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CASE REPORT

SOCKET AUGMENTATION WITH PLATELET RICH FIBRIN AND FREEZE DRIED BONE GRANULES AND REHABILITATION WITH PROSTHESIS - A CASE REPORT

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ABSTRACT:
Reconstructive dental surgeons are constantly looking for an "edge" that jumps start the healing process to maximize predictability as well as the volume of regenerated bone. Significant resorption of the alveolar ridge occurs after tooth extraction. According to the Osteology Consensus Group 2011, ridge preservation is a general term for interventions that aim to "preserve the ridge volume within the envelop existing at the time of extraction". Platelet rich plasma concentrates are blood-derived products used for prevention and treatment of haemorrhages due to serious thrombopenia of central origin, such as medullary aplasia, acute leukaemia, etc. The clinical experience confirms it that it can be very much used as a healing biomaterial. It features all the parameters permitting optimal healing. These consist of a fibrin matrix polymerized in a tetra molecular structure, that includes the addition of platelets, leucocytes, and cytokines, and the presence of circulating stem cells which help the PRF to achieve excellent results provided all the necessary instruction from its making to its placement are followed. This papar illusterates a case of socket augmentation with platelet rich fibrin and freeze dried bone granules and rehabitation with prosthesis.

Key words: Platelet rich fibrin, platelet rich plasma, bone grafting, fibrin, Implants.

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INTRODUCTION

Reconstructive dental surgeons are constantly looking for an "edge" that jumps start the healing process to maximize predictability as well as the volume of regenerated bone. Significant resorption of the alveolar ridge occurs after tooth extraction.[1-3] In a dog model study, Araujo and Lindhe[2] showed that dimensional changes take place in two phases over an 8-week period. In phase I, a pronounced reduction of the height of the facial plate occurs, which results in a 2-mm discrepancy between facial and lingual plate's. In the second phase reduction of the width of both plates take place, resulting in a collapse of the socket towards the centre. According to a dry skull study by Pietrokovski,[4] the width reduction seems to affect the facial plate more than the lingual counterpart, resulting in loss of root prominence and a flattened appearance. Schropp et al[3] estimated a 50% reduction in the width of the human premolar and molar sockets over a 12-month period post-extraction.

The alveolar bone changes described above may lead to a compromised site for proper implant placement in a functionally and aesthetically desirable position. Pre-implant reconstruction of the deficient alveolar ridge facilitates ideal prosthetic positioning of implants and improves the long-term success of implant-supported restorations.[5-7] Regardless of the choice of graft material (autograft, allograft, xenograft or alloplast) or membrane selection (bio-resorbable or non-resorbable), predictable bone regeneration is dependent upon 4 major biologic principles: primary wound closure, blood supply, space maintenance, and wound stability.[8] Bone grafting is most successful when it occurs in a contained, well vascularised environment, stressing the importance of primary closure and the promotion of angiogenesis.

Blood supply provides the necessary cells, growth factors, and inhibitors to initiate the oestogenic bio mineralization cascade. Injury to blood vessels during oral surgical procedures causes blood extravasations, subsequent platelet aggregation, and fibrin clot formation. The major role of fibrin in wound repair is haemostasis, but fibrin also provides a matrix for the migration of fibroblasts and endothelial cells that are involved in

angiogenesis and responsible for remodelling of new tissue.

According to the Osteology Consensus Group 2011,[9] ridge preservation is a general term for interventions that aim to "preserve the ridge volume within the envelop existing at the time of extraction". Anitua et al [10] reported on twenty patients who underwent tooth extraction due to periodontal diseases or root fracture. Five patients received platelet rich plasma (PRP), and to help prevent tissue collapse five patients received PRP mixed with autologus bone. The control group consist of ten patients whose sockets were left to heal naturally. Sockets treated with PRP had completely epithelised at the end of the study, while this was not the case where PRP was not used.

Despite of the great variety of materials and techniques, the current consensus is that the resorption process that mainly affects the ridge volume and height of the buccal plate cannot be completely avoided. However, alternate methods and better materials that are now available ensure and help us in a variety of ways to allow us to get a less resorbed and more well maintained bony ridge which can be used for building either a removable or a fixed prosthesis on it. This case report stresses on the fixed implant prosthesis with the help of bone graft commercially available along with the use of Platelet Rich Fibrin (PRF).

CASE REPORT

A 59 years old male reported with the complaint for replacement of all the missing teeth. On examination of the individual #36, was found to be missing and root stumps of 37 were seen in the mandibular arch and #25 was missing in the maxillary arch. The ridge formed was well contoured after extraction of the teeth which was dated back to about 4 years. Further thorough medical history was taken which revealed that the patient was diabetic since 10 years and that he was taking medication on a regular basis for the same to keep this condition in a guarded state. Intra Oral Periapical Radiograph (IOPA) was taken of #36, #37 region in order to ensure that the bone had formed well and to evaluate further the diagnostics as to guide the patient for fixed or removable prosthesis. IOPA revealed vertical bone loss and depressed bone height of the socket along with an overall decreased bone density and bone height of that area.

Treatment modalities were explained to the patient, and an implant supported prosthesis in #36, #37 region was agreed upon. A study model was made as to plan out the guide for the implant placement prosthesis and Cone Beam Computed Tomography Scan (CBCT) was advised to get a clearer 3D outline of the condition of the bone. The mandibular views showed a generalized decrease in bone height and decrease in the bucco-lingual cortical plate width was also noted **(Figure 1)**. Hence bone grafting along with PRF was planned in order to improve the bone quality.

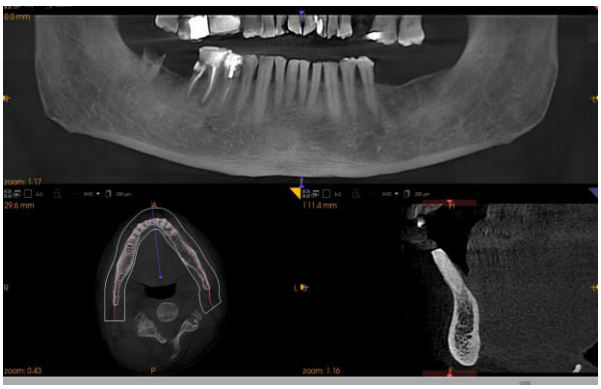

Figure 1: CBCT image showing decrease in bone height and decrease in the bucco-lingual cortical plate width in logitudnal view (a), axial view (b) and cross sectional view (c).

PRF membrane was prepared with minimum armamentarium needed. A 24 gauge syringe, and 10 ml blood collection tubes for holding the blood in the centrifuge were required. After withdrawl of the blood from the radial artery, it was centrifuged at 3000 RPM for 10 to 12 minutes. At the end of the cycle a fibrin clot containing platelets located in the middle of the tube, just between the red blood cell layer at the bottom and acellular plasma at the top **(Figure 2)** was obtained**.** Unlike PRP, the PRF results from a natural and progressive polymerization which occurs during centrifugation. This clot is removed from the tube and the attached red blood cells scraped off and discarded**.**

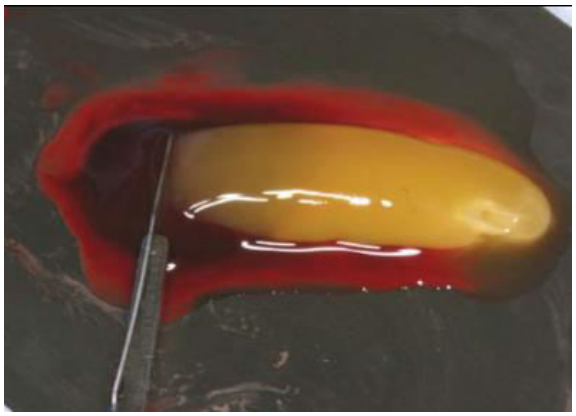

Figure 2: Showing removed clot from the test tube and scraping off of red blood cell layer

Next up the clot is then transferred into the PRF box, and covered with the compressor and lid. This produces an autologous fibrin membrane in approximately one minute. The exudate collected at the bottom of the box may be used to hydrate graft materials, rinse the surgical site, and store autologous grafts. Hence the PRF box acts as a simple yet a vital aid in the procedure of preparation of the membrane

Finally, implant supported prosthesis was placed in the left lower posterior region in relation to #36 and #37 region of the jaw under complete aseptic conditions along with freeze dried bone granules from Tata memorial hospital, tissue bank and PRF membrane was also made and placed in the socket along with the implant to achieve optimum bone levels and faster healing in order to support the implants in their respective position **(Figure 3)**. Loading of the tooth on the implant was done 6 months post operatively.

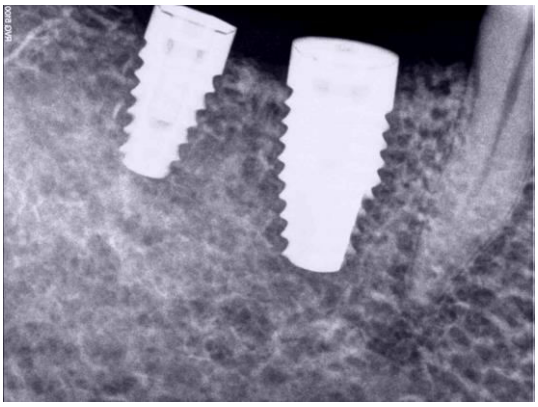

Figure 3: IOPA showing implant placement in #36 and # 37 region

DISCUSSION

Platelet Rich Plasma concentrates are blood-derived products used for the prevention and the treatment of haemorrhages due to serious thrombopenia of central origin, such as medullary aplasia, acute leukaemia, etc. Fibrin is the activated form of a plasmatic molecule called fibrinogen.[11] This soluble fibrillary molecule is massively present both in plasma and in the platelet alfa-granules and plays a determining role in platelet aggregation during haemostasis. It is transformed into a biologic glue capable of consolidating the initial platelet cluster, thus constituting protective wall along vascular breaches during coagulation. Infact, fibrinogen is the final substrate of all coagulation reactions. Being a soluble protein, fibrinogen is transformed into an insoluble fibrin by thrombin while the polymerized fibrin gel constitutes the first cicatricial matrix of the injured site. [12-14]

Platelet concentrates for topical surgery, such as the standard platelet concentrates of transfusion haematology, were thus arbitrarily called PRP. Moreover, the described protocols generally use a double centrifugation to increase the collected platelet concentration. To correct this misuse of language, many names were suggested: cPRP, plasma rich growth factors [10] etc. It seems however, that cPRP is the simpler and more adequate term.

Several studies have shown that bone regenerative procedures may be enhanced by addition of specific growth factors[15,16]. Platelet-rich plasma (PRP) was proposed as a method of introducing concentrated growth factors PDGF (platelet derived growth factor), TGF-ß (Transforming growth factor-ß), and IGF-1 to the surgical site, enriching the natural blood clot in order to expedite wound healing and stimulate bone regeneration. A natural human blood clot contains 95% red blood cells (RBCs), 5% platelets, less than 1% white blood cells (WBCs), and numerous amounts of fibrin strands. A PRP blood clot, on the other hand, contains 4% RBCs, 95% platelets, and 1% WBCs. The classic PRP production protocol requires blood collection with anticoagulant, 2 steps of centrifugation, and artificial polymerization of the platelet concentrate using calcium chloride and bovine thrombin. Since its introduction, PRP has been used in conjunction with different grafting materials in bone augmentation procedures. To date, the results from these studies are controversial and no conclusions can be drawn regarding the bone regenerative effect of PRP.

Platelet-rich fibrin (PRF) represents a new step in the platelet gel therapeutic concept with simplified processing minus artificial biochemical modification. Unlike other platelet concentrates, this technique requires neither anticoagulants nor bovine thrombin (nor any other jellifying agent), making it no more than centrifuged natural blood without additives. Developed in France by Choukroun et al in 2001,[17] the PRF production protocol attempts to accumulate platelets and released cytokines in a fibrin clot. Though platelets and leukocyte cytokines play an important part in the biology of this biomaterial, the fibrin matrix supporting them certainly constitutes the determining element responsible for the real therapeutic potential of PRF. Cytokines are quickly used and destroyed in a healing wound. The synergy between cytokines and their supporting fibrin matrix has much more importance than any other parameter. A physiologic fibrin matrix (such as PRF) will have very different effects than a fibrin glue enriched with cytokines (such as PRP), which

will have a massively uncontrollable and short-term effect.

PRF has to be considered as a fibrin biomaterial. Its molecular structure with low thrombin concentration is an optimal matrix for migration of endothelial cells and fibroblasts. It permits a rapid angiogenesis and an easier remodelling of fibrin in a more prone resistant connective tissue. Therefore, these PRF membranes can be used for all types of superficial cutaneous and mucous healing. But PRF is not only a simple fibrin membrane. It is also a matrix containing all the molecular and cellular elements permitting optimal healing. The matrix carries all the favourable constituents' present in a blood sample, hence making this biomaterial a physiological concentrate. It is obtained without any addition or manipulation. It is a matrix of autologous fibrin, in which are embedded a large quantity of platelet and leukocyte cytokines during centrifugation. Simonpieri et al [18,19] reported on a new technique for maxillary reconstruction using FDBA (Freeze dried bone allograft), PRF membranes and 0.5% metronidazole solution. A small quantity of a 0.5% metronidazole solution (10 mg) was used to provide an efficient protection of the bone graft against unavoidable bacterial contamination. In his study, 32 PRF membranes were used to protect the surgical site and foster soft tissue healing and PRF fragments were mixed with the graft particles. The membranes may be cut into few-millimetre fragments and mixed with the graft material, functioning as a "biological connector" between the different elements of the graft, and as a matrix which favours neo-angiogenesis, the capture of stem cells, and the migration of osteoprogenitor cells to the center of the graft. The following four results were observed by the above said study: First, the fibrin clot plays an important mechanical role, with the PRF membrane maintaining and protecting the grafted biomaterials and PRF fragments serving as biological connectors between bone particles. Second, the integration of this fibrin network into the regenerative site facilitates cellular migration, particularly for endothelial cells necessary for the neo-angiogenesis, vascularization and survival of the graft. When performing ridge augmentation, PRF membranes are used to protect and stabilize the graft materials. Thirdly, the membranes act as fibrin bandages, accelerating the healing of the soft tissues, facilitating the rapid closure of the incision despite a substantial volume of added bone. Using the reported protocol, they also (fourth) observed a high degree of gingival maturation after healing with a thickening of keratinized gingival tissues that improved the aesthetic integration and final result of their prosthetic rehabilitations. In addition, all their clinical experiences emphasized that the use of PRF seemed to reduce postoperative pain and oedema, and limited even minor infectious phenomena. In this above said case the healing seen was considerably good with the use of PRF and the final results obtained were tremendously superior as compared to non PRF incorporated results the wound contracted much faster with very less bleeding and least post-operative complaints what so ever**.**

CONCLUSION

Early publications and clinical experience seem to indicate that PRF improves early wound closure, maturation of bone grafts, and the final aesthetic result of the peri-implant and periodontal soft tissues. Although it can be interpreted from the study that PRF is important for faster healing to occur. The clinical experience confirms it that it can be very much used as a healing biomaterial. These consist of a fibrin matrix polymerized in a tetra molecular structure, that includes the addition of the platelets, leucocytes, and cytokines, and the presence of circulating stem cells which help the PRF to achieve excellent results provided all the necessary instruction from its making to its placement are followed.

REFERENCES

1. Cardaropoli G, Araujo M, Hayacibara R, Sukekava F. Healing of extraction socket and surgical procedure-augmentated and non-augmented-defects in the alveolar ridge. An experimental study in the dog. J Clin Periodontol 2005; 32: 435-440.
2. Araujo MG, Lindhe J. Dimensional ridge alteration following tooth extraction. An experimental study in dogs. J Clin Periodontol 2005; 32: 212-218.
3. Schropp L,Wenzel A, Kostopoulos L, Karring T. Bone healing and soft tissue contour changes following single-tooth extraction: A clinical and radiographic 12-month prospective study. Int J Periodont Restorative Dent 2003; 23: 313-323.
4. Pietrokovski J. The bony residual ridge in man. J Prosthet Dent 1975; 34: 456-462.
5. Raghoebar GM, Timmenga NM, Reintsema H, et al. Maxillary bone grafting for insertion of endosseous implants: Results after 12–124 months. Clin Oral Implants Res 2001; 12: 279-286.
6. Wallace SS, Froum SJ. Effect of maxillary sinus augmentation on the survival of endosseous dental implants. A systematic review. Ann Periodontol 2003; 8:328-343.
7. Tulasne JF. Commentary on maxillary preimplant rehabilitation. A study of 55 cases using autologous bone graft augmentation. Rev Stomatol Chir Maxillofac. 1999; 100: 265-266.

8. Wang HL, Boyapati L. "PASS" principles for predictable bone regeneration. Implant Dent 2006; 15(1): 8-17.
9. Hammerle CH, Araujo MG, Simion M, 2011 OCG. Evidence-based knowledge on the biology and treatment of extraction socket. Clin Oral Implants Res 2012; 23(5): 80-82.
10. Anitua E. Plasma rich in growth factors: Preliminary results of use in the preparation of future sites for implants. Int J Oral Maxillofac Implants 1999; 14: 529-535.
11. Mosesson MW, Siebenlist KR, Meh DA. The structure and biological features of fibrinogen and fibrin. Ann N Y Acad Sci 2001; 936:11-30.
12. Clark RA. Fibrin and wound healing. Ann N Y Acad Sci 2001; 936: 355-67.
13. Collen A, Koolwijk P, Kroon M, Van Hinsbergh VW. Influence of fibrin structure on the formation and maintenance of capillarylike tubules by human microvascular endothelial cells. Angiogenesis 1998; 2: 153-65.
14. Van Hinsbergh VW, Collen A, Koolwijk P. Role of fibrin matrix in angiogenesis. Ann N Y Acad Sci 2001; 936: 426-37.
15. Jung RE, Glauser R, Scharer P, Hammerle CH, Sailer HF, Weber FE. Effect of rh-BMP-2 on guided bone regeneration in humans. Clin Oral Implants Research 2003; 14: 556-568.
16. Nevins, M, Giannobile WV, McGuire MK, Kao RT, Mellonig JT, Hinrichs JT, et al. Platelet derived growth factor stimulates bone fill and rate of attachment level gain: Results of a large multicenter randomized controlled trial. J Periodontol 2005; 76: 2205-2215.
17. Choukroun J, Adda F, Schoeffler C, Vervelle A. Une opportunité en paro-implantologie: le PRF. Implantodontie 2001; 42:55-62.
18. Simonpieri A, Del Corso M, Sammartino G, Dohan Ehrenfest DM. The Relevance of Choukroun's Platelet-Rich Fibrin and Metronidazole during Complex Maxillary Rehabilitations Using Bone Allograft. Part I: A New Grafting Protocol. Implant Dent 2009; 18:102–111.
19. Simonpieri A, Del Corso M, Sammartino G, Dohan Ehrenfest DM. The Relevance of Choukroun's Platelet-Rich Fibrin and Metronidazole during Complex Maxillary Rehabilitations Using Bone Allograft. Part II: Implant Surgery, Prosthodontics, and Survival. Implant Dent 2009; 18: 220–229.

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