

The Use of advance Platelet-Rich Fibrin during Immediate Implantation for the Esthetic Replacement of Maxillary Anterior Segment with Chronic Apical Lesion

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Abstract: *Objective: To observe the clinical effect of immediate dental implants apply to the chronic apical lesions after tooth extraction with the advance platelet-rich fibrin (A-PRF). Methods: six cases with chronic apical lesions, after removal of teeth and completely clear the infection lesions found there were buccal bone defects. Then all patients accepted immediate dental implant combine with A-PRF fragments filling the bone defect area and covered by PRF membrane. There month later, the final restoration were finished. Result: 1. All the cases achieved good clinical efficacy. No case of infection or implant failing. 2. Three months and six-month follow up, imaging studies showed the osteogenesis well. Pink aesthetic implant the desired effect, in all cases pink aesthetic score reached 10 points or more. Conclusions: Advance Platelet-rich fibrin (platelet-rich fibrin PRF) in patients with chronic apical lesions after tooth extraction performed immediately before planting earlier clinical success rate of bone graft, anti-infective ability, more effective, aesthetic effect can be expected, is one worthy of immediate implant bone grafting methods.*

Keywords: Advance Platelet-Rich Fibrin (A-PRF), Immediate Implantation, Maxillary anterior Esthetic, Dental implant

1. Introduction

Conventional dental implant treatment is after tooth were removed, and waiting the socket natural healing 3-6 months, and then put the implant. But, at that time, the alveolar ridge atrophy usually occurred, physiological absorption of alveolar bone height becomes low, the width narrows, gingival papilla loss, especially the anterior region and premolar area, labial bone plates absorb and attached gingival loss will lead to difficult or impossible to put the implant in the right place¹. Clinically, dental implantation in the Maxillary anterior aesthetics zone is a high risk and difficulty to treatment, lack of bone mass, and inadequate attached gingival, especially buccal bone wall collapse directly affects the aesthetic effect of the subsequent implant restoration^{2,3}. Therefore, the Maxillary anterior aesthetics zone implantation is always the hot topic; and the suitable time for put implant in the anterior region is also more scholars' debate issue⁴. The teeth which with chronic infection have to extract in the Maxillary anterior region were common in clinical practice, however, such cases are even more complex and high-risk cases for implantation. The current study was carried out by using advance platelet-rich fibrin (A-PRF) to solve this problem.

The immediate dental implant and bone graft may maintenance and regeneration of the damaged labial bone wall, which serves as a support for three dimensional reconstructions (vertical, horizontal, and labial/lingual thickness) of the alveolar ridge.^{2,4,5}

Platelet-rich fibrin (platelet-rich fibrin PRF) is a rich source of autologous leukocytes and platelets and fibrin biomaterial, PRF also effectively simulate the formation of blood clots in the physiological state of fibrin, and the body's normal blood

clot fibrin similar and well avoids immune rejection and cross-infection¹⁰. (2005) In vitro studies show that Carroll and other PRF platelet release six kinds of growth factors, vascular endothelial growth factor (VEGF), platelet-derived growth factor (PDGF), transforming growth factor (TGF), insulin-like growth factor (IGF), epidermal growth factor (EGF) and basic fibroblast growth factor (bFGF). PRF major growth factors from platelets, fibrin bond three-dimensional network structure with various growth factors combine to produce, making it a relatively stable gel is stored in the PRF, slow release, play each other synergies, promote tissue regeneration and repair. 2013 joseph choukroun centrifuge program and test tubes for further improvement, allowing rich BMP2, BMP7, which can directly induce mesenchymal cells into bone cells, have a stronger ability to promote bone tissue repair.

In this study, the replacement of a fractured tooth with immediate implant is presented step by step with the use of A-PRF. The purpose of this study is the use of advance platelet rich fibrin (A-PRF) infection in patients with chronic anterior aesthetic zone of immediate implant bone while to observe its ability to resist infection and osteogenic effects, and gingival aesthetic effect .

2. Case study

2.1 Case report: Six cases with chronic apical lesions in the maxillary anterior teeth need to be removed and implant restoration (table1).

2.2 Preoperative examination: all the patients had a Preoperative comprehensive oral examination and CBCT scan.

2.3 Surgical Methods:

2.3.1A-PRF Preparation

A-PRF was prepared as described by Choukroun et al. 1 After administration of local anesthesia, venous blood was drawn from the jugular vein into 10-mL tubes (Vacuette, Grenier Bio-One, Kremsmünster, Austria) without anticoagulant. A total of 40 mL of blood was taken from each patient. The tubes were immediately centrifuged at 400g for 12 minutes (A-PRF fibrin centrifugal machine, and Germany TBL, Model: pc02). After centrifugation, 3 layers were obtained: acellular plasma (platelet poor plasma) was concentrated at the top and was collected by syringe; fibrin clots and red corpuscles were removed from the tube with a scalpel; a PRF clot was immediately separated from red corpuscles by tweezers. This clot was either cut into small pieces and mixed with graft material or pressed to obtain a membrane (Figure 1).

Table1: The information of 6 cases which accepted the immediate implant and A-PRF graft

Patient	Gender	Age	Site	diagnosis
1	Female	65	24	24root fraction
2	female	32	12	12 chronic apical lesions after root canal treatment
3	female	46	11,21	chronic apical lesions after root canal treatment
4	female	43	13	13root fraction
5	male	45	11	11root fraction
6	male	34	21	11root fraction



Figure 1: A-PRF clot will use special instruments into a massive backlog or a membrane.

2.3.2 Surgical Procedure

The fractured root was carefully removed and a thorough curettage of the remaining alveolus was performed to eliminate any residual infective tissue in the avulsion socket that could compromise the osseointegration of an immediately placed implant. After completely remove infected lesions found that the buccal bone defect (fig2). A 4.1 mm diameter and 10 mm length implant (straumann,SLA)(or 4.3mm diameter,11.5mm length implant ,nobelactive) was placed (Fig 3,4), reaching 35 Ncm primary stability. Then use the A-PRF to filling the bone defect area(fig 5),and uses theA-PRF membrane to cover the bone graft and area(fig6);then ,suture.

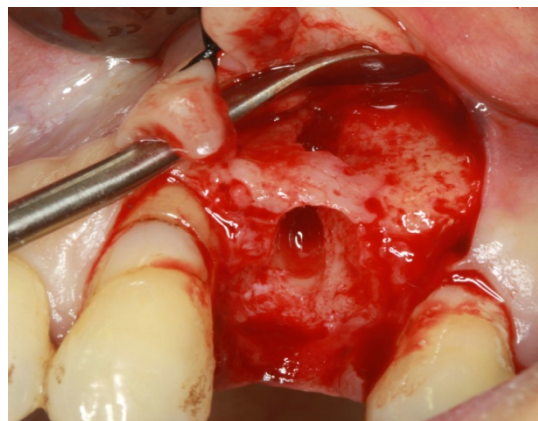


Figure 2: Clinical view of 24 was removed and completely removed infected lesions found that the buccal bone defect

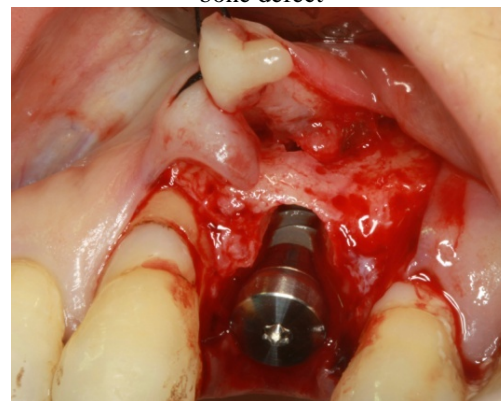


Figure 3: A 4.1 mm diameter and 10 mm length implant (straumann,SLA) was placed

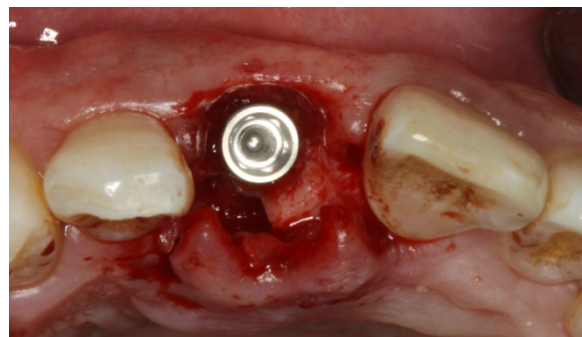


Figure 4: A 4.3mm diameter, 11.5mm length implant (nobelactive) was placed

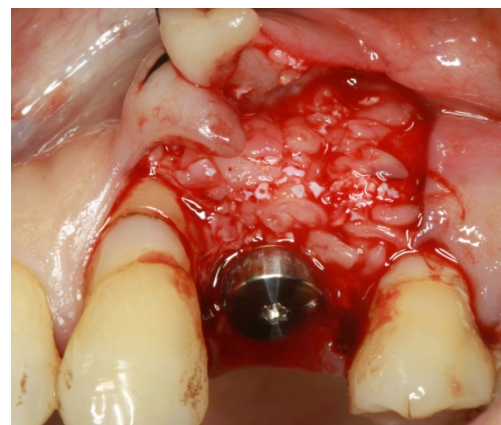


Figure 5: A-PRF to filling the bone defect area, cover the implant



Figure 6: the A- PRF membrane to cover the bone graft and area.

2.4 Assessment Method

2.4.1 Postoperative Pain

Using Visual Analogue Scale/Score(VAS)method to evaluate the patients’ postoperative pain.

2.4.2 Gingival Healing

7 days and 14 days after surgery, evaluated the gingival healing. 0 =Partly healed or infection 1= wound completely healed without infection.

2.4.3 Bone Healing

Using CBCT comes with software to measure the bone volume changes of Before extraction, three months after the surgery, six months after the surgery respectively.

2.4.4 Gingival Pink Esthetic Score

After implant restoration was finished, using Gingival Pink esthetic score to evaluated the gums color, shape, quality. Evaluation include: mesial papilla (0 = defect ,1 = incomplete, 2 = complete), distal papillae (0 = defect, 1 = incomplete, 2 = complete), soft tissue edge level (0 = uncoordinated 1 = partial coordination 2 = coordination), soft tissue appearance (0 = not natural ,1 = basic natural, 2 = nature), alveolar (0 =defect, 1 = not complete defect, 2 = full), soft tissue color (0 = uncoordinated, 1 = partial coordination, 2 = coordination), soft tissue texture (0 = uncoordinated, 1 = partial coordination, 2 = coordination)

3. Result

3.1Six cases of clinical patients achieved good clinical efficacy (table 2), slightly swollen gums after 7 days, 14 days gums completed healed. No case of infection or implant failing.

3.2Three months later, before the final restoration, CBCT and periapical films were taken, the CBCT imaging shows well osteogenesis (fig7).

3.3All the cases achieved good restoration and the patients were satisfied with the implant restoration; all cases pink aesthetic score reached 10 points or more(table 2)(fig8,).

Table1: the result information of 6 cases which accepted the immediate implant and A-PRF graft

patient	CBCT image	treatment	Implant insert torque (Ncm)	Implant Model	Pink Esthetis Score (PES)
1	Buccal bone defect in the apical area	Extracted24 immediate implant A-PRF failing	35	4.1*10RN STRAUU MN	12
2	Buccal bone defect in the apical area	Extracted12 immediate implant A-PRF failing	35	4.3*11.5 NOBEL ACTIVE	12
3	Buccal bone defect in the neck area	Extracted11,21 immediate implant A-PRF failing	35	4.3*11.5 NOBEL ACTIVE	12
4	Buccal bone defect in the neck area	Extracted13 immediate implant A-PRF failing	35	4.3*11.5 NOBEL ACTIVE	11
5	Buccal bone defect in the middle root area	Extracted11 immediate implant A-PRF failing	35	4.3*11.5 NOBEL ACTIVE	11
6	Palatal bone defect in the neck area	Extracted11 immediate implant A-PRF failing	35	4.3*13 NOBEL ACTIVE	11

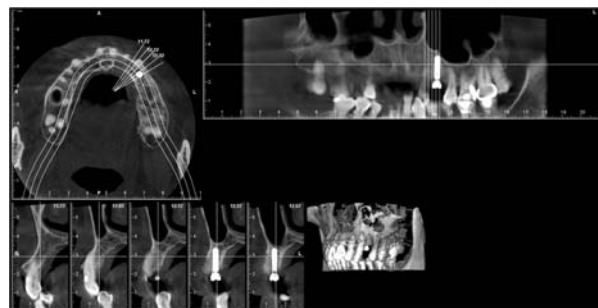


Figure 7: CBCT imaging shows well osteogenesis



Figure 8: The final result is good,the gingival pink score is more than 12.

4. Discussion

After tooth extraction, immediate implant installation has been suggested for prevention of alveolar bone loss and

reduction of the overall treatment period.^{2,3,11} bone defects are always a problem if an immediate implant installation is to occur. Without the immediate placement of the implant and graft material, the alveolar ridge after extraction would resorb significantly, resulting in the absence of adequate bone volume for ideal implant positioning^{6,7,8}. This is particularly true for patients with a thin alveolar ridge and gingival tissue. However, healing of the tissues is always difficult to control and the development of new techniques and materials to improve these treatments is still necessary.

Platelet concentrates for surgical use are widely used and continuously investigated in oral and maxillofacial surgery⁹. The objective is to gather platelet growth factors and to inject them on a surgical site to stimulate the healing process. Platelet-rich plasma (PRP) originates from the patient's own blood. It has shown many successes in reducing bone resorption after implant placement.^{9,10} However, some studies show the opposite results. PRP cannot improve bone regeneration around peri-implant bony defects.

Another technology called leukocyte and platelet-rich fibrin (L-PRF) allows for the preparation of strong fibrin membranes enriched with cells (activated platelets, leukocytes, circulating cells) and platelet growth factors. This autologous healing biomaterial is free of additives (no anticoagulant during blood harvest, no chemicals for activation), simple, inexpensive, and quick to prepare (15 minutes for all steps). Several articles have reported the use of these L-PRF membranes for the stimulation of bone and gingival healing during subantral sinus augmentations and global rehabilitations using dental implants.¹⁰ The effect of these membranes on soft tissue healing and maturation is particularly significant.

2013 Joseph Choukroun centrifuge program and test tubes for further improvement, allowing rich BMP2, BMP7, which can directly induce mesenchymal cells into bone cells, have a stronger ability to promote bone tissue repair. Bone morphogenetic proteins (BMPs) are a group of osteoinductive sequentially arranged amino acids and polypeptides that are pleiotropic regulators of bone volume, skeletal organogenesis, and bone re-generation. They function as signaling agents affecting cellular events such as proliferation, differentiation, and extracellular matrix formation. Capable of stimulating adult mesenchymal stem cells to induce bone formation, they offer the promise of a true osteoinductive bone graft substitute that obviates a donor site.

Many cases of the immediate dental implant installation have partial wall defects around the dental implant. In the case of wide defects, a bone graft or a guided bone regeneration (GBR) technique can be considered^{3,4}. Autogenous bone is the best selection for the graft. Previously, an extraoral source was used, but intraoral donor sites, such as the ascending ramus⁵ or chin bone,⁶ can also be used.

Regardless of the donor site, an autogenous bone graft requires a second operation and has the possibility of donor site morbidity. A GBR technique can be applied to cases showing a slight deficiency relative to the required amount. In the case of a nonresorbable membrane, complications such as

membrane exposure, infection, and inflammation have been reported.⁷

Various bone substitutes have been introduced for ridge preservation, bone augmentation, and filling peri-implant defects in oral implantology. Among the variety of grafting materials, PRF has become a focus of current studies due to its potential to accelerate and improve the healing process. implant-supported restoration of the maxillary anterior segment that is biologically, functionally, and esthetically acceptable following root fracture in the maxillary anterior segment is always complex². Careful extraction of the fractured root, residual labial bone preservation, proper flap design, ideal positioning of the implant, appropriate soft tissue contour, and the crown emergence are all important steps necessary to achieve a predictable, stable, functional, and esthetic success.

Immediate implants in the maxillary esthetic area are currently used frequently and are subtle, exacting treatments. However immediate implant placement and bone grafts are always sensitive to the gingival quality, as the gingival tissue has to cover and protect the site. If the gingival tissue is weak or damaged, dehiscence can appear in the covering tissue leading to the contamination of the grafted site. For this reason, some authors recommend the use of connective tissue grafts to reinforce the peri-implant tissues. The L-PRF is therefore especially indicated in this application. The fibrin membrane of L-PRF acts as a bio-barrier, protecting the implant and the graft from the oral environment. Moreover, by providing growth factors, leukocytes, and a permeable fibrin matrix for the growth of endothelial and epithelial cells, this healing material stimulates neoangiogenesis and accelerates gingival healing and maturation. The use of healing materials such as L-PRF are well suited to these applications because this material has a robust stimulating effect on the healing of soft and osseous tissues.

5. Conclusions

Platelet-rich fibrin (platelet-rich fibrin PRF) in patients with chronic apical lesions after tooth extraction performed immediately implantation show high success rate of bone graft, anti-infective ability. This technique offers advantages for patient comfort and the healing process. It also facilitates a natural healing and maturation of the periimplant bone and soft tissues around the implant.

References

- [1] Schropp L, Wenzel A, Kostopoulos L, et al. Bone healing and soft tissue contour changes following single-tooth extraction: a clinical and radiographic 12 month prospective study. *Int J Perio Rest Dent.* 2003, 23(4): 313-323. (journal style)
- [2] Aratljo MG, Sukekava F, Hndhe J, et al. Ridge alterations following implant placement in fresh extraction sockets: all experimental study in the dog. *Journal of Clinical Periodontology*, 2005, 32(6): 645—652. (journal style)

- [3] Buser D , Martin WC , Belser UC . Surgical considerations with regard to single—tooth replacements in the esthetic zone. In: Buser U, Wismeijer D, editors . ITI Treatment Guide , V01 . I: Implants therapy in the esthetic zone : single—tooth replacements. Berlin: Quintessenz, 2007: 26—37 (journal style)
- [4] Buser D, Chen ST, Weber HP, et al. Early implant placement following single tooth extraction in esthetic zone : biologic rationale and surgical procedures. Int J Periodontics Restorative Dent , 2008 , 28(5) : 441—451. (journal style)
- [5] Buser D, Halbritter S, Hart C, et al. Early implant placement with simultaneous GBR following single—tooth extraction in the esthetic zone . 12—month results of a prospective study with 20 consecutive patients . J Periodontol, 2009, 80(1): 152—162. (journal style)
- [6] Aratijo M, Hndhe J. Ridge alterations following tooth extraction with and without flap elevation: experimental study in the dog. Clinical Oral Implants Research, 2009, 20(6): 545—549. (journal style)
- [7] Ficki S, Zuhr O, Wachtel H, et al. Hard tissue alterations after socket preservation with additional buccal overbuilding: a study in the beagle dog. Journal of Clinical Periodontology, 2009,36(10): 898—904. (journal style)
- [8] Ruga E, Gallesio C, Chiusa L, et al. Clinical and histologic outcomes of calcium sulfate in the treatment of postextraction sockets. J Craniofac Surg 2011;22:494-498 (journal style)
- [9] Dohan Ehrenfest DM, Del Corso M, Inchingolo F, et al. Platelet-rich plasma (PRP) and platelet-rich fibrin (PRF) in human cell cultures: growth factor release and contradictory results. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2010;110:418-421 (journal style)
- [10] Ehrenfest DM, Bielecki T, Del Corso M, et al. Shedding light in the controversial terminology for platelet-rich products: platelet-rich plasma (PRP), platelet-rich fibrin (PRF), platelet-leukocyte gel (PLG), preparation rich in growth factors (PRGF), classification and commercialism. J Biomed Mater Res A 2010;95:1280-1282 (journal style)
- [11] Rosenquist B, Grenthe B. Immediate placement of implants into extraction sockets: implant survival. Int J Oral Maxillofac Implants 1996;11:205-209. (journal style)
- [12] A. Bonaccorsi, “On the Relationship between Firm Size and Export Intensity,” Journal of International Business Studies, XXIII (4), pp. 605-635, 1992. (journal style)

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