Research Article

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A Beneficial Tool to Reduce Post-Operative Complications and Aid in Tissue Healing after Surgical Extraction of Impacted Third Molars

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ABSTRACT

Aims: The present study done to evaluate the efficacy of autologous Platelet Rich Plasma in bone regeneration and periodontal healing distal to 2nd molars after surgical extraction of impacted mandibular third molars.

Material and Method: Study sample included 10 patients who underwent bilateral surgical extraction of 3rd molars. PRP was placed into extraction socket considered as study site and the other taken as control site. In the post-operative period, pain, swelling and periodontal healing distal to 2nd molar was assessed. Bone density at the extraction sockets evaluated for 6months and compared radiographically using gray scale histogram.

Results: Significant bone regeneration and periodontal healing were noted at the PRP site. Post-operative swelling and pain were comparatively less at the PRP site.

Conclusion: In the present study, PRP has added benefit of both reduced post-operative discomfort, soft and hard tissue healing without any postoperative complications.

Keywords: Third molar, Platelet rich plasma, Bone regeneration, Growth factors.

INTRODUCTION

Platelet-rich plasma (PRP) has recently been found to be a useful delivery system for growth factors important in oral and maxillofacial surgery [1]. Platelets play a very important role in wound healing because they promote the initial coagulation and also release various wound healing growth factors. These growth factors are responsible for increasing cell mitosis, collagen production, recruiting cells to the site of injury, initiating vascular in-growth, and inducing cell differentiation [2].

Platelet-rich plasma forms a source of various growth factors that is obtained by sequestering and concentrating freshly drawn venous blood. Using the concept that ***"if a few are good, then a lot may be better"*** increased concentration of platelets at a wound promotes more rapid and better healing. Oral implants, maxillofacial reconstruction, regenerative periodontal procedures are highly dependent on successful bone regeneration. Different graft materials, protein & barrier membranes are often used in bone regenerative techniques to improve bone quality. Studies of both in-vitro & in-vivo have disclosed the effectiveness of growth factors that can enhance cell proliferation, differentiation, chemo-taxis, & extracellular matrix synthesis involved in healing of tissues, despite their potential usefulness of animal derived or genetically

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Fig 1: Pre-operative intraoral photograph of bilateral mesioangular impacted mandibular third molars.

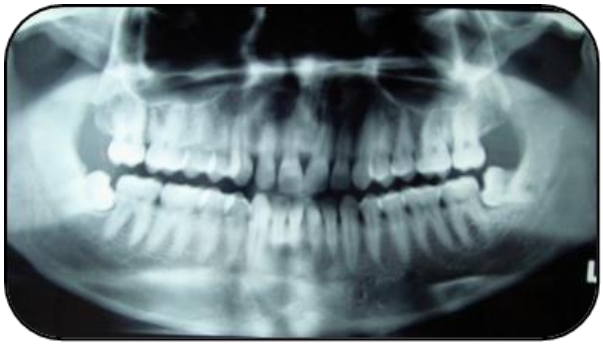


Fig 2: Pre-operative OPG showing bilateral impacted mandibular third molars.

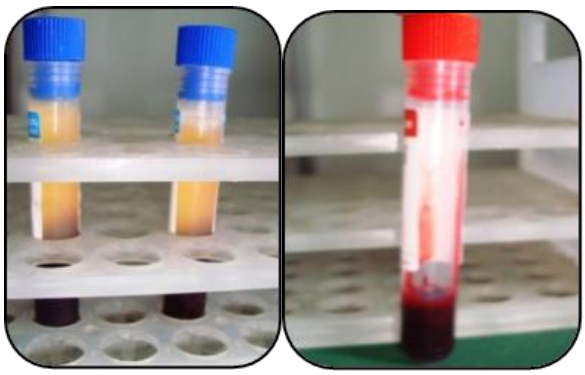


Fig 3: Centrifugation of blood and separation of PRP.

engineered growth factors which are currently not available for regenerative therapies because their safety has not yet been confirmed.

Third molar extractions are often used as a measurement tool for comparing treatments because they are usually performed electively on a younger population that do not present with multiple confounding factors (eg, systemic pathologies, multiple medications) [34]. The

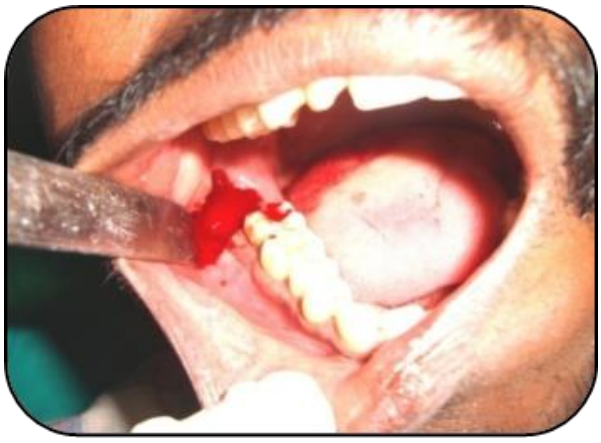


Fig 4: PRP placed in the extraction socket of 48.

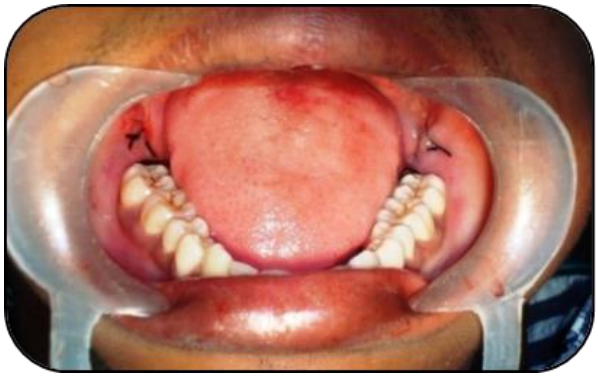
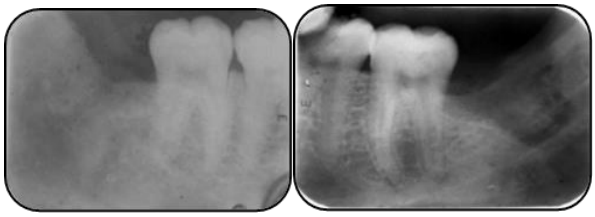
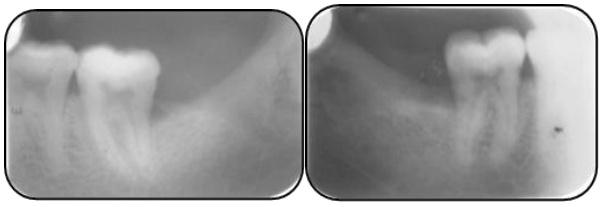


Fig 5: Wound closure.



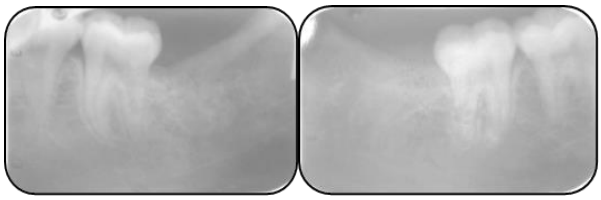
Non PRP Site PRP Site

Fig 6: Radiographs {IOPAs} at 1st month post-operatively.



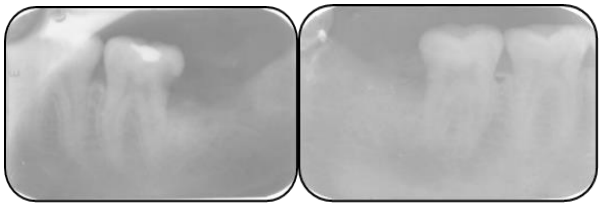
Non PRP Site PRP Site

Fig 7: 2nd month post-operatively.



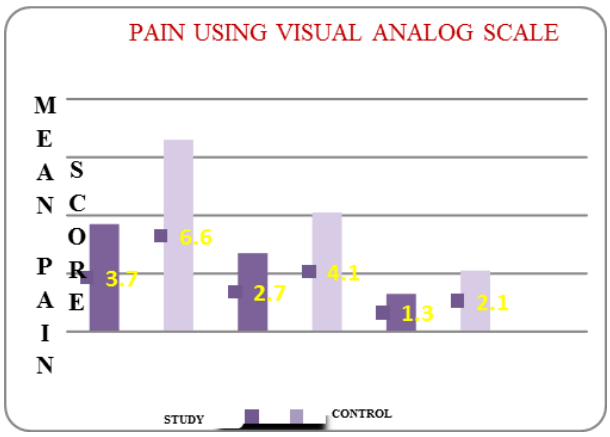
Non PRP Site PRP Site

Fig 8: 3rd month post-operatively.

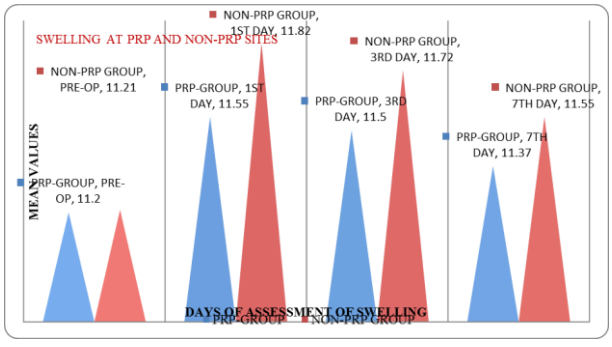


Non PRP Site PRP Site

Fig 9: 4th month post-operatively.

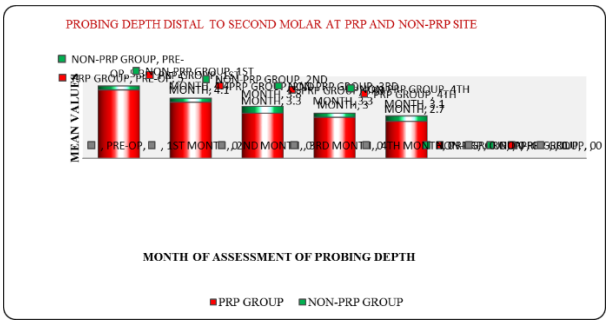


Graph 1: Comparison of pain using VAS at PRP and NON-PRP site.

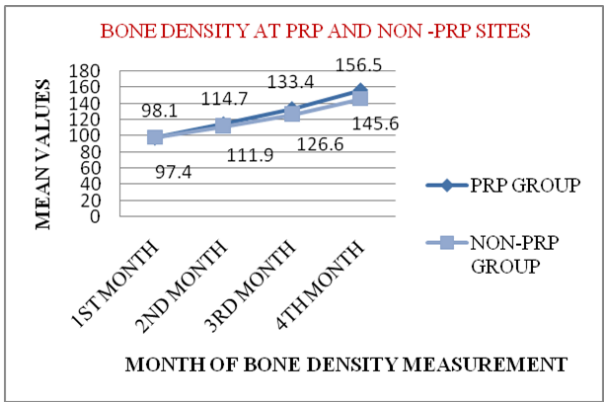


Graph 2: Comparison of swelling at PRP and NON-PRP site.

impaction surgery done for the removal of the third molars presents itself with a variety of factors, which are uncomfortable to the patient. Pain,



Graph 3: Comparison of periodontal probing depth at PRP and NON-PRP site.



Graph 4: Comparison of bone density mean values of gray level histogram in PRP and NON-PRP group.

swelling, trismus, infection, bone loss, pocket formation distal to the second molar being a few factors [35]. The 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 [33]. If PRP supports a faster and denser bone graft, oral and maxillofacial reconstructive surgery would be taken up to a new level [2]. Quick and easy preparation of PRP gives the possibility of its big bio-potential to be used for the improvement of the clinical results in a lot of surgical procedures.

Keeping in view of the above findings of research on PRP, the present study was planned on 10 patients to evaluate and compare the efficacy of PRP in bone regeneration after removal of bilateral impacted mandibular third molars.

MATERIALS AND METHODS

The present study was undertaken at the Department of Oral and Maxillofacial surgery, Government Dental College and Hospital,

Hyderabad after obtaining ethical clearance. This study involved a total of 10 patients, both male and female, who were referred to the Department of Oral and Maxillofacial Surgery for the surgical extraction of bilateral impacted mandibular 3rd molar at the same appointment considering one side as PRP site and other as NON-PRP site as shown in fig.1&2. Patients with systemic diseases, compromised immune system, platelet count less than 1,50,000/mm^3 allergies and hypersensitivity to drugs, antibiotics, anti-inflammatory drugs, under cortisone medication were excluded from the study. Routine investigations were done. The patients who were willing were enrolled for the study and informed consent taken.

Preparation of PRP prior to the procedure:

Under aseptic techniques, 10 ml of venous blood was drawn from the Antecubital region of patient's forearm using 10 ml disposable syringe. This was transferred to two 5ml test tubes containing 1ml of citrate phosphate dextrose adenine anticoagulant .The Vials were shaken to ensure mixture of anti-coagulant with the drawn blood. 10ml autologous blood was collected in two 5ml syringes containing C.P.D.A. anti-coagulant. The whole blood was then centrifuged at 1200 rpm for 15 min as shown in figure 3. Platelet Poor Plasma and Buffy coat layer was discarded using a syringe having 18 guage spinal needle. The 3mm of plasma layer along with 2mm of RBC was collected to yield PRP. Surgical extraction of bilaterally impacted mesioangular mandibular molars was done by single operator under local anesthesia. The pre-processed PRP present in the sterile disposable test tube was mixed with 0.5ml of $CaCl_2$ to obtain the PRP gel [36], which was placed into the selected extraction socket i.e.,48 extraction socket as shown in fig.4. The other socket i.e., 38 left empty considering it as NON-PRP site. Wound closure done in fig.5. Routine post-operative instructions were given to all the patients after the surgical extraction of bilateral impacted mandibular 3rd molars.

All the patients were assessed and compared for post-operative swelling and pain on 1st, 3rd and 7th post-operative days. Pain was measured using visual analog scale. Bone density was assessed and compared in IOPAs and mean gray scale histogram values obtained at PRP and NON-PRP sites after 1st, 2nd, 3rd and 4th months shown in figures 6, 7, 8, 9. IOPAs of extraction sockets were scanned and obtained through Adope Photoshop 7.0 software. Measurements for pocket depth were made using a William's periodontal probe in 3 different positions for all the mandibular second molars (distobuccal, distal, distolingual). Pocket depth was assessed post-operatively after 1st, 2nd, 3rd and 4th months so as not to interfere with the healing of the treated sites.

RESULTS

Out of 10 subjects, two were females and eight were males. The age of the subjects ranged from 19 years to 35 years with mean age of 24.6 yrs for males and 22.5 yrs for females. Bilateral mesioangular mandibular third molar impaction surgery was carried out and the extraction socket on right side was grafted with PRP and left side socket left empty. Left side was taken as control group. The results were evaluated and compared based on clinical assessment, radiographic analysis and densitometric values by gray level histogram. All the results were obtained using the mean value and standard deviation for each of the parameters taken and checked for statistical significance.

Pain was less at PRP site when compared to NON-PRP site, by doing two independent sample student t-test. Statistically significant difference {P>0.5 at 1st post-operative day} {P>0.1 at 7th post-operative day} between PRP and NON-PRP groups were observed at 1st& 7th post-operative days in Graph 1. The pre-operative and post-operative values for swelling were taken using anatomical landmarks considering four points and measuring horizontal and vertical distances. Though mean values for post-operative swelling were less at PRP site, there was no statistical difference at PRP and NON-PRP sites in Graph 2.

There was a difference in the mean probing depth distal to 2nd molar at PRP site when compared to NON-PRP site. Statistically significant difference i.e., {P>.01} was observed after 2nd post-operative month in Graph 3. The mean gray level values showing greater bone density at PRP sites, after 4th month the mean gray level value at PRP site was 156.5 and at NON-PRP site was 145.6, showing statistically significant difference in gray level

values {P>.05 level} at PRP and NON-PRP sites in Graph 4.

DISCUSSION

Immediately following tooth removal, a healing process begins that affects the eventual alveolar bone volume and architecture of the alveolar ridge. Satisfactory and timely healing are essential to obtain ideal functional reconstruction. Traumatic removal of a tooth, or a poor healing response, may lead to excessive bone loss delaying tooth replacement, necessitate expensive and time-consuming reconstructive surgeries, or even be impossible to correct. Patients and clinicians could benefit if a cost-effective, simple technique were available that decreased bone-healing time and increased the predictability of favorable results [34].

One of the most recent and innovative bone regenerative techniques is the use of PRP [2]. Platelet-rich plasma is an emerging biotechnology in current tissue engineering and cellular therapy. Acceleration of bone growth and soft tissue healing has been well documented in the literature. PRP from autologous blood yields a product that is safe and free from transmissible diseases. With proper preparation, large number of platelets are activated producing high concentration of growth factors which stimulate soft tissue growth, osteogenesis and angiogenesis [3].

The positive effects of PRP on tissue regeneration, a increasing number of human clinical studies have detailed the use of growth factors in reconstructive oral and maxillofacial surgery [4,5] , periodontology [6,7,8], implantology [9,10], pre-prosthetic surgeries [8,10], sinus grafting [10], distraction osteogenesis [11,12] alveolar bone grafting [13] and plastic surgery [14]. There are various methods of PRP preparation from autologous blood. Techniques vary from using 10cc of blood in a clinical laboratory centrifuge [9,14,15,16,17] to using a unit (250–450cc) of whole blood by putting in the cell separator which concentrate the platelets 18,5,8]. Any procedure developed to concentrate platelets should show a sufficiently high concentration of platelets to affect a clinical outcome and demonstrate high percentage of growth factor [5,15]. In this study PRP was prepared from 10cc of patient's blood and centrifuged in a digital centrifuge.

PRP when activated to form gel causes degranulation of alpha granules in the platelets releasing the growth factors. PRP can be activated with calcium chloride alone [18], calcium chloride along with bovine thrombin [19,20,21], human thrombin, autologous bone or autologous blood containing thrombin [15], TRAP (Thrombin Receptor Activator Peptide) [19,22]. The technique adopted in the present study uses $CaCl_2$ alone with PRP to form an autologous platelet gel. This platelet gel was free of eliciting any antigen-antibody reaction as it was prepared from patient's own blood. Bovine thrombin was not utilized in this study since it is associated with the development of antibodies to clotting factors V, XI, and thrombin, resulting in risk of life threatening coagulopathies [23].

Studies [18,24] stated that the use of EDTA is potentially more harmful than citrate. Although EDTA yields greater number of platelets, they appeared damaged by EDTA [18] causing fragmentation of platelets. Hence CPDA anticoagulant solution was used in the study as it maintains and preserves platelet membrane integrity [16]. The importance of this relates to the fact that growth factors were extruded from platelets during exocytosis. During this process, completion of protein molecule and formation of the tertiary structure occur. Fragmented platelets may spill more growth factors into solution, but their tertiary structure is altered and therefore their activity and effectiveness are lowered [5,25].

THE POSITIVE EFFECTS OF PRP [5,26,27,28]

Jump starts' the cascade of osteogenesis in bone graft.
Improves trabecular bone density.
Earlier availability of growth factors and BMP.
Early consolidation of the graft.
Hastens the mineralization of the graft.
Placement of implants into the graft at an earlier time.
Enhances osteoconduction.

In the present study PRP was placed in the surgically removed impacted mesioangular mandibular third molar extraction sockets. Result

with regard to the enhanced soft tissue healing and increased rate of bone formation may be due to the advantages of PRP mentioned above. No graft material was added to PRP in this study as in other studies [5,8, 9]. Visual analogue scale was used to assess pain on 1st, 3rd and 7th post-operative days. Probably the main responsible reason which reduces the pain perceived by the patients is that PRP allows a reduction in the percentage of Prostaglandins release such as PG_2 [24]. The facial swelling was assessed using anatomical landmarks [29] at PRP and NON-PRP sites. No significant difference was noticed which is in accordance with the study [16].

The better condition wound healing can be experienced in a better periodontal healing. The mean periodontal probing depth distal to second molar showed a significantly greater reduction at PRP site compared to NON-PRP site similar to the study [30]. Another study[7] observed that probing depth reduction was greater after 3months post-operatively. Bone density assessment showed a significant increase in mean gray level histogram values after 4th month post-operative period at PRP site similar to a study [31]. Other study [32] found an increased bone density at 3rd and 6th post-operative period at PRP site.

The present study also reveals decreased levels of pain, swelling in the immediate post-operative period and better periodontal healing and bone regeneration at the PRP site indicating that PRP certainly as a valid method in inducing and accelerating soft and hard tissue regeneration. An added benefit of PRP is its ability to form a biologic gel that provided clot stability and functions as an adhesive [33]

CONCLUSION

In this study autologous PRP was used as a beneficial tool to promote periodontal healing and osseous regeneration in human mandibular impacted third molar extraction sites. It clearly indicates a definite improvement in the reduction of probing depth 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.

An added benefit of PRP noted in this present study was its ability to form a biologic gel that provided clot stability and functioned as an adhesive. The procedure of PRP preparation is simple, cost effective and had demonstrated positive result in the healing of soft and hard tissues at both immediate and late post-operative period. However, further studies may be conducted on large sample with long term follow-up period along with histological study to have better evaluation of results with PRP usage.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

REFERENCES

1. Duretti Fufa, Blake Shealy, May Jacobson, Sherwin Kevy, Martha M. Murray, Activation of platelet-rich plasma using soluble type 1 collagen, Journal of oral and maxillofacial surgery, 66,4,684-690, 2008.

2. Earl G. Freymiller, and Tara L. Aghaloo, Platelet-rich plasma, Ready or not?, j oral maxillofacial surg, 62,484-488, 2004.

3. Carol A. Jameson, Autologous platelet concentrate for the production Of platelet gel, 38,1 lab medicine, cp, mt (ascp)sbb, 2007.

4. A.Dugrillon, H.Eichler, S.Kern and H.Kluter, Autologous concentrated platelet rich plasma (cPRP) for local application in bone regeneration, Int.J.Oral Maxillofac.Surg, 31, 615-619, 2002.

5. Robert E. Marx, Eric R. Carlson, Ralph M.Eichstaedt, Steven R.Schimmele, James E.Strauss, Platelet-Rich Plasma, Growth Factor Enhancement for bone grafts, Oral Surg Oral Med Oral Pathol Oral Radiol Endod, 85,638-46, 1998.

6. Yeltiwar RK, Vaishnav N, Autologous platelet concentrate gel And freeze dried bone allograft (FDBA)-is it a miracle mix for Regenerative

periodontics, J ind soc Periodontol, 9,78–84, 2005.

7. Gilberto Sammartino, Mariano Tia, Gaetano Marenzi,Alessandro Espedito di Lauro, Elio D'Agostino ,Use of Autologous Platelet-Rich Plasma (PRP) in Periodontal Defect Treatment After Extraction of Impacted Mandibular Third Molars, J Oral Maxillofacial Surg, 63,766-770, 2005.

8. James D. Kassolis, Paul S.Rosen, and Mark A., Reynolds Alveolar Ridge and Sinus Augmentation Utilizing Platelet-Rich Plasma in Combination with Freeze-Dried Bone Allograft, Case Series, J Peridontol; 71, 1654-1661, 2000.

9. Anitua E, Plasma rich in growth Factors, preliminary results of use in the preparation of future site for Implants, Int j oral maxillofacImplants 14,4, 529–535,1999.

10. Shana man R, Filstein MR, Danesh-Meyer MJ, Localized ridge Augmentation using GBR and platelet Rich plasma, case reports, Int j Periodotics restorative dent, 21,4,345–355,2001.

11. M.Robiony, F.Polini, and M.Politi, Osteogenesis Distraction and Platelet-rich Plasma for Bone Reconstruction of the Severely Atrophic Mandible, Preliminary Results, J Oral Maxillofacial Surg, 60,630-635, 2002.

12. Thor A, Warfvinge G, Fernandes R, The course of a long standing Glandular odontogenic cyst, marginal Resection and reconstruction with Particulated bone graft, platelet rich Plasma, and additional vertical Alveolar distraction, J Oral Maxillofac Surg. 64,7,1121–1128, 2006.

13. Tomoki Oyama, Soh Nishimoto, Tomoe Tsugawa, and Fumiaki Shimizu, Efficacy of Platelet-Rich Plasma in Alveolar Bone Grafting, J Oral MaxillofacSurg, 62,555-558, 2004.

14. Daniel Man, Harvey Plosker, and Jill E. Winland-Brown, The Use of Platelet rich Plasma (Platelet Gel) and Autologous Platelet-Poor Plasma (Fibrin Glue) in Cosmetic Surgery, Plast. Reconstr. Surg, 107,229, 2001.

15. Gonshor A, Technique for producing platelet-rich plasma and Platelet concentrate, background and Process, Int j periodontics restorative Dent ,22,6,547–557, 2002.

16. Simon D, Manuel S, Geetha V, Naik BR, Potential for osseous Regeneration of platelet rich plasma- a Comparative study in mandibular third molar sockets, Indian j dent res,15,4,133–136,2004.

17. Sonnleitner D, Huemer P, Sulliva DY, Producing platelet rich plasma and Platelet concentrate for intraoral bone Grafting techniques: a technical note, A simplified technique, Intjoralmaxillofacial\implants: 15,6,879- 882, 2002.

18. Landesberg R, Roy M, Glickman RS, Quantification of growth Factors levels using a simplified Method of platelet rich plasma gel Preparation, J oral maxillofacial surg, 58,3,297–300, 2000.

19. Tsay RC, VO J, Burke A, Eisig SB, Luhh, Landesberg R, Growth factor retention by platelet Rich plasma: J oral maxillofacial surg, 63,4, 521–528, 2005.

20. Marx R, Garg A, Dental and Craniofacial applications of platelet Rich plasma, Quintessence publishing Co, inc., 2005

21. Lynch S, Genco R, Marx Re, Chapter 4, platelet rich plasma: a Source of multiple autologous growth Factors for bone grafts.Tissue Engineering- applications in maxillofacial surgery and Periodontics, Quintessence Publications co, inc 71–82, 1999.

22. Landesberg R, Burke A, Pinsky D, Katz R et al, Activation of platelet Rich plasma using thrombin receptor Agonist peptide, J oral maxillofacial Surg,63,4,529–535, 2005.

23. Dean H. Whitman, Ronald L Berry and David M Green, Platelet gel: an autologous alternative to fibrin glue with applications in oral & maxillofacial Surgery. Oral & maxillofacial surg, 55,11,1294-1299, 1997.

24. Mancuso JD:Platelet Rich Plasma: A Preliminary Report in Routine Impacted

Mandibular Third Molar Surgery and the Prevention of Alveolar Osteitis, J Oral Maxillofacial Surg, 61,40,(supple), 2003

25. Http://www.seattle-implants.com/articles/platelet.htm.

26. Tischler M, Platelet rich Plasma: The use of autologous growth Factors to enhance bone and soft Tissue grafts, N y state dent j, 68,3, 22–24, 2002.

27. Damante JH, Da S Guerra EN, Ferreria Jr O, Spontaneous resolution of Simple bone cyst, DentomaxillofacRadiol: 31,3,182–186, 2002.

28. R.F. Elgazzar, M.A. Mutabagani, S.E. Abdelaal, A.A. Sadakah, Platelet rich plasma may enhance peripheral nerve regeneration after cyanoacrylate reanastomosis: A controlled blind study on rats, International journal of oral & maxillofacial surgery, 37,8,748-755, 2008.

29. Hidemichi Yuasa, Masayuki Sugiura, Clinical post-operative findings after removal of impacted mandibular third molars, Prediction of post-operative facial swelling and pain based on pre-operative variables, BJOMS, 42,209-214, 2004.

30. Mozzati, Scoletta, Gallarato, Clinical application of autologous Platelet rich plasma (p.r.p.) in the Extraction of third impacted Mandibular molar, Revista Românå De Stomatologie – Vol. Liii, Nr. 2, 2007.

31. Vivek GK, Sripathi Rao BH, Potential for osseous regeneration of platelet rich plasma: a comparative study in mandibular third molar sockets,J Maxillofacial Oral Surg, 8, 4,308–31, 2009.

32. Pushkar D. Gawande, Rajshekhar Halli , Efficacy of platelet rich plasma in bone regeneration after surgical removal of impacted bilateral mandibular third molars: pilot study, J Maxillofacial Oral Surg, 8,4,301–307, 2009.

33. James L. Rutkowski, David A. Johnson etal, Platelet Rich Plasma to Facilitate Wound Healing Following Tooth Extraction; Journal of Oral Implantology, Vol. XXXVI/No. One/2010, 11-23, 2011.

34. Shubha Ranjan Dutta, Purnima Singh, etal, Mandibular Third Molar Extraction Wound Healing With and Without Platelet Rich Plasma: A Comparative Prospective Study, Journal of Maxillofacial Oral Surgery, (July–Sept), 14(3), 808–815, 2015.

35. Joy R. Das, P. Sreejith Valiya Parambath etal, Efficacy of Platelet Rich Plasma in Third Molar Impaction Surgery, PRP in Third Molar Surgery, Universal Research Journal of Dentistry, Vol 4 · Issue 1, January-April 2016.

36. Ben W. Eby, Platelet rich plasma, Harvesting with a single spin centrifuge, Journal of oral implantology, Vol.xxviiiiii/No.6/ 297-301, 2002.