

# Histomorphological Comparison of Platelet Rich Fibrin Combinations for Ridge Preservation.

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## **ABSTRACT**

**Background**: Evidence shows that preservation of alveolar ridge dimension following tooth extraction is important for future implant placement. Several procedures have been developed to prevent ridge resorption following tooth extraction. Most commonly used techniques involve the use of bone substitutes and various types of membranes to cover the graft. The use of autologous Platelet Rich Fibrin (PRF) is a recent introduction to be used as a membrane to cover bone substitutes placed in extraction sockets as well as mixed with the graft material. (1,2) PRF is an inexpensive autologous gel enriched with platelets from venous blood that is easily processed in a clinical setting and contains a multitude of growth factors including PDGF, TGF-β, VEGF, EGF and IGF1. The purpose of this case report is to compare the histomorphologic results of various combinations of PRF, freeze dried bone allograft (FDBA) and polylactic acid membranes (Guidor®) in extraction sockets in a single patient.

Material & and Methods: A 49-year old female patient with a 12 pack-year smoking history presented for extraction of her remaining maxillary teeth in preparation for an implant retained complete denture. On the day of surgery, 40ml of venous blood was drawn and centrifuged to produce four PRF gels. Two PRF gels were minced and mixed with FDBA. Two clots were processed to be used as membranes to cover the sockets. Teeth #s 4, 6, 11, and 13 were extracted with minimal trauma and sockets were thoroughly debrided. Varying combination of FDBA, PRF, and Guidor® membranes were used for ridge preservation grafting in the four sockets. Four and half months following extraction, trephine cores were taken at the time of implant placement and submitted for histological analysis.

Results: Clinical healing was uneventful at all sockets but soft tissue healing appeared more on sites covered with PRF membranes. However, histologic healing showed more bone formation and maturation in the sites covered with Guidor® membranes.

Conclusions: Within the limits of this case report, although PRF membranes seemed to slightly enhance soft tissue healing, the use of Guidor® membranes appeared to improve hard tissue healing.

## **BACK GROUND**

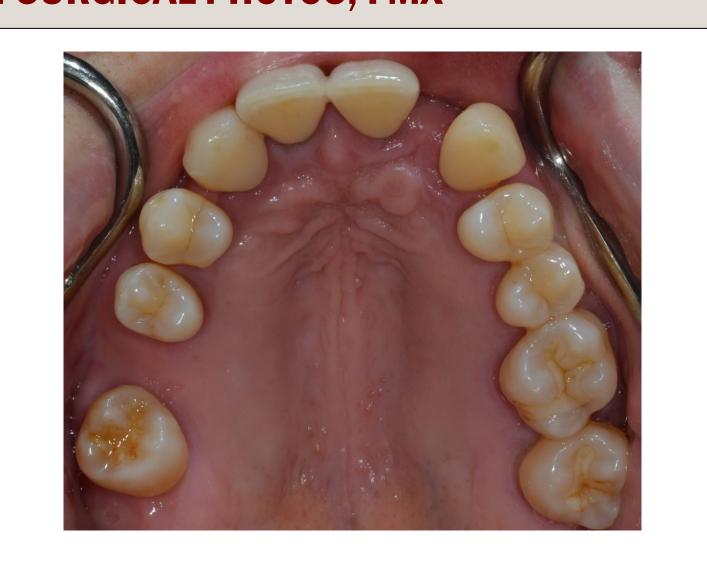
Adequate edentulous bony ridge dimensions, both horizontal and vertical, are essential for ideal implant placement to achieve optimum stability, esthetics and function. It is well documented that significant bone loss occurs post extraction in the edentulous ridge both in horizontal and vertical aspects, resulting in loss of up to 40-60% of ridge width and height within the first year after extraction(3).

Ridge preservation is a routine procedure that is effective in minimizing the loss of ridge width during healing. Freeze dried bone allograft (FDBA) is often used for ridge preservation and when placed in fresh extraction sockets serves as a scaffold for bone cells to migrate and form new

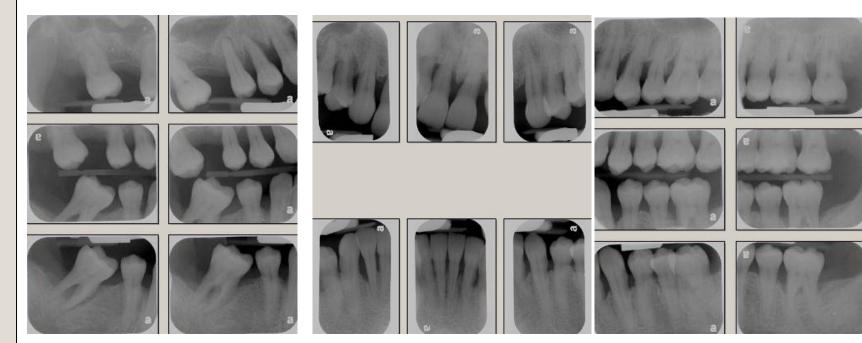
Platelet-rich fibrin (PRF) is a second generation platelet concentrate which is a fibrin gel enriched with platelets and is obtained from an anticoagulant-free blood harvest. Platelet alpha granules form an intra-cellular pool of wound healing molecules including PDGF, TGF-β, VEGF, EGF and IGF. Consequently, PRF is said to promote efficient cell migration and proliferation, and therefore may promote better wound healing. Its unique structure may also act as a vehicle for carrying cells that are essential for tissue regeneration. Admixing PRF with FDBA takes advantage of the biological properties of both materials and may enhance preservation of alveolar ridge

As far as authors' knowledge, there is no histomorphological comparison between combinations of PRF used for ridge preservation procedures.

## PRE-SURGICAL PHOTOS, FMX



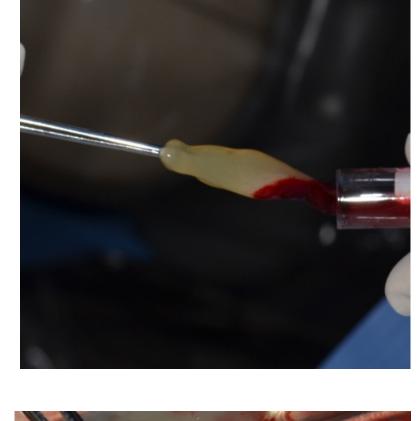


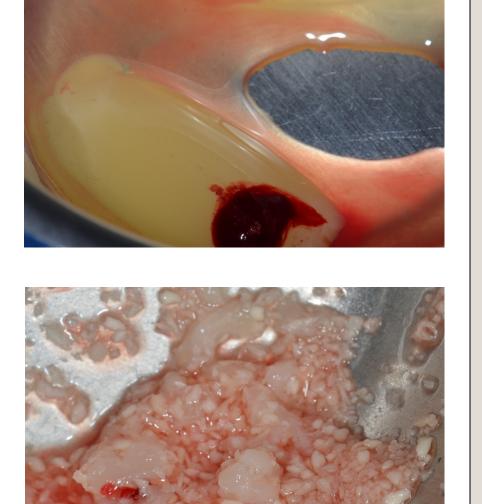


## PRF PREPARAATION

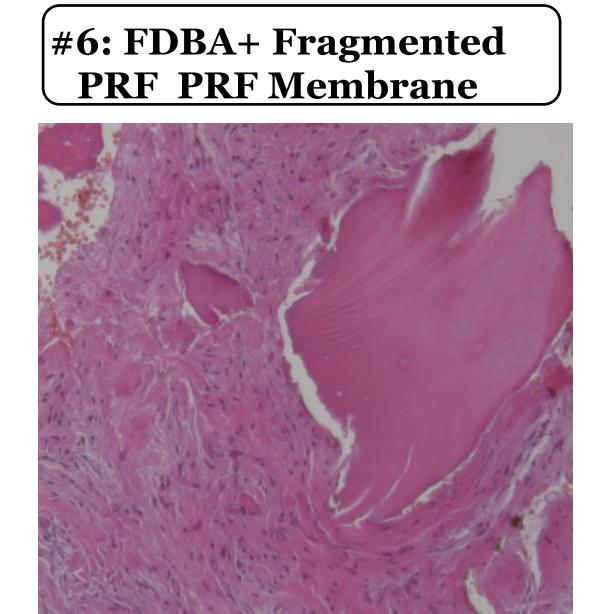


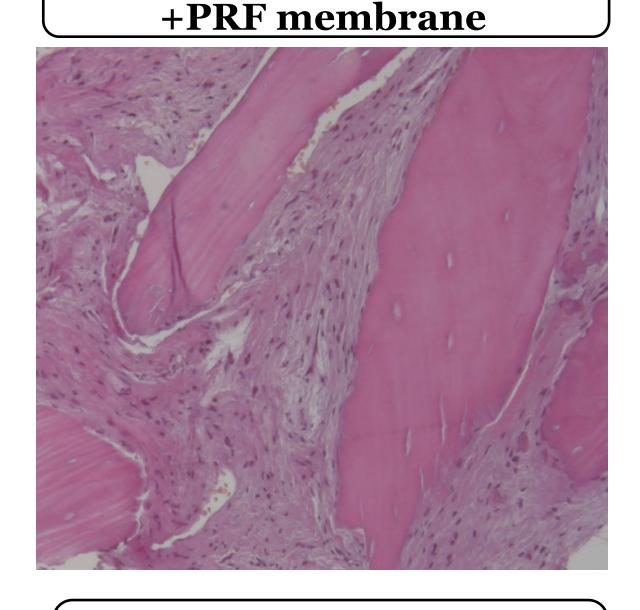






## HISTOLOGICAL EVALUATION





#11: FDBA

PRF+ Guidor Membrane

**#4: FDBA+ Fragmented** 

+ Guidor Membrane

membranes were used to graft the sockets as described below. #4: FDBA mixed with fragmented PRF + Guidor® membrane. #13: FDBA #6: FDBA mixed with fragmented PRF + PRF membrane.

#11: FDBA + PRF membrane.

**MATERIAL & METHODS** 

delayed implant placement.

#13: FDBA + Guidor® membrane.

Strapping sutures were placed with 5-0 Vycryl. Amoxicillin 500mg t.i.d for 7days, ibuprofen 600mg t.i.d for 3 days, and 0.12% chlorhexidine mouthrinse were prescribed post-operatively. Clinical healing was uneventful at all sites. Three months post extraction, CBCT imaging was obtained. Average simulated Haunsfield Units (HU) were measured with iCAT vision® software at an area of 2mm apically and mid B-L from the alveolar crest based on a fabricated radiographic stent. 2 x 2 mm bone cores were removed with a trephine drill for histological analysis from all four sites at the time of implant placement 4.5 months post extraction. Harvested core samples were stored in 10% folmalin until processing. H&E stain was performed on each sample. Under the light microscope, vital bone, residual bone graft material, and connective tissue were analyzed.

A 49-year old female was referred to Graduate Periodontics for extraction of

all maxillary teeth with placement of four dental implants for an implant-

retained complete denture. Informed consent was obtained from patient

all maxillary teeth, socket preservation with combination of FDBA with or

without fragmented PRF, PRF and Guidor® membrane with subsequent

On the day of surgery, 40ml (10ml x 4 tubes) of blood was drawn and was

for 8min. PRF gel were removed from each tube, and stored in a PRF box®

until ready for use. Two PRF gels were minced and mixed with FDBA. Two

PRF gels were compressed to use as membranes to cover the sockets. #4, 6,

11, and 13 were extracted with minimum trauma, the rest of teeth were

remained in order to maintain occlusal vertical dimension. Sockets were

thoroughly debrided. Various combinations of FDBA, PRF, and Guidor ®

processed to make four PRF gels. Four tubes were centrifuged with 3300rpm

after explaining costs, benefits and risks. The patient agreed to extraction of

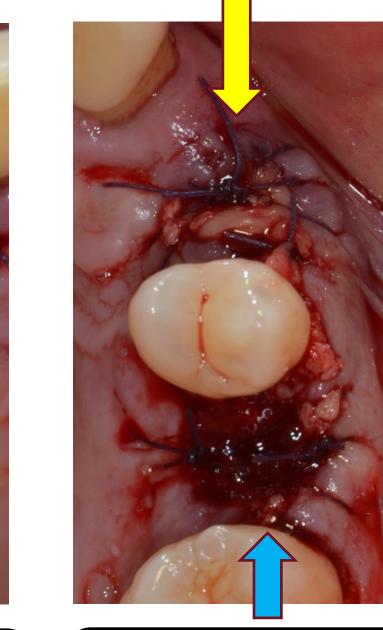
## **SURGICAL SITES**

## **FDBA** Fragmented PRF PRF Membrane

**FDBA** 

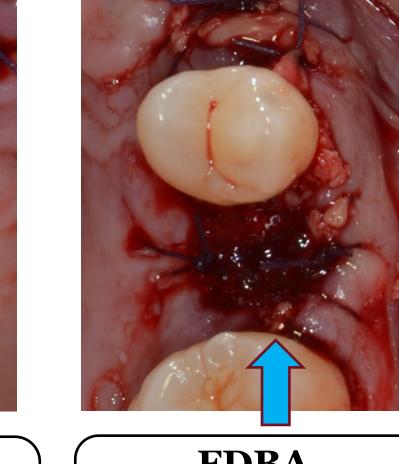
**Fragmented PRF** 

| Guidor Membrane



**FDBA** 

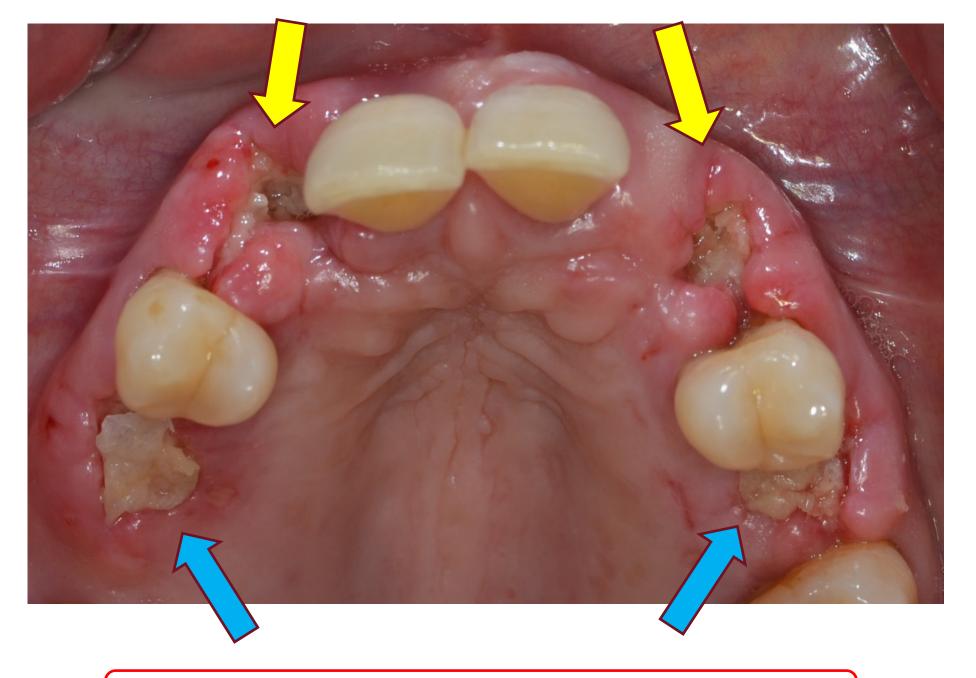
PRF Membrane.





## 1 Week POT

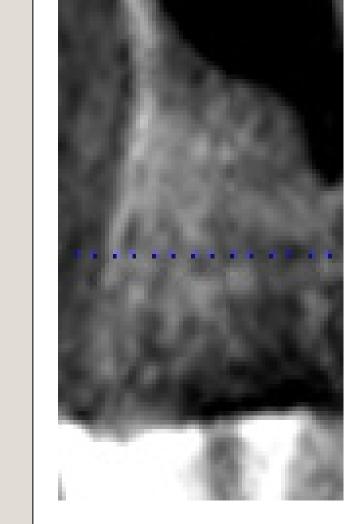
PRF Membrane was not noted

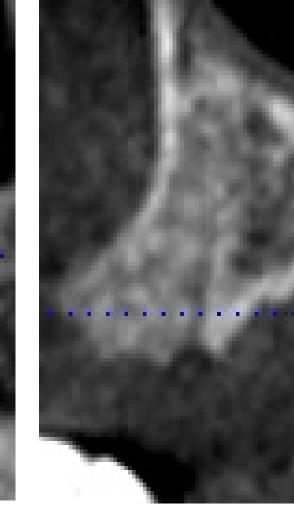


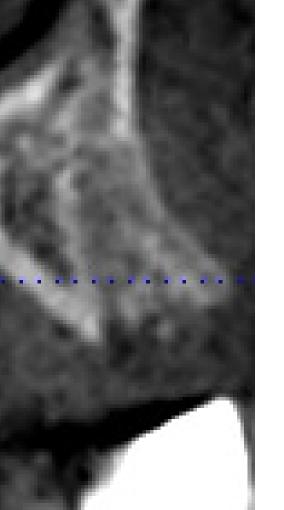
Guidor Membranes were intact

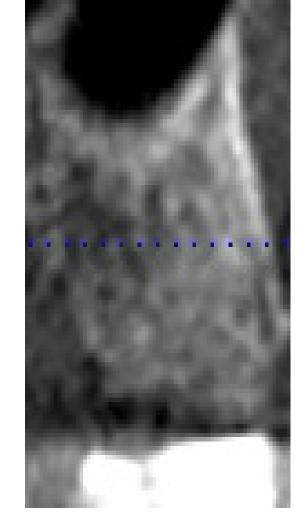
#### **CBCT IMAGES**

#11 HU:326±196.4 HU: 587±213.1 HU: 328±137.9 HU: 335±207.3









## **RESULTS**

All extraction sites healed uneventfully. Clinically, the sites covered with PRF membranes had faster soft tissue healing over the extraction sites than those covered with Guidor® membranes. Core samples for histological examination from each site were obtained only from the coronal part of implant osteotomy site due to technical difficulties in achieving parallelism to ensure optimal retention with locator abutments for the maxillary complete denture. Histologic analysis of core samples revealed more new bone formation around FDBA particles was found at the sites covered with Guidor® membranes regardless of whether minced PRF was added to the graft or not. The sites covered by PRF membranes demonstrated lesser amounts of new bone formation and more residual graft material remaining. CBCT imaging suggested more residual graft particles and borders of socket walls were clearly observed on #s 6 and 11. This suggests that a lower bone turnover rate was found on PRF membrane sites compared to Guidor® membrane sites. Since the radiographic stent was adjusted on #11 area after CBCT was taken, HU was measured on the middle of socket with 2x2mm on #11. HU of #6 was higher than other areas. All implants were placed without problems. Primary insertion torque of 30-35 N-cm was demonstrated for #s 6, 11, 13 while #4 demonstrated an insertion torque of only 5 N-cm.

## 2 Months POT

## 3 Months POT





## **DISCUSSION**

Higher bone turnover was anticipated in PRF membrane sites since potential growth factors in the PRF could stimulate epithelial healing and angiogenesis followed by earlier bone healing. Dohan showed that the degree of vibration of the centrifuge machine would affect the amount of slow releasing growth factors.(4) Since the use of PRF is relatively new technique, many variations of PRF generation (type of centrifuge, rpm, time) have been previously reported. There is no consensus on standardization of the protocol to optimize the capture and release of growth factors. In addition that, quantitative evaluation of each growth factors (ex, PDGF, TGF-β, BMP-2 etc.) were not evaluated with the particular centrifuge used in this case report. Further research will be needed to measure quantity of different types of growth factors to determine the optimal protocol.

Since the PRF membrane is more quickly resorbed compared to the Guidor® membrane, PRF was not found clinically at 1 week post operatively. As a consequence, FDBA particles were more exposed to the oral cavity. However, the Guidor® membranes minimized graft exposure because the membrane was tucked on the buccal and lingual flap tightly. Further investigation will be needed to determine the resorption rate of PRF membranes and its effect on the bone turnover under the membrane. It should be noted that the histologic cores in this report only reflect the most superficial bone (~2 mm) of the osteotomy site and may not reflect bone healing in deeper regions of the grafted sockets.

At the time of implant placement, lower primary stability was obtained on #4 (5 N-cm). On the contrary, optimal stability was achieved on #6, 11,13 with over 30 N-cm. The reason for this result might be due to lack of apical residual original bone on #4. At the time of extraction, vertical height from crest to sinus floor was less than 10mm. A crestal sinus floor elevation approach was attempted with FDBA for #4. On CBCT, the slight dome shape on the sinus floor was observed post-operatively. Within the limitations of this case report, it was concluded that Guidor® membrane sites have higher bone turnover rate at the shallow regions below the alveolar crest. Additional randomized clinical trials with a greater number of sites & subjects will be needed to make more definitive conclusions regarding potential benefits of PRF in bone healing.

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