

Original Research

Comparative evaluation of platelet rich fibrin with demineralized bone matrix as a grafting material in the treatment of periapical lesions

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ABSTRACT:

Introduction: The development of the inflammatory periapical lesion which results due to trauma from occlusion or pulpal necrosis causes a local response of bone around the apex of the tooth. Depending upon the nature of wound and available biological growth factors the outcome will be either regeneration or repair. Being a rich source of growth factors, platelet rich fibrin (PRF) possess many advantages in bone regeneration. The purpose of this study is to evaluate the healing potential of the combination of PRF and Demineralized bone graft as opposed to using these materials alone. **Materials and Methods:** A periapical surgery was performed on thirteen patients with a large periapical inflammatory lesion and a large bony defect. Two study groups were made based on lottery method into Group A and Group B. The defects were then filled with a combination of PRF and Demineralized bone graft crystals in Group A and only Demineralized bone graft was used in Group B. Radiographically hard tissue fill (using standardized paralleling cone technique) were evaluated at baseline, 1 month and 9 months postsurgery. **Results:** No differences in any of the investigated parameters were observed at baseline. At 6 months postsurgery, both groups showed significant improvement in clinical parameters ($p < 0.001$). PRF+DBM (Group A) was more effective than DBM (Group B) alone as a favorable increase of hard tissue fill was noted in group A compared with group B. On the basis of our outcome, we conclude the use of PRF in combination with Demineralized bone graft might have accelerated the bone regeneration in Group A as compared to Group B.

Keywords: Demineralized bone matrix • platelet rich fibrin • periapical lesions • periodontal regeneration

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INTRODUCTION

Periodontitis is an inflammatory disease that leads to the loss of tooth-supporting tissues. Bone loss due to periapical pathology is a common presentation in clinical practice. Periapical surgery includes removal of diseased soft tissue and sometimes application of different graft material to enhance new bone formation at the defective site [1]. Traditionally a variety of bone graft materials have been used as an adjuvant in the healing of periapical defects but the use of autologous bone substitute such as platelet rich fibrin has been widely accepted for its potential benefit of accelerating the body's natural healing process in bone regeneration. Platelets after cellular interactions, release different growth factors (cytokines) which are biologically active substances that are involved in tissue-repair mechanism such as chemotaxis, cell proliferation,

angiogenesis, extracellular matrix deposition, and remodelling and stimulate bone and soft tissue healing [2]. Ease of preparation, cost-effective and relative lack of complications has made PRF a very safe and popular biomaterial leading to widespread use in regenerative procedures [3].

MATERIALS & METHODS

THE STUDY POPULATION

Thirteen patients (ten females and seven males; aged from 24 to 44 years, average age 34 ± 11 years) having periapical disease based on clinical signs and symptoms, intraoral and radiographic findings (periapical radiolucency > 1 cm in dia) were included in this study. Two groups were made Group A & Group B and patients were randomly allocated in these groups based on Lottery method. The subjects included those in which conventional endodontic

therapy failed to resolve the periapical lesion and periapical root-end surgery was required and were otherwise medically healthy individuals. All patients were informed of the nature of this study and signed an informed consent prior to their inclusion. The study was performed in accordance with the Helsinki Declaration of 1975, as revised in 2000 and the study protocol was reviewed and approved by the college ethical committee.

THE STUDY DESIGN

The study was designed as a prospective controlled clinical study. All patients underwent initial therapy, consisting of oral hygiene instruction, full-mouth scaling and root planning to combat any existing periodontal inflammation and occlusal adjustment when indicated. After periodontal re-evaluation, the patients were included in this study. Followed by endodontic treatment in the teeth associated with the lesion. Obturation and periapical curettage with grafting was done on the day of surgery.

PROTOCOL FOR PRF PREPARATION

Choukroun's protocol^[3] had been followed for the preparation of PRF. Just prior to surgery, 8 ml intravenous blood was drawn from the antecubital vein and was collected in a 10-ml sterile tube without anticoagulant. The tube was centrifuged immediately at 3,000 rotations per minute for 10 min. This allows the structured fibrin clot in the middle of the tube between the red blood cells at the down most and

acellular plasma layer which lacks platelets at the top. A natural and progressive polymerization which occurs during centrifugation results the formation of PRF. PRF can be separated easily from red blood cells layer using a sterile tweezers and scissors from the tube.

SURGICAL TREATMENT

Periapical surgery was performed following the standard surgical technique using crevicular and two releasing incisions and reflection of full thickness mucoperiosteal flap. Thorough debridement, tissue curettage was done at the defect site followed by irrigation using sterile saline solution. Glass ionomer cement was used as the root end filling. The PRF prepared and stored prior to surgery was mixed with DBM (Osseograft) by sprinkling the graft material over the PRF gel and together the mixture was placed into the bony defect in Group A while only DBM alone was used in Group B. The mucoperiosteal flaps were repositioned and secured in place by giving simple interrupted suture using 3-0 non absorbable black silk surgical suture. Primary closure was obtained and standard postoperative instructions and medications (diclofenac sodium 50 mg TID + amoxicillin-clavulanic acid 625mg TID for 5 days) were prescribed. The patients were recalled at 1 week for suture removal & at 1 month, and 6 months thereafter, when they were examined clinically regarding postoperative discomfort, pain, sensitivity to percussion, and presence/absence of swelling.

GROUP A



Pre Operative Iopar



Baseline

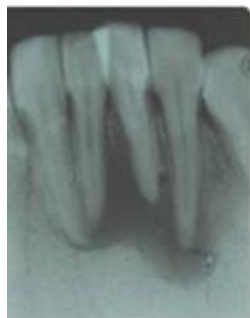


1 Month

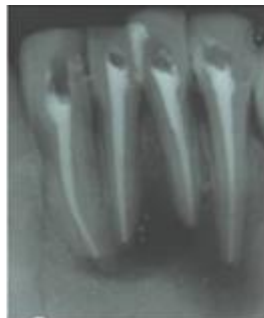


6 Month

GROUP B



Pre Operative Iopar Showing Large Periapical Lesion



Baseline



1 Month



6 Month

STATISTICAL ANALYSIS

Radiographic assessment using standardized radiographs was done at baseline, 1 month and 6 months after surgery to evaluate defect resolution in terms of area of radiolucency. The image was then subjected to morphometric area measurement with the area measurement tool in the VixWin Pro digital image analysis software (Version 1.3, Gendex Dental Systems, Hatfield, PA, USA) by outlining the radiolucency.^[4] Calibration was done automatically by the software. The area measured was recorded in the evaluation sheet. At the 6 month, again the same procedure was repeated and the area was measured using the same criteria as mentioned before. Paired t-

test was performed using SPSS for windows (version 20) to evaluate changes between baseline and 1 month and baseline and 6 months.

RESULTS

The patients did not complain of any unusual or severe pain. There were no signs of infection, untoward reaction, wound dehiscence or extrusion of material in any of the patients. The SD of area measured at baseline for the groups A & B were 5.2 & 9.20 respectively and area after 6 months were 3.93 & 6.87 respectively. There was a highly significant difference in the area measurement comparing the baseline and at 6 months [Table 1].

Table 1: Comparison Of Area At Baseline With Area At 6 Months

Group	Area At Baseline	Area At 6 Month	Area (Mean Difference)	* P Value
GROUP A (PRF +DBM)	5.2	3.93	1.27	0.006*
GROUP B (DBM)	9.20	6.87	2.33	0.001*
GROUP A vs GROUP B	-	-	-	0.01

*P-value :Highly significant

DISCUSSION

Periapical surgery is the last treatment option for chronic inflammatory perical lesions when orthograde treatment fails or is not possible. Recent years Platelet rich fibrin (PRF) becomes a biological revolution in soft tissue & osseous regeneration. PRF contains and releases different growth factors that stimulate bone and soft tissue healing ^[5]. Growth

factors are actively participating in tissue repair mechanism such as angiogenesis, chemotaxis, cell proliferation, extracellular matrix deposition, and remodelling. Autologous platelet storage via PRF is an easy, cost-effective way to obtain high concentrations of growth factors for tissue healing. The PRF production protocol attempts to accumulate platelets and released cytokines in a fibrin clot.

Currently available clinical evidence suggests that healing rate of surgical sites enhanced with PRF is upto two to three times higher than normal surgical sites [6]. This study compared combination PRF+DBM with DBM alone in the treatment of human periapical defects. The results indicate that PRF+DBM treatment was effective in significantly improving clinical and radiographic parameters at 6 months after surgery

HARD TISSUE FILL

In this study, the average radiographic hard tissue fill is in accordance with previous reports on the clinical benefits of a regenerative approach employing PRP combined with DBM. Parimala *et al.* reported a significant radiographic defect hard tissue fill of 4.04 mm in the PRP + BPBM group [7] compared with DBM alone.

MECHANISM OF PRF

The PRF is considered as a second-generation platelet concentrate. Choukroun developed the PRF making protocol in 2001. The PRF is produced without adding an anticoagulant, bovine thrombin, or calcium chloride is not needed for platelet activation

and fibrin polymerization [2]. The homogenous fibrin network formed from centrifugation is more highly coherent than natural fibrin clots. PRF composed of a fibrin matrix polymerized in a tetra molecular structure, with inclusion of platelet, cytokines, circulating stem cells and leucocytes [8].

The autologous growth factors released by PRF in a gradual manner for at least one week and up to 28 d [9]. The homologous organization of fibrin network is formed during centrifugation by natural and slow polymerization. The anticoagulant absence leads to massive platelet activation in the test tube. A progressive polymerization incorporates intrinsic circulating cytokines in the fibrin meshes. This configuration increases the lifespan of these cytokines, only at the time of initial cicatricial remodelling they are released and used [10]. PRF also has a more durable and stronger effect than PRP. The elastic nature of PRF membrane acts like a fibrin bandage which accelerates the healing of wound edges.

The use of biological platelet extracts (PRF) in healing of inflammatory lesions have been reported by various authors [Table 2]

Author	Year	Teeth	Material	Follow up
Goyal L [11]	2014	22	PRF & alloplastic bone graft	12 months
Bhandari et al., [12]	2013	11 and 21	PRF & Osseograft	14 months
Singh et al., [13]	2013	15 cases of upper anteriors	PRF	6 months
Shivashankar et al., [14]	2013	11 and 12	PRF & HA graft	24 months
Jayalakshmi et al., [15]	2012	21 and 22	PRF and β -TCP	12 months

SUMMARY & CONCLUSION

Within the limitations of this study, it can be concluded that PRF can be used as a safe, efficacious and cost-effective alternative to conventional bone substitutes for promoting early resolution of periapical defects. In conclusion, the results of this study indicate that the PRF + DBM combination improved clinical and radiographic outcome better than DBM alone in the treatment of periapical defects. Further exploratory studies in comparison with other platelet concentrates need to be undertaken to evaluate the treatment outcome in periodontal defects.

BIBLIOGRAPHY

- Abramovitz I, Better H, Shacham A, Shalomi B, Metzger Z. Case Selection for apical surgery: A retrospective evaluation of associated factors and rationale. *J Endod.* 2002; 28:527-30. [PubMed]
- Dohan DM, Choukroun J, Diss A, Dohan SL, Dohan AJ, Mouhyi J *et al.* Platelet-rich fibrin (PRF): A second-generation platelet concentrate. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2006; 101:45-50. [PubMed]
- Miron RJ, Zucchelli G, Pikos MA *et al.* Use of platelet rich fibrin in regenerative dentistry: A Systematic review. *Clin Oral Investig* 2017;21:1913-1927
- Carvalho FB, Gonçalves M, Guerreiro-Tanomaru JM, Tanomaru-Filho M. Evaluation of periapical changes following endodontic therapy: Digital subtraction technique compared with computerized morphometric analysis. *Dentomaxillofac Radiol* 2009;38:438-44.
- Carlson NE, Roach RB Jr. — Platelet-rich plasma Clinical applications in Dentistry. *J Am Dent Assoc.* 2002;133(10):1383-86.
- Marx RE, Carlson ER, Eichstaedt RM, Schimmele SR, Strauss JE, Georgeff KR — Platelet-rich plasma: growth factor enhancement for bone grafts. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1998;85:638-46.
- Parimala M, Mehta DS. Comparative evaluation of bovine porous bone mineral. *J. Indian Soc. Periodontol.* 14(2), 126–131 (2010).
- Toffler M, Toscano N, Holtzclaw D, Corso MD, Ehrenfest DD. Introducing Choukroun's Platelet Rich Fibrin (PRF) to the Reconstructive Surgery Milieu. *Implant Dent.* 2009;1:21-30.
- He L, Lin Y, Hu X, Zhang Y, Wu H. A comparative study of platelet-rich fibrin (PRF) and platelet-rich plasma (PRP) on the effect of proliferation and differentiation of rat osteoblasts in vitro. *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontology.* 2009;108(5):707–13.
- Lee KW, Williams MC, Camps JJ, Pashley DH. Adhesion of endodontic sealers to dentin and gutta-percha. *J Endod* 2002;28:684-8.

11. Goyal L. Clinical effectiveness of combining platelet rich fibrin with alloplastic bone substitute for the management of combined endodontic periodontal lesion. *Restor Dent Endod.* 2014;39(1):51-55.
12. Bhandari S, Ashwini T S, Naik R, Bandiwadekar T, Makandar S. Regenerative periapical surgery: A case report. *Dent Hypotheses.* 2013;4:61-66.
13. Singh S, Singh A, Singh S, Singh R. Application of PRF in surgical management of periapical lesions. *Natl J Maxillofac Surg.* 2013;4:94-99.
14. Shivashankar VY, Johns DA, Vidyanath S, Sam G. Combination of platelet rich fibrin, hydroxyapatite and PRF membrane in the management of large inflammatory periapical lesion. *J Conserv Dent.* 2013;16:261-64.
15. Jayalakshmi KB, Agarwal S, Singh MP, Vishwanath BT, Krishna A, Agrawal R. Platelet-rich fibrin with beta-tricalcium phosphate-a novel approach for bone augmentation in chronic periapical lesion: a case report. *Case Rep Dent.* 2012;2012:902858.