

## A Novel Combination Of Platelet Rich Fibrin And Pepgen P-15 Xenograft, In The Treatment Of Intrabony Defects: A Volumetric CT Scan Analysis.

### Abstract

A novel combination of Pepgen P-15 xenograft and platelet rich fibrin (PRF) is used in the periodontal regeneration of intrabony defects, in three patients (two males, one female) on tooth site #20, #21, #30. Clinical parameters like pocket probing depth, relative attachment level, position of gingival margin were evaluated presurgically (baseline) and post surgically at 6 and 9 month intervals. Radiographic parameters including linear bone growth (LBG) and volumetric bone gain were assessed through the acquired Dentascan three dimensional reconstructed images. There was an improvement in all the clinical parameters and increase in radiographic LBG of 33 to 37% and volumetric bone gain of 55 to 81%, at defect sites. Clinical and CT scan assessment indicate the regenerative potentiality of PRF and Pepgen P-15, in treatment of periodontal intrabony defects.

### Key Words

Polypeptide Hormones; Intra-Bony Defect; Regenerative Treatment; Volumetric CT

### Introduction

In the past, various treatment modalities have been attempted to enhance the periodontal regeneration. Recently, a synthetic biomimetic hydroxyapatite xenograft, PEPGEN-P15®\*, has been demonstrated to promote the bone formation. It is one among the many materials to mimic autogenous bone, as 15 amino acid sequence of Type I collagen (P-15 peptide) coats the surface of anorganic bone mineral (ABM).<sup>[1]</sup> P-15 peptide has steric similarities to the cell binding site of type-I collagen present in the bone.

Another recent approach, for periodontal regeneration is the use of polypeptide growth factors, known to promote proliferation and migration of periodontal ligament cells, synthesis of extracellular matrix as well as differentiation of cementoblasts and osteoblasts. Platelet-rich fibrin (PRF), a second-generation platelet concentrate (PC), originally described by Choukroun et al,<sup>[2]</sup> is a safe and convenient approach to deliver high concentrations of polypeptide growth factors. PRF can be obtained by gentle centrifugation of peripheral blood, not requiring the addition of any anticlotting agent, which

renders its preparation less chaotic. Dohan Ehrenfest et al<sup>[3]</sup> showed that approximately 97% of platelets and 50% of leukocytes of the original blood volume were concentrated and three dimensionally distributed in the PRF clot, that is believed to release polypeptide growth factors, such as transforming growth factor- $\beta$ 1, platelet-derived growth factor, vascular endothelial growth factor and matrix glycoproteins (such as thrombospondin-1), in a sustained fashion for at least 7

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days, as shown in vitro.<sup>3</sup> PRF also shows positive effects like “Jump-starts” the cascade of osteogenesis in a bone graft, facilitates graft stabilization, promotes early consolidation of the graft, speeds up mineralization and finally improves trabecular bone density.<sup>[2]</sup>

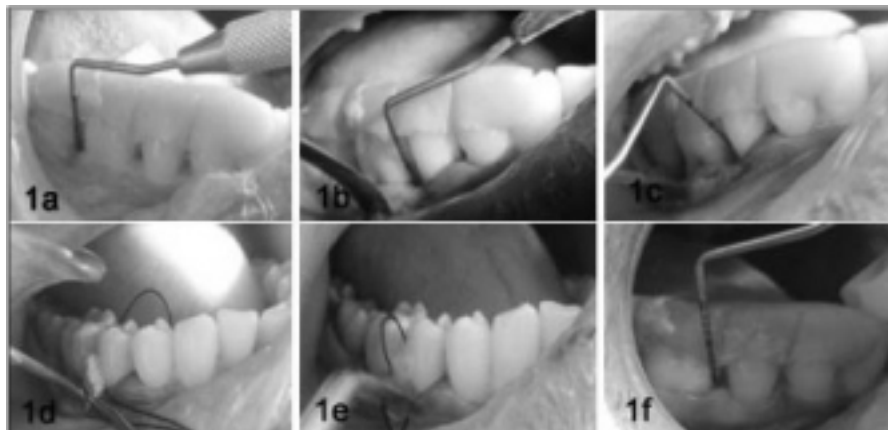


Figure 1. Surgical procedure A: Preoperative #30; B, C: Intraoperative measurements taken at intrabony defect site #30 after Open-flap debridement; D: Placement of PEPGEN P-15 graft; E: Placement of PRF; F: 9 month postoperative PD was reduced to 3 mm

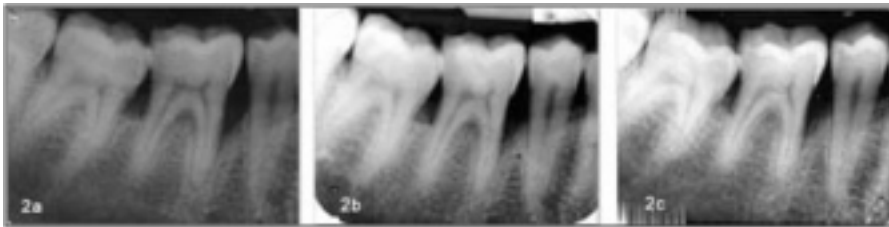


Figure 2. Intraoral periapical radiographs #30; A: Preoperative (baseline); B: 6 months postoperative; C: 9 months postoperative



Figure 3. Preoperative Dentascan Images. A: sagittal section; B: axial section; C: coronal section; D: defect volume obtained; E: linear bone defect measurements; F: 3D Reconstructed model

Hence, the present case series, reveals a clinical and radiographic evaluation of, PEPGEN-P 15, when used in combination with PRF in the treatment of periodontal intrabony defects with the primary outcome variables being the linear bone growth and defect volume gain, as evaluated using a high resolution spiral computed tomography (CT) scan.

### Clinical Presentation

Three patients (two male and one female, aged 25 to 35 years) diagnosed with generalized chronic periodontitis, having intrabony defects at teeth sites #20 mesial, #21 distal and #30 mesial, with radiographic evidence of bone loss (Fig. 2), were treated in the Department of Periodontology & oral Implantology, Maharishi Markandeshwar College of Dental Sciences & Research, Mullana, Haryana, India from January 2012 to March 2012. The patients were systemically healthy, nonsmokers and reported no

known drug allergies and no current medications. Phase I therapy was performed. Volumetric analysis of the defect sites was done, by acquiring three-dimensional CT scan images, using a multidetector 64-slice CT scan machine†, aided by Dentascan software. Clinical parameters in all three patients, including: 1) pocket probing depth (PD) >5mm; 2) Relative clinical attachment levels (RAL) >10mm; and 3) Relative position of gingival margin (PGM) (mid-facial), were recorded immediately before surgery (as baseline), at 6 and 9 month intervals. A millimeter graded periodontal probe‡ with acrylic stent as reference point was used for measurements. (Fig. 1a)

### Case Management

Prior to the procedures, written informed consent was obtained from all patients. The procedures followed were in accordance with the ethical standards of the University Ethical committee on

human experimentation and with the Helsinki Declaration of 1975, as revised in 2000. A conventional open flap debridement surgery in the respective quadrant, along with placement of Peppen-P15 in combination with PRF within the intrabony defect sites was done (intrabony component of >3mm, Fig. 1b through 1e). Interrupted sutures were given and a periodontal pack was placed. The patients were given postsurgical instructions and advised to rinse with 0.12% Chlorhexidine mouth rinse twice daily for 1 week. A prescription of systemic antibiotics (500 mg amoxicillin, every 8 hours for 5 days), and analgesics (400 mg ibuprofen, every 8 hours for 5 days) was provided.

### Results

At 6 and 9 month follow-up examination, it was observed that PD reduced in range of 3 to 5 mm with 1 to 2 mm coronal shift in PGM and again in CAL of 2 to 5 mm (Table 1).

A three-dimensional (3D) reconstructed Dentascan images acquired at 9 month interval, confirmed positive changes in the defect morphology, with a linear bone growth of 1.5-3mm (33 to 37 %). The volumetric analysis showed a bone fill of 55 to 81% at the defect sites (Table 2, Figs. 3 through 4).

### Discussion

The in vitro studies by Bhatnagar et al<sup>[1]</sup>, Yuan et al<sup>[4]</sup> and in vivo studies by Yukna et al<sup>[5]</sup> have shown the efficacy of ABM/P-15 (Peppen-P15) to promote attachment of periodontal ligament fibroblasts and provide better bone healing than ABM alone.

The present case series demonstrates that platelet rich fibrin, and xenograft Peppen-P15 enhances the clinical and the radiographic outcome in regeneration of intrabony osseous defects, as observed in the clinical studies by Pradeep AR et al and Lekovic V et al, indicating that PRF in combination with bone grafts like hydroxyapatite or bovine porous bone mineral, can significantly improve the regenerative effects within intrabony periodontal defects.<sup>[6],[7]</sup> The use of combination of Platelet rich fibrin with bone graft was more beneficial, as two distinct wound healing processes results in their synergistic effect.<sup>[8]</sup> Also, in present case series, a 3-dimensional volumetric analysis using Computed

TABLE 1 Clinical Parameters at Baseline and 6 and 9 months postoperative (mm)

	Case I (#30 MESIAL)			Case II (#20 MESIAL)			Case III (#21 DISTAL)		
	Baseline	6 months	9 months	Baseline	6 months	9 months	Baseline	6 months	9 months
PD	8	4	3	6	4	3	6	4	2
RAL	12	8	6	10	8	6	10	8	6
PGM (midbuccally)	7	6	6	4	3	3	8	7	7
BOP	0	1	0	0	0	1	0	0	1

TABLE 2 Radiographic Parameters at Baseline and 9 months postoperative

	Case I (#30 MESIAL)			Case II (#20 MESIAL)			Case III (#21 DISTAL)		
	Baseline	9 months	% gain	Baseline	9 months	% gain	Baseline	9 months	% gain
Linear Defect Depth (mm)	8.1	5.1	37	4.6	3.0	35	4.6	3.1	33
Bone defect volume (mm <sup>3</sup> )	11.6	3.4	70	12.4	5.6	55	11.0	2.1	81



Figure 4. Postoperative (9 months) Dentascan Images. A: sagittal section; B: axial section; C: coronal section; D: defect volume obtained; E: linear bone defect measurements; F: 3D Reconstructed model

tomography (CT) has been introduced, to overcome the difficulties caused by the nature of conventional radiography.<sup>[9]</sup> Recently, multi-slice Spiral tomography has replaced conventional Computed tomography. Dentascan, a dental computed tomography software program, is an extension of Computed tomography technology, which improves specificity and sensitivity over standard imaging.<sup>[10]</sup> The limitation to the use of CT scan is, it being an expensive mode of radiographic assessment, along with higher amount of radiation exposure than conventional IOPAs.

### Conclusions

The autologous mode of obtaining PRF is cost effective and less chaotic. To the best of our knowledge, use of PRF along with PEPGEN P-15 in the regenerative treatment of periodontal intrabony defects in humans, has not been previously reported. Also a new technique of volumetric analysis using DENTASCAN has been introduced here.

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