Role of Platelet-Rich Plasma in Healing after Impacted Mandibular 3rd Molar Surgery

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Abstract:

Platelet-rich plasma (PRP), the concentrate of platelets in plasma contains various Growth factors that enhance osseous regeneration. This prospective study was conducted, to compare the role of Platelet rich plasma in healing after impacted mandibular 3rd molar surgery.

The study was performed by a single operator, all the patients underwent bilateral removal of mandibular 3rd molars and PRP that was prepared prior to start of the surgical procedure was placed into one of the extraction socket randomly selected by the author and the other side used as control. Clinical parameters like hypersensitivity reactions, pain, swelling, soft tissue healing, and dry socket were assessed. The bone fill and radiographic bone density were evaluated simultaneously. All the patients were followed up after the 1stday, 2ndday, 1week, 3-week, 2 months, 4months and after 6 months post operatively.

Soft tissue healing differed significantly between PRP and NON-PRP sites.

On radiographic evaluation significant differences were observed in the mean scores of radiographic density between PRP and NON-PRP sites on Photo Stimulating Phosphor (PSP) images and IOPA Radiographs.

It was concluded that PRP contributed to better healing of soft tissues and bone and is a visible means of growth factory delivery. However, further studies are needed to substantiate our findings. It is the need of the hour for more controlled and scientific models, to assess the ultimate efficacy of PRP.

Key Words: Platelet-rich Plasma, Impacted 3rd molar surgery.

Introduction:

It is well known that platelets have many functions beyond that of hemostasis. Platelets contain important growth factors that, when secreted, are responsible for increasing cell mitosis, increasing collagen production, recruiting other cells to the site of injury, initiating vascular in-growth, and inducing cell differentiation. These are all crucial steps in early wound healing. Using the concept that if a few are good, then a lot may be better, increasing the concentration of platelets at a wound may promote more rapid healing. It seems very logical that increasing the concentration of platelets in a bone graft, and therefore increasing the concentration of growth factors, may lead to a more rapid and denser regenerate.[1]

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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. 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. Because these concentrated platelets are suspended in a small volume of plasma, PRP is more than just a platelets concentrate; it also contains the 3 proteins in blood known to act as cell adhesion molecules for osteoconduction and as a matrix for bone, connective tissue, and epithelial migration. These cell adhesion molecules are fibrin itself, fibronectin and vitronectin.[2]

Platelet-rich plasma (PRP) was first introduced to the oral surgery community by authors in their 1997 article entitled "platelet gel; an autologous alternative to fibrin glue with applications in oral and maxillofacial surgery." The authors thought that "through activation of the platelets within the gel and the resultant release of growth factors, enhanced wound healing should be expected." PRP enjoyed a great increase in popularity

in the oral and maxillofacial surgery community after the publication of a landmark article by author in 1998, author's study showed that combining PRP with autogenous bone in a mandibular continuity defects resulted in significantly faster radiographic maturation and a histomorphometrically denser bone regenerate. It certainly seemed as though a new age in bone grafting had begun.[1]

Material and Methods:

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

Inclusion criteria:

1. Patients age between 17-35 years having bilateral impacted mandibular 3rd molars. Absence of pericoronitis, periapical infection or lesions with respect to impacted 3rd molars, Absence of opposing traumatic occlusion or impinging upper 3rd molars.
2. Patients who are non-smokers ,non-alcoholics and without any systemic diseases.
3. Female patients not on use of oral contraceptives.

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 and Intra oral periapical radiographs and Panoromic radiographs were taken

All patients signed an informed consent before participating in the study which was reviewed and approved by the ethical committee of our institute.

Study sample included 20 impacted mandibular 3rd molars from 10 patients, all patients underwent bilateral removal of impacted 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 randomly selected by the author.

Patients were recalled on day 1, day 2, day 7, 3 weeks, 2 months, 4months, and 6 months postoperatively for follow-up study.

Clinical Evaluation:

Clinical evaluation included assessment of hypersensitivity reactions, pain, swelling, soft tissue healing and dry socket.

Panoromic Radiography:

All panoramic radiographs of the selected patients were made using ORTHOSLICE 1000 TROPHY, France, and Panoromic Machine with exposure modes of 65 kvp, and 8 mA with a Photo Stimulating Phosphor (PSP) image receptor.

The exposed Photo Stimulating Phosphor (PSP) image receptor or plates were scanned by using OREX COMBIX-2000 scanner and a DIGIDENT software programme (ver.2).

The images were viewed on the monitor; contrast and brightness were adjusted to enhance the image quality. The first postoperative radiographic image parameters were standardized and recorded for each patient and the same were applied for subsequent radiographs taken at 2months, 4months and 6 months post-operatively.

The radiographic bone density was measured using DENT-A-VIEW Software at three regions-the alveolar crest, the furcation level and apical regions of the surgically removed impacted mandibular 3rd molar sites bilaterally.

The data were recorded and stored for statistical analysis.

PREPARATION OF PRP GEL [3-7]

Under all aseptic techniques, 12 ml of blood was drawn intravenously from the anticubital region of patients forearm using vacutainer needle and BD Vacutainers (each 4 ml) containing CPDA (0.8ml each). The Vacutainers were thoroughly shaken to ensure mixture of anti coagulant with the drawn blood. 12 ml autologous blood collected in Vacutainer containing C.P.D.A. anti-coagulant. The whole blood is then centrifuged at 2400 r.p.m. for 10 mins. The supernatant formed was platelet poor plasma and buffy coat

PPP and Buffy coat (upper1mm RB.C.) layer was collected in a fresh vacutainer and again centrifuged at 3600 r.p.m.for 10 mins. The upper half of the supernatant was discarded and the lower half was mixed thoroughly to yield PRP (fig1 to 9).

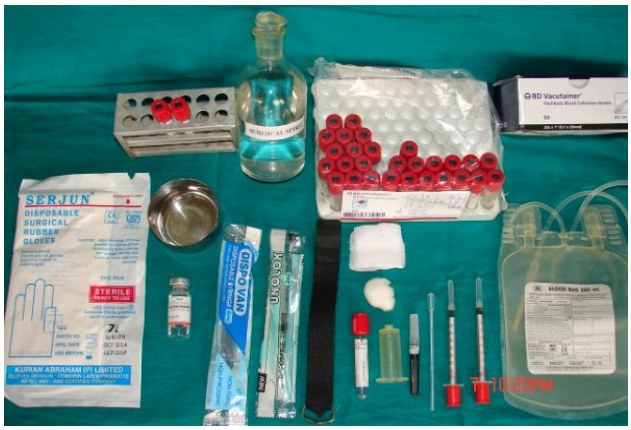


Fig.1: Armamentarium for PRP.

Fig.2: Centrifugation machine.


Fig.3: Drawn blood

Surgical Technique:

Inferior alveolar nerve block, lingual nerve block and long buccal nerveblock were administered using 2% lignocaine hydrochloride with 1: 80,000 adrenaline, standard Ward's incision was followed in all the cases. Full thickness mucoperiosteal flap was raised to expose sufficient bone on lateral and distal aspect of the impacted molar. Removal of bone was done with carbide bur. Constant irrigation was done with normal saline while removing bone to prevent thermal necrosis.

Fig.4: Separating plasma and buffy coat.

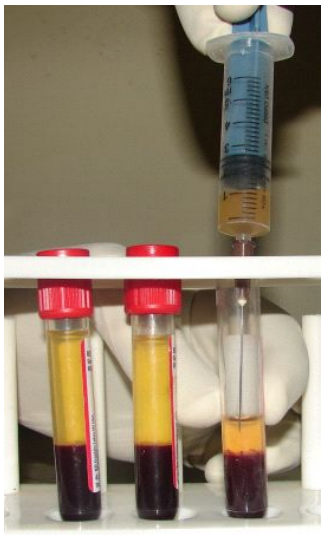


Fig.5: After first spin of centrifugation.

Surgical removal of impacted tooth were done. 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. Surgical removal of impacted mandibular 3rd molar was done on the opposite side in the similar way and one of the extraction socket was randomly chosen by the operator for PRP placement.

PRP placement: The pre processed PRP was taken into the sterile S.S.bowl and 0.5ml of $CaCl_2$ was mixed to obtain the PRP gel, which was placed into the selected extraction socket and primary closure of the wound was done (fig 7,8,9). No graft material was added to PRP in this study, in contrast to most others. [3, 8] It is assumed that the combination of bone grafts with PRP might have further improved the result of our study. Wound was closed with 3-0 black braided

silk interrupted sutures. Pressure pack was given.Regular post extraction instructions were given.

Medication prescription Tab. Amox 500 mg/ TID X 5 days , Tab. Imol 500 mg/TID X 3 days , Clorhexidine mouthwash gargle QID.

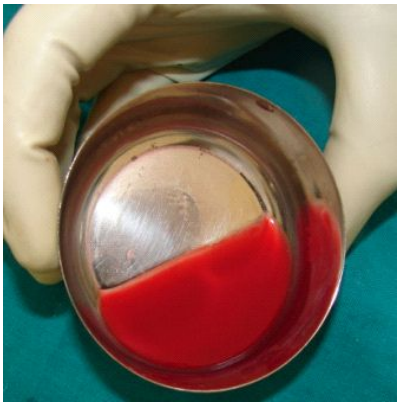


Fig.6: PRP gel.

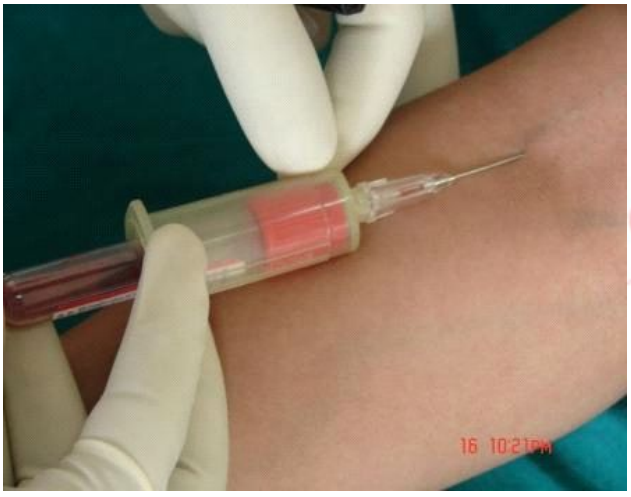


Fig.7: Drawing blood from patient.

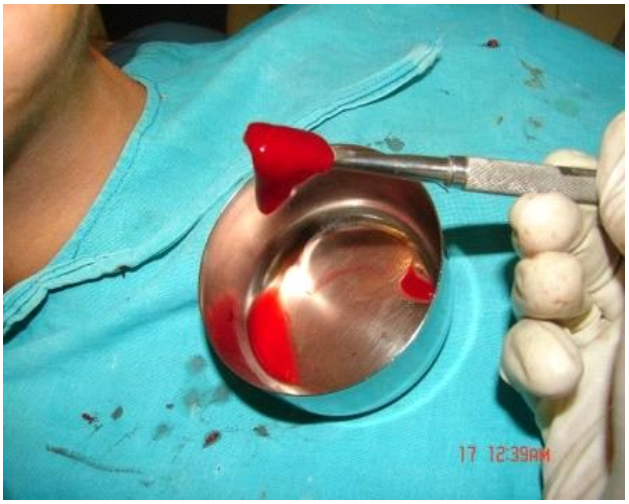
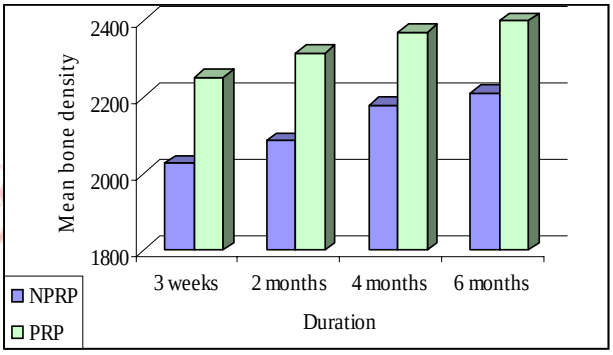


Fig.8: PRP gel to be placed in tooth socket.

Fig.9: PRP gel placed at surgical site.

Results:

Graph 1: Mean Bone density values at 3weeks, 2months, 4months and 6months for PRP sites and NON-PRP sites on OPG



Significant differences were observed in the mean scores of bone density over OPG and IOPARs between PRP and NON-PRP groups at 3 weeks, 2months, 4months, and 6months postoperatively.

Discussion:

The mean values of bone density for PRP groups were significantly higher as compared to NON-PRP groups.

In the present study the mean radiographic bone density at the post extraction sockets was calculated using DIGIDENT software programme (ver.2) after exposures made using a Photo Stimulating Phosphor (PSP) image receptor at 3weeks, 2months, 4months, and 6months post-operatively.

These results in regard to the increased rate of bone formation may be attributed to the advantages that PRP possesses Which include, Safety- eliminates risks of clerical errors (no risk of using another patient's blood by mistake) Safety- uses

autologous source rather than homologous, Convenience for patient- no visit to blood bank necessary ,Improved support for tissue healing ,More rapid mineralization of collagen in bone repair and graft sites, Earlier stability of grafts , More patients are eligible for the procedures because the criteria for blood bank donations does not have to be met , Cytokines and growth factors are brought to the site in a manner that would not occur with fibrin glue , Formation of a firm nonfriable clot , Thrombin causes cleavage of fibrinopeptides A and B from the fibrinogen molecule, which results in the formation of fibrin monomers , Thrombin also activates factor XIII that in turn allow for a stable fibrin cross-linkage in the presence of ionized calcium, No potential for disease transmission when using autologous blood , Less thrombogenic than untreated graft material or grafts pretreated with blood, Minimal adhesion formation-resolves in 4-6 months.

Positive Effects of Platelet Gel:

"Jump-starts" the cascade of osteogenesis in a bone graft, Promotes early consolidation of the graft, Speeds up mineralization of the graft, Improves trabecular bone density, Allows placement of implants into the graft at an earlier time, Provides earlier availability of growth factors and BMP, Enhances osteoconduction [9].

The limitation of the present study was that the sample size was small consisting of 20 impacted teeth from 10 patients and 6 month post operative follow up is a short duration , as has been reported in the literature where a long term follow up of 2-5 years has been done.

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. 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 visit 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. The procedure of PRP preparation is simple, cost effective and has demonstrated good results.

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