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Original Research

Evaluation of plasma rich protein in the healing capacity of the third molar extraction sockets: a comparative study

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ABSTRACT

Introduction: Platelet-rich plasma (PRP) is an autologous concentration of human platelets in a small volume of plasma. Because it is a concentration of platelets, it is also a concentration of the 7 fundamental protein growth factors proved to be actively secreted by platelets to initiate all wound healing. The aims of this narrative review were: i) to describe the different uses of PRP in dental surgery and oral surgery; and ii) to discuss its efficacy, efficiency and risk/ benefit ratio. **Materials & Method:** Study sample included 30 patients requiring bilateral mandibular 3rd molars extraction, all patients underwent bilateral removal of 3rd molars and PRP that was prepared prior to start of the procedure was activated to form PRP gel which was placed into one of the extraction socket selected by the author. All patients were recalled on day 1, day 3, day 7, 2months, 3months, and 4 months, postoperatively for follow-up study. **Results**: There were 15 male subjects and 15 female subjects who had participated in the study. At 16 weeks: blending of bone seen in all 30 patients in both PRP (study) site & NONPRP (control) site. Trabecular bone formation also seen in all 30 patients in both the sites. Assessment of bone density (gray level value) at 16 weeks shows, the average gray scale value for PRP (study) site (136.9) was comparatively higher than NON PRP(control) site(113). **Conclusion**: The 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. This improvement in the wound healing, decrease in pain, 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. The procedure of PRP preparation is simple, cost effective and has demonstrated good results.

Key words: Plasma rich protein, third molar extraction, osseous regeneration.

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INTRODUCTION

Research in dental and oral surgery often involves materials and procedures which are capable of improving clinical outcomes in terms of percentages of success[1]. Platelet rich plasma (PRP) is a new approach to tissue regeneration: it is widely used in various surgical fields, including head and neck surgery, otolaryngology, cardiovascular surgery, and maxillofacial surgery. [2, 3]

PRP is a concentration of platelets in blood plasma. In a healthy human, average circulating platelet counts are approximately 200,000 platelets/μL. Clinically; PRP is typically administered at a severalfold increase over that baseline concentration.[4] The interest in concentrated platelets is derived from their early role in the normal healing response. Platelets contain more than 300 biologically active molecules which are released upon activation and subsequently influence the tissue regeneration process.[5]

Bone regenerative techniques including graft materials , protein & barrier membranes are often used to improve bone quality before or during these treatment. Many studies both invitro & invivo have disclosed the effectiveness of growth factors that can enhance cell proliferation, differentiation, chemotaxis, & extracellular matrix synthesis involved in healing of tissues, despite their potential usefulness animal derived or genetically engineered growth factors are currently not available for regenerative therapies because their safety has not yet been completely confirmed.[6]

Platelet-rich plasma (PRP) is an autologous concentration of human platelets in a small volume of plasma. Because it is a concentration of platelets, it is also a concentration of the 7 fundamental protein growth factors proved to be actively secreted by platelets to initiate all wound healing.[7] These growth factors include 3 isomers of platelet-derived growth factors (PDGFαα, PDGFββ, and PDGFαβ), 2 of the numerous transforming growth factors-β (TGFβ1 and TGFβ2), vascular endothelial growth factor, and epithelial growth factor. All these growth factors have been documented to exist in platelets.[8] The aims of this narrative review were: i) to describe the different uses of PRP in dental surgery and oral surgery; and ii) to discuss its efficacy, efficiency and risk/ benefit ratio.

METHODS

The present study was undertaken at the department Oral and Maxillofacial surgery, after obtaining ethical clearance. This study involved both male and female patients, who were referred to the department of oral and maxillofacial surgery for removal of mandibular 3rd molar.

After obtaining the complete history, patients were examined clinically and were explained about the procedure, its complications and the follow-up period involved in the study. The patients who were willing were enrolled for the study. Informed consent was taken.

Study sample included 30 patients requiring bilateral mandibular 3rd molars extraction, all patients underwent bilateral removal of 3rd molars and PRP that was prepared prior to start of the procedure was activated to form PRP gel which was placed into one of the extraction socket selected by the author.

All patients were recalled on day 1, day 3, day 7, 2months, 3months, and 4 months, postoperatively for follow-up study. Pain was evaluated using the Visual Analogue Scale.

IOPA radiographs were taken preoperatively at the end of 8th week, 12th week and 16th week postoperatively to assess and compare radiographic bone densities between PRP sites and Non PRP sites.

PREPARATION OF PRP GEL

Under all aseptic techniques, 10 ml of blood was drawn intravenously from the anticubital region of patients forearm using BD syringes(10ml).This was transferred to centrifugal vials containing 1ml of citrate phosphate dextrose anticoagulant The Vials were thoroughly shaken to ensure mixture of anti coagulant with the drawn blood. 10 ml autologous blood collected in Vial containing C.P.D.A. anticoagulant. The whole blood is then centrifuged at 2400 r.p.m. for 10 mins. The supernatant formed is platelet poor plasma and buffy coat. PPP and Buffy coat (upper1mm RB.C.) layer is collected in a fresh vial and again centrifuged at 3600 r.p.m.for 10 mins. The upper half of the supernatant is discarded and the lower half is mixed thoroughly to yield **PRP.**

The patient was asked to rinse the mouth with 0.2 % chlorhexidine for two minutes prior to start of the procedure; the face was prepared with betadine and was draped.

1. Anaesthesia: Bilateral inferior alveolar nerve block, lingual nerve block and long buccal nerveblock were administered using 2% lignocaine hydrochloride with 1: 80,000 adrenaline.

2. Bilateral Extraction: the 3rd molar tooth was luxated with the help of straight elevator and then extracted with molar forceps employing minimal forces. Similarly opposite side extraction was completed with minimum forces.

3. Wound Toilet: The surrounding bone was smoothened. The wound was gently irrigated with sterile saline solution and checked for any small detached fragments of bone or tooth pieces.

4. PRP placement: The pre processed PRP was taken into the sterile S.S.bowl and 0.5ml of CaCl2 was mixed to obtain the PRP gel, which was placed into the selected extraction socket.

Wound closure: wound was closed with 3-0 maersilk interrupted sutures. Pressure pack was given. Regular post extraction instructions were given.

RESULTS

The study consisted of totally 30 patients who visited the dental clinics of the Department of Oral and Maxillofacial Surgery. Following completion of clinical study on the patients, the measurements and data taken from all the patients were tabulated for statistical studies. After analysis of the data the following observations were made:

There were 15 male subjects and 15 female subjects who had participated in the study. The patients who had participated in the study were in the age range of 18 years to 45years, with a mean age of 27 years.

Assessment of pain:

Assessment of pain by Visual Analogue Scale on the first day showed mean pain score of 3.6 in study site and 4.3 in control site, on 3rd day mean pain score was 1.5 in study site and 1.7 in control site, on 7th day score was 0 in both study and control site, though pain was less in study site compared to control site, no statistically significant difference between study & control group at 1st day,3rd day & 7th day.

Assessment of soft tissue healing by healing index by Landry, Turnbell and Howley showed mean score on 1st day of 3.7 in study site, 2.7 in control site. On 3rd day 4.4 in study site,3.2 in control site on 7th day mean score of 5.0 in study site and 4.1 in control site, by doing repeated anova measure test for study and control group healing was better for study site compared to control site between 3rd day to 7th day(p value for 3rd day - 0.019 and 0.020 for 7th day),there was significant difference between the study & control sites in all the 10 patients**.**

Radiographic assessment at 8 weeks for bone margins blending seen in 21 patients in both study & control site. Macnamer chi-square test shows p value of 1.0. Trabecular bone formation seen in 8 patients at study site but absent in all the 30 patients at control site.

At 12 weeks: blending of bone margins seen in all the 27 patients in both study & control sites except in 3 patient it was seen in study site but absent in control site of that patient.

Trabecular bone formation seen in 27 patients in study site but only in 15 patients in control site, (p value - 0.054), there was significant difference between the PRP site and NON PRP site.

At 16 weeks: blending of bone seen in all 30 patients in both PRP (study) site & NONPRP (control) site. Trabecular bone formation also seen in all 30 patients in both the sites. Assessment of bone density (gray level value) at 16 weeks shows, the average gray scale value for PRP(study) site (136.9) was comparatively higher than NONPRP(control) site(113)

Table 1: assessment of pain using visual analogue scale

Period	Study	Control
1st day	3.6	4.3
3rd day	1.5	1.7
7th day	00	00

Table 2: assessment of post operative healing index

Period	Study	Control
1st day	3.7	2.7
3rd day	4.4	3.2
7th day	5.0	4.1

Table 3: assessment of bone density on psot operative radiographs

	Study	Control
Bone density	136.9	113

DISCUSSION

During the last decade, there have been several in vivo animal studies, which have used biological mediators such as polypeptide growth factors to expedite soft tissue and bony healing.TGF b1 and b2 have shown to inhibit bone resorption, osteoclast formation and activity, as well as to trigger rapid maturation of collagen in early wounds.[9]

Using PRP involves taking a sample of a patient's blood preoperatively, concentrating autologous platelets and applying the resultant gel to the surgical site. This technique produces a blood clot that has nearly a reverse ratio of red blood cells and platelets compared with a natural clot. Surgical sites enhanced with PRP have been shown to heal at two to three times that of normal surgical sites. Thus, PRP can be a great adjunct to many surgical procedures.[10]

The PRP is activated to form PRP gel thus causing degranulation of α-granules present in the platelets and releasing the growth factors. The various agents for the activation reported in literature include CaCl2 alone, CaCl2 plus bovine thrombin, Human Thrombin, autologous bone or whole blood which contains thrombin.

When PRP has been placed into bone defects without other grafting materials, the results are again nonconclusive. study from July 2000 to December 2000, the author showed a lower rate of alveolar osteitis, less pain, and more dense radiographic bone healing when PRP was placed into third molar extraction sockets.[10] However, in an yet another study the author found no enhanced bone formation when inferior border mandibular defects in dogs were treated with PRP.

On evaluating soft tissue healing, we found that PRP sites good healing.This signifies a better soft tissue healing of extraction sockets with PRP as compared to the NON-PRP sockets. Our finding is supported by the authors 24 who in their study reported that soft tissue healing was significantly better in the cases where the extraction sockets were treated with PRP. And also in another study the author11 reported decreased rate of alveolar osteitis, objectively faster soft tissue flap healing and decreased swelling in the extraction sockets treated with PRP.

At 16 weeks no difference between two sites,but on assessment of bone density (gray level value) shows,the average gray scale value for PRP(study) site was comparatively higher than NONPRP(control) site. Our results with regard to the enhanced soft tissue healing and increased rate of bone formation may be attributed to the above mentioned advantages that PRP possesses

No graft material was added to PRP in this study, in contrast to most others. It is assumed that the combination of bone grafts with PRP might have further improved the results of our study.

CONCLUSION

The 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. This improvement in the wound healing, decrease in pain, 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. The procedure of PRP preparation is simple, cost effective and has demonstrated good results.

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