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Role of Platelet Rich Protein in Healing of Extracted Mandibular Third Molar Impaction

Abstract

Objectives: The Study aims to prepare/ procure PRP from autologous whole blood withdrawn from the patients prior to the surgical procedure and understand the additional benefits in wound healing of mandibular 3rd molar sockets with the application of platelet rich plasma. **Materials and Methods:** The present study was undertaken by the department of oral and maxillofacial surgery at Rama Dental College, Hospital and Research centre, Kanpur. This study involved both male and female patients, age between 17-35 years with impacted third molar, who were referred to the department for removal of 3rd molars. **Results:** On evaluating dehiscence, we found that PRP sites showed dehiscence in 1 (10%) out of 10 cases, NON-PRP sites 4 (40%) cases. In our study we observed significant decrease in swelling second PO day at the PRP sites, and swelling disappeared and non significant by 7th day post operatively at both sites. **Conclusion:** The present study clearly indicates a definite improvement in the soft tissue healing and faster regeneration of bone after third molar surgery in cases treated with PRP as compared to the control group post operatively.

Key Words

Dehiscence; platelet rich plasma; regeneration

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INTRODUCTION

Platelet rich plasma (PRP) is an autologous concentration of human platelets in a small volume of plasma. It is a concentration of 7 fundamental growth factors proved to be actively secreated by platelets to initiate wound healing. It also contains the 3 proteins in the blood known to act as cell adhesion molecules for osteoconduction and as a matrix for bone, connective tissue and epithelial migration.

MATERIAL AND METHODS

The present study was undertaken by the department of oral and maxillofacial surgery at Rama Dental College, Hospital and Research centre, Kanpur. This study involved both male and female patients with impacted 3rd molars, who were referred to the department for removal of 3rd molars.

Inclusion Criteria

1. Patient age between 17-35 yrs.
2. Patients having bilateral impacted mandibular third molars.
3. Absence of pericoronitis, periapical infection or lesion with respect to impacted 3rd molars.
4. Absence of opposite traumatic occlusion or impinging upper third molars.
5. Patients who are non smokers and non alcoholics.
6. Patients without any systemic disease.
7. Female patients not on use of oral contraceptives.

After obtaining complete history, patients were examined clinically and were explained about the procedure, its complication and follow up period involved in the study. The patients who were willing were enrolled for the study and following radiographs were taken - IOPAR and OPG. Preoperatively all the patients were evaluated for bleeding time, clotting time and platelet count. All patients signed informed consent before participating in the study. Study sample included twenty impacted mandibular 3rd molars from 10 patients, all patients underwent bilateral removal of impacted 3rd molar and PRP that was prepared prior

Table 1: Master Chart – Clinical Evaluation

O.P.NO	DAY	PAIN – VAS & VRS		SWELLING(cm)		DEHISCENCE		DRY SOCKET	
		PRP SITE	NON PRP	PRP SITE	NON PRP	PRP SITE	NON PRP	PRP SITE	NON PRP
	PRE OP	0 A	0 A	10.8	10.8				
111903	DAY 2 PO	5 C	7 D	11.5	11.8	-	-	-	-
	DAY 7 PO	3 B	4 C	10.9	11.0	-	-	-	-
	PRE OP	0 A	0 A	10.8	10.9				
115590	DAY 2 PO	5 C	6 C	11.6	11.9	-	-	-	-
	DAY 7 PO	1 B	1 B	10.8	11.0	-	+	-	-
	PRE OP	0 A	0 A	10.5	10.4				
118013	DAY 2 PO	4 B	5 B	11.4	10.6	-	-	-	-
	DAY 7 PO	1 A	2 A	10.5	10.5	-	-	-	-
	PRE OP	0 A	0 A	10.5	10.7				
122486	DAY 2 PO	4 B	6 C	11.5	12.0	-	-	-	-
	DAY 7 PO	0 A	3 B	10.7	11.0	-	-	-	-
	PRE OP	0 A	0 A	11.0	10.8				
116614	DAY 2 PO	5 C	6 C	11.8	11.8	-	-	-	-
	DAY 7 PO	2 B	4 C	11.0	11.0	-	-	-	-
	PRE OP	0 A	0 A	10.6	10.6				
123990	DAY 2 PO	3 B	5 C	11.6	11.8	-	-	-	-
	DAY 7 PO	0 A	2 B	10.6	10.6	-	-	-	-
	PRE OP	0 A	0 A	11.0	10.8				
129865	DAY 2 PO	5 C	6 C	11.9	11.8	-	-	-	-
	DAY 7 PO	1 A	3 B	11.1	11.0	-	+	-	-
	PRE OP	0 A	0 A	10.8	10.5				
123843	DAY 2 PO	6 C	6 C	11.5	11.5	-	-	-	-
	DAY 7 PO	2 B	4 B	10.8	10.7	-	+	-	-
	PRE OP	0 A	0 A	10.7	10.7				
129655	DAY 2 PO	5 C	6 C	11.7	11.5	-	-	-	-
	DAY 7 PO	1 A	2 B	10.7	10.7	+	+	-	-
121829	PRE OP	0 A	0 A	10.4	10.5				
	DAY 2 PO	5 C	7 D	11.2	11.5	-	-	-	-
	DAY 7 PO	1 B	3 B	10.5	10.7	-	-	-	-

to the start of procedure was activated to form PRP gel that was placed in one of the extraction socket randomly selected by the author. All the patients were recalled on day 1, day 2, day 7, 3 weeks, 2 months, 4 months and 6 months postoperatively for follow up study.

RESULTS

On evaluating dehiscence, we found that PRP sites showed dehiscence in 1 (10%) out of 10 cases, NON-PRP sites 4 (40%) cases. This signifies a better soft tissue healing of extraction socket with PRP as compared to NON PRP sockets. In our study patients experienced lower levels of pain on visual analog scale (VAS) at PRP treated sites. An average of 4.7 on day 2 and 1.2 at week 1 post-operatively at the PRP treated sites and average of 6.0 on day 2 and 2 .8 at week 1 post-operatively at NON-PRP sites. It was also noticed that there was slower rise and faster decrease in pain levels at PRP sites as against NON-PRP sites. In our study patients subjectively experienced lower levels of pain on verbal response scale (VRS) at PRP treated sites .the percentage scores of VRS preoperatively A- 100% for PRP group and NON-PRP group. the percentage of VRS scores at day two postoperatively were B- 70 % , C-70% for PRP group and B- 10%, C- 70% ,D- twenty % for NON-PRP group. At 1 week post - operatively, A-50% , B-50 % for PRP group and A-10% , B-70% and C-20% for NON-PRP group. In our study we observed significant decrease in swelling on day 2 at the PRP sites, and swelling disappeared by 7^{th} day post operatively at both sites. In our study there was no occurrence of dry socket. The mean values of radiographic density for PRP groups were significantly higher as compared to NON-PRP

Table 2: Radiographic Data IOPA Radiographs

O.P. NO.	SITE	3 WEEKS	2 MONTHS	4 MONTHS	6 MONTHS
111903	PRP	54.08	52.42	70.78	76.28
	NON PRP	40.05	58.09	59.09	60.28
115590	PRP	56.09	59.23	66.43	69.09
	NON PRP	39.72	42.03	45.92	51.23
118013	PRP	53.19	70.96	80.92	87.34
	NON PRP	52.23	55.73	60.89	62.19
122486	PRP	50.42	68.79	86.79	90.13
	NON PRP	52.55	64.17	73.52	78.61
116614	PRP	74.15	80.51	97.18	98
	NON PRP	72.72	74.34	85.03	88.71
123990	PRP	52.31	62.56	78.37	82
	NON PRP	50.72	56.09	65.73	68.11
129865	PRP	74.72	80.92	87.72	92.53
	NON PRP	60.62	67.53	73.35	78.43
123843	PRP	62.15	71.7	84.62	88.44
	NON PRP	59.72	65.61	72.73	72.01
129655	PRP	73.21	78.76	84.43	92.23
	NON PRP	70.92	77.53	80.12	82.66
121829	PRP	55.82	67.82	79.83	83.45
	NON PRP	52.75	59.73	68.18	75.34

groups 3 weeks, two months, 4 months and 6 months postoperatively. The results of the present study demonstrate that PRP contributed to better healing of soft tissues and bone as compared to the extraction sockets without its use. It offers the clinical surgeon access to various growth factors with a simple, safe, cost effective and available technology.

DISSCUSION

PRP works via degranulation of a granules in the platelet, which contains synthesized and prepackaged growth factors. The active secreation of these growth factors is initiated by the clotting process of the blood and begins within 10 minutes after clotting. More than 95% of the pre synthesized growth factors are secreated within 1 hour. Therefore, PRP must be developed in anticoagulated state and should be used on the graft, flap or wound, within 10 minutes of clot initiation.

Studies done by Hanesworth *et al*., and Lui *et al*., documented the necessity of devices to concentrate sufficient platelets and explained enhanced bone regeneration and soft tissue results associated with PRP. Because most individuals have a baseline platelet count 200,000 +_ 75,000/uL, a PRP platelet count of 1 million/uL as measured in the standard 6-ml aliquot has become benchmark of "therapeutic PRP". Because PRP enhances osteoprogeinator cells in the host bone and in bone graft, it has found clinical applications in fully autogenous bone graft and composites of autogenous bone graft with a variety of bone substitutes with as little as 20 % of autogenous bone. Therefore, PRP has shown improved results in continuity defect, sinus lift augmentation grafting, horizontal and vertical ridge augmentation, ridge preservation grafting, and periodontal/peri-implant defects. We have also observed PRP to allow earlier implant loading and improved osteointegration when used in compromised bone such as osteoporotic bone and bone after radiotherapy. As PRP also enhances soft tissue mucosal and skin healing, it is used in connective tissue graft, palatal, gingival and mucosal grafts together with Alloderm for root coverage, skin graft donor and recipient site, dermal fat graft, face lifts, blepharoplasty, and laser resurfacing surgery. Because it is an autogenous preparation, PRP is inherently safe and free from concerns over transmissible diseases such as HIV, hepatitis, West Nile fever and Cructzfeld–Jacob disease (CJD). The PRP is activated to form PRP gel thus causing degranulation of a-granules present in the platelets and releasing growth factors. The various agents used for activation are $cacl_2$ alone,

$cacl_2$ plus bovine thrombin, human thrombin, autologous bone or whole blood which contains thrombin. Bovine thrombin was not utilized in our study since its use is associated with development of antibodies to clotting factors V, XI and thrombin, results in risk of life threatening coagulopathies.[1]

In our technique $cacl_2$ alone was mixed with PRP to form autologous platelet gel which was free from eliciting any antigen-antibody reaction as it was prepared from patient's own blood. In a study author stated that use of Ethylene Diamide Tetra-Acetic Acid (EDTA) as anticoagulant is not recommended because it fragments platelets. Citerate Phosphate Dextrose (CPD) is preferred and is the anticoagulant used by blood banks for platelet transfusions because it preserves the integrity of platelet membrane. The importance of this relates to the fact that growth factors are extruded from platelets during exocytosis. During this process, completion of protein molecule and formation of tertiary structure occur. Fragmented platelets may spill more growth factors into solution, providing for higher levels, but their tertiary structure is altered and therefore their activity and effectiveness is lessened.[2] On evaluating wound dehiscence, we found that PRP sites showed dehiscence in 1 (10%) out of 10 cases, NON-PRP sites 4 (40%) cases. This signifies a better soft tissue healing of extraction socket with PRP as compared to NON-PRP sockets. Our finding is supported by authors[3] who reported that soft tissue healing was significantly better in the cases where extraction sockets were treated with PRP. In another study the author[4] reported decreased rate of alveolar osteitis, objectively faster soft tissue flap healing and decreased swelling in the extraction sockets treated with PRP. Similarly, few other authors[5] also demonstrated the positive effect of PRP to enhance soft tissue healing in post rhytidectomy wounds as was evidenced by less edema and ecchymosis. In our study patients subjectively experienced lower levels of pain (VAS) at PRP treated sites. An average of 4.7 on day 2 and 1.2 at week 1 post-operative at the PRP treated sites and 6.0 on day 2 and 2.8 at week 1 post-operatively at NON-PRP sites. It was also noticed that there was slower rise and faster decrease in pain in PRP sites as against NON-PRP sites. Our observation is supported by a study in which the patients had subjectively lower level of pain on Visual Analog Scale of 1 to 10(VAS) with average of 3 at PRP site at 6 on the untreated side.[4] In our study patients experienced lower level of pain on verbal rating scale (VRS). A-no pain, B-some pain , C-moderate pain, D-strong pain, and E-very strong pain. The percentage scores of VRS preoperatively A- 100% for PRP group and NON-PRP group. The percentage of VRS scores at day 2 postoperatively were B-70% , C-70% for PRP group and B-10%, C-70% , D-20% for NON-PRP group . At 1 week post - operatively, A-50%, B-50% for PRP group and A-10% , B-70% and C-20% for NON-PRP group. Swelling reaches maximum about 36 hours after surgery and normally disappears within a week.[7] Hence in our study observation and recording were done on 2^{nd} and 7^{th} day postoperatively, we observed significant decrease in swelling 2^{nd} Post operatively day at the PRP sites, and swelling disappeared by 7^{th} day post operatively at both sites. In one case swelling was more on PRP site compared to NON-PRP site, which may be due to longer duration of operation since the traction on mucogingival flap during surgery is more severe during a long complicated operation than in easier one.[6] Our finding is supported by the author[3] who observed faster decrease of swelling at PRP site compared to NON-PRP site. Also in another study author[4] reported decreased rate of alveolar osteitis, objectively faster soft tissue flap healing and decreased swelling in the extraction sockets treated with PRP. In our study there was no occurrence of dry socket in any of the case as compared to study by an author[4] in which the overall rate of alveolar osteitis in the PRP treated site was 3.4 % (4 cases) versus the untreated site, which was 12. 8% (15 cases), representing an almost four fold increase. Significant difference were observed in the mean scores of radiographic density between PRP and NON-PRP groups at 3 weeks, 2 months, 4 months and 6 months postoperatively. No graft material was added to PRP in this study, in contrast to most others.[7,8] It is assumed that the combination of bone graft with PRP might have further improved the results of our study. The limitation of the present study was that the sample size was small and 6 months postoperative follow up is a short duration, as has been reported in the literature where a long term follow up of two to 5 years was done.

CONCLUSION

This study attempted the use of PRP as an adjunct to promote wound healing and osseous regeneration in human mandibular third molar extraction sites.

The present study clearly indicates a definite improvement in the soft tissue healing and faster

regeneration of bone after third molar surgery in cases treated with PRP as compared to the control group. This improvement in the wound healing, decrease in pain, swelling, dehiscence and increase in the bone density signifies and highlights the use of PRP, certainly as a valid method in inducing and accelerating soft and hard tissue regeneration. Moreover the preparation of PRP by collecting the blood in the immediate preoperative period avoids a time consuming visits to blood bank for the patient. An added benefit of PRP noted in the present study is its ability to form a biologic gel that provided clot stability and function as an adhesive.

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