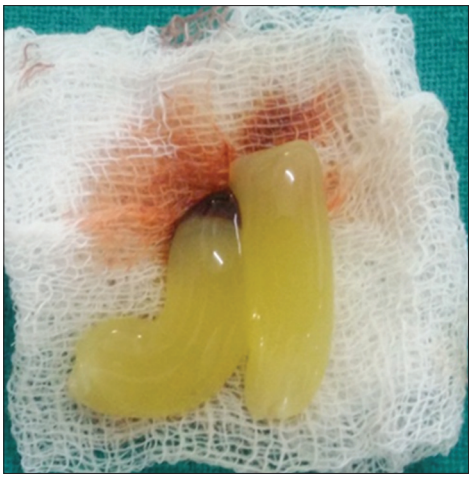

Figure 2: Platelet-rich fibrin

Table 1: Comparison of mean visual analogue scale score in two groups

Time	Mean±SD		t^{S}	P^{S}
	Group 1	Group 2		
Preoperative	3.59±2.02	3.91±2.00	0.53	0.602
Day 1	4.91±1.51	4.86±1.78	0.91	0.928
Day 3	5.09±1.15	4.45±1.65	1.48	0.146
Day 7	1.73±0.63	0.68±0.57	5.77	<0.001**
$F^{\#}$	55.578	88.665		
$P^{\#}$	<0.001**	<0.001**		

#Repeated measure ANOVA, SUnpaired' test, *P<0.05; Significant, **P<0.001; Highly significant. SD: Standard deviation[4,5]

Table 2: Comparison of mean swelling (total) in two groups

Time	Mean±SD		t^{S}	P^{S}
	Group 1	Group 2		
Preoperative	347.18±23.79	349.45±25.83	0.304	0.763
Day 1	352.36±23.23	353.18±25.71	0.111	0.912
Day 3	359.68±22.23	356.91±25.91	0.381	0.705
Day 7	349.50±23.02	348.77±26.08	0.098	0.922
$F^{\#}$	94.282	141.099		
$P^{\#}$	<0.001**	<0.001**		

#Repeated measure ANOVA, SUnpaired *t*-test, *P<0.05; significant, **P<0.001; highly significant. SD: Standard deviation[4,5]

39.23 ± 6.57 mm and 7th postoperative day was 41.45 ± 6.32 in the control group and 42.00 ± 5.33 mm and 44.23 ± 5.07 in the study group [Table 3 and Figure 9].

DISCUSSION

Mandibular third molar surgery is one of the most common procedures performed in dentistry. In cases where the teeth are deeply impacted and covered by a large quantity of bone, surgery can be very difficult, leading to increased tissue manipulation, a longer operation time, and consequently more postoperative discomfort. Postoperative complications include pain, swelling, infection, alveolar osteitis (dry socket), and hemorrhage.[6,7] Oral and maxillofacial surgeons always seek to improve their surgical technique to reduce these complications after surgery.

This study aimed to evaluate the effect of PRF on postoperative complications after mandibular third molar surgery, which could help the oral and maxillofacial surgeon to provide a better postoperative outcome for patients and evaluate any additional clinical benefits. The results showed a reduction in pain, swelling, and trismus in the 1st week after surgery when PRF was used.

It is very clear from the results of our study that pain at postoperative days 1, 3, and 7 is definitely less compared to the control group. As there was less postoperative pain in the study group, the patients tend to stop analgesics on the 3rd postoperative day, whereas the patients in the control group continued analgesics for a much longer time. It is evident that PRF can be an adjuvant to reduce pain in difficult 3rd molar extractions.

Comparison of our study findings with Kumar *et al.*,[4,8,9] suggest almost identical results as far as postoperative pain is concerned. In this study, postoperative sequelae, such as pain, swelling, and mouth opening (Trismus), were recorded for all patients preoperatively and postoperatively at 1st, 3rd, and 7th postoperative days, there was pain in 40 out of 44 patients preoperatively. The mean postoperative pain in the study group was 88.665 and that in the control group was 55.578.

Swelling following the surgical removal of teeth is an expected finding during the postoperative course. The onset of swelling is typically between 12 and 24 h following the procedure, with a peak swelling noted 48–72 h postoperatively. In the early postoperative period, the use

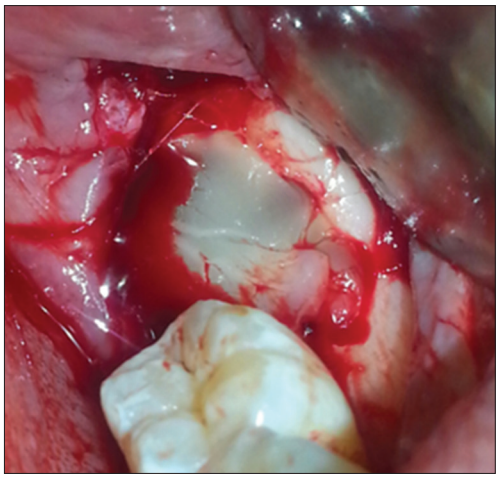

Figure 3: Platelet-rich fibrin placement in extraction socket

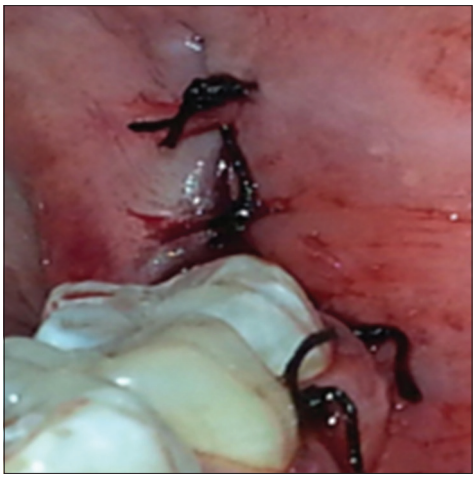

Figure 4: Suture placement

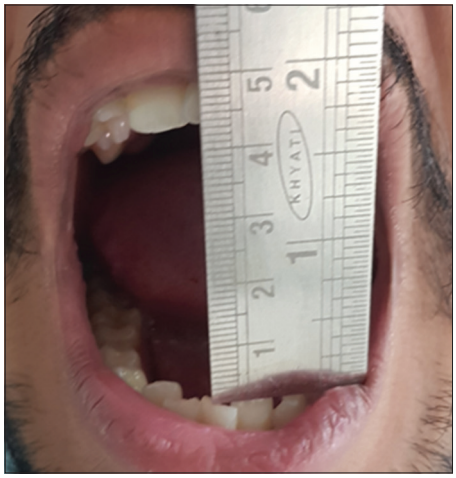

Figure 5: Measurement of Trismus

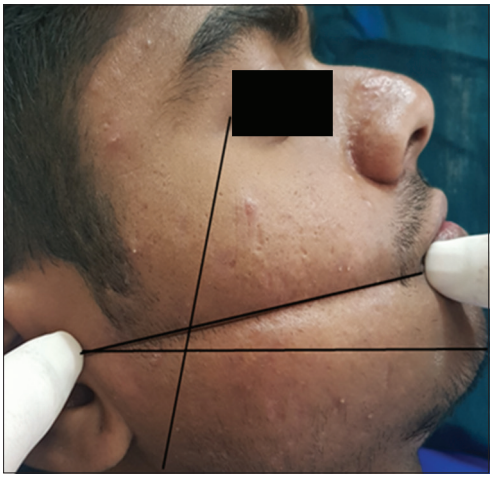

Figure 6: Measurement of swelling

Table 3: Comparison of mean trismus in two groups

Time	Mean±SD		$t^{\$}$	$P^{\$}$
	Group 1	Group 2		
Preoperative	42.14±5.80	43.73±5.59	0.926	0.360
Day 1	39.23±6.57	42.00±5.33	1.537	0.132
Day 3	37.68±7.63	42.14±5.07	2.280	0.028*
Day 7	41.45±6.32	44.23±5.05	1.608	0.115
$F^{\#}$	34.351	52.328		
$P^{\#}$	<0.001**	<0.001**		

#Repeated measure ANOVA, $Unpaired *t*-test, *$P<0.05$; significant, **$P<0.001$; highly significant. SD: Standard deviation[4,5]

of ice packs may help with the management of swelling. In addition, perioperative steroids may be used to prevent swelling in patients undergoing significantly invasive procedures (e.g., third molar extraction). While the use of peri-operative steroids may produce moderate decrease in swelling, these medications are typically short in action.[10-12]

There was swelling in 8 out of 44 patients preoperatively. The mean postoperative swelling in the control group was 94.282 mm and that in the study group was 141.099 mm. It is clear from the findings of our study that at postoperative day 1, swelling was more in the study group but progressively decreased as compared to the control group at days 3 and 7. Evaluation of swelling in different difficult situations as determined by Pederson's difficulty index clearly indicated that more difficult procedures may require the combination of steroids and PRF.[13,14]

Trismus constitutes an important immediate postoperative complication of surgical removal of impacted tooth, which is caused by the edema associated with surgical trauma. This pain causes the muscles to contract, resulting in loss or range of motion. As trismus is caused due to pain and swelling, drugs used to manage these complications followed by physical therapy helps in increasing the mouth opening.

Postoperative trismus has been an important feature of mandibular 3rd molar surgery. In our study postoperative inter incisal mouth opening was found be consistently

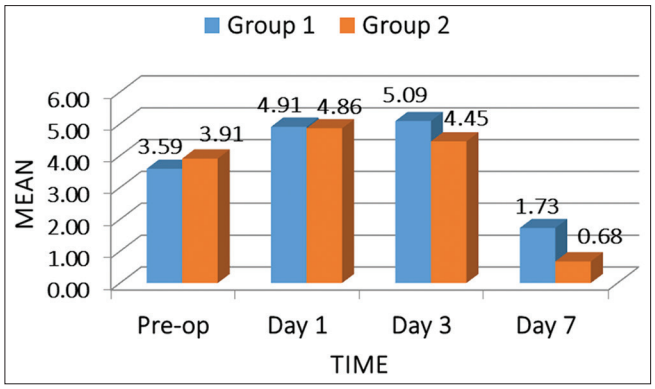

Figure 7: Comparison of mean visual analogue scale score in two groups

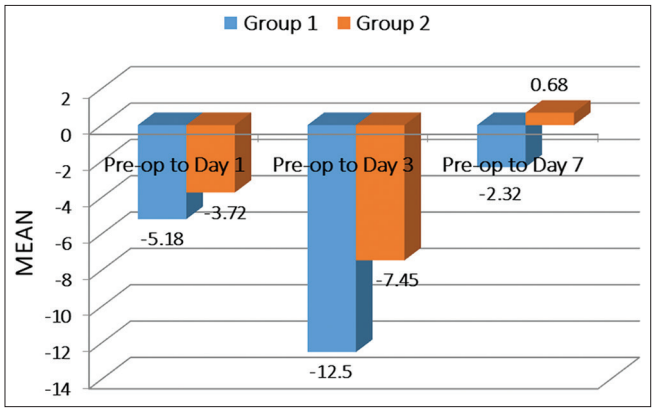

Figure 8: Comparison of change in swelling (total) from preop to various time intervals between both groups

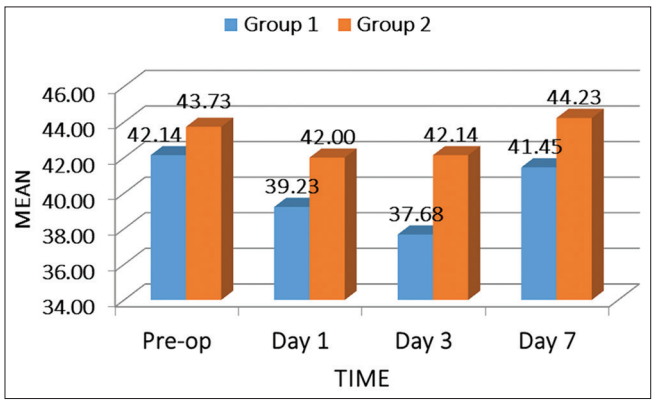

Figure 9: Comparison of mean trismus in two groups

better in the study group as compared to the control group. The outcome in our study was better than findings in a few comparable studies.

In 5 out of 44 patients recorded restriction in mouth opening preoperatively. The mean preoperative mouth opening in the study group was 34.351 mm and that in the control group was 52.328 mm.

PRF in the form of a platelet gel can be used in conjunction with bone grafts, which has several advantages, such as promoting wound healing, bone growth and maturation, wound sealing and hemostasis, and imparting better handling properties to graft materials. It can also be used as a membrane. Many clinical trials suggest the combination of bone grafts and PRF to enhance bone density.[15,16]

The advancements were made possible due to the recent findings by Ghanaati *et al*. that introduced the Blow-speed concept for blood centrifugation whereby lower centrifugation speeds were shown to contain higher numbers of cells including leukocytes before the formation of a fibrin clot and this injectable PRF is given directly into the injured tendon, ligament, muscle, joint, or disc or extraction sockets that has been determined to be a source of pain and is not-healing appropriately.[17,18]

In this study, 1 patient in the control group had dry socket and no patients in the study group. Therefore, PRF can be considered a viable option for socket healing after surgical extraction of impacted mandibular third molars.

In a similar case-control study conducted by Ogundipe *et al*. on the use of autologous PRP gel to decrease postoperative complications in surgical extraction of mandibular third molars, the PRP group had decreased pain, swelling, and trismus compared with the control group, but this difference was statistically significant only for postoperative pain. Therefore, PRF seems to have a more positive influence on postoperative sequelae compared to PRP.[5]

Nevertheless, a few limitations existing in our study and these could be enumerated as follows:

1. Although the sample size is statistically significant, a larger sample size can always give better output
2. Split-mouth study in the 3rd molar surgery was a possibility that could have been considered
3. Radiographic analysis could have been done
4. Comparison of identical levels of impaction could have been done.

CONCLUSION

Surgical extractions of lower 3rd molars have been a routinely performed procedure by oral and maxillofacial surgeons. There have been concerns about postoperative pain, swelling, and trismus. PRF has certainly gained tremendous attention in recent years due to its capacity to successfully regenerate either soft or hard tissues, enhancing new blood vessels (angiogenesis), or tissue formation during healing; randomized control trials (RCTs) are the gold standard in clinical trials.[19,20] PRF was shown to clearly improve the

outcomes in terms of pain, swelling, and trismus and this RCT is one more effort to investigate the role of PRF in improving the outcomes associated with the 3rd molar surgery. The wisdom gained in our study can have a profound implication in other facets of oral and maxillofacial surgery such as oral implantology, management of pathology, and other minor surgical procedures.

Declaration of patient consent

The authors declare that they have obtained consent from patients. Patients have given their consent for their images and other clinical information to be reported in the journal. Patients understand that their names will not be published and due efforts will be made to conceal their identity but anonymity cannot be guaranteed.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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