

# COMPARISON BETWEEN PRF AND GELATIN SPONGE AS FILLING MATERIALS IN LATERAL SINUS LIFT PROCEDURES CONCURRENTLY WITH IMPLANT PLACEMENT

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## ABSTRACT:

**Aim of study:** was to compare the effectiveness of PRF (platelet rich fibrin) with gelatin sponge as filling materials in lateral sinus lift procedures simultaneously with implant placement.

**Materials and Methods:** This study included 20 patients underwent unilateral sinus floor lifting with simultaneous placement of 24 implants. In 10 patients we used the PRF as a sole filling material in the sinus and in other 10 patients we used the gelatin sponge. For each patient presurgical and 3 postsurgical (8days,3and6 months) panoramic x-rays were performed.

**Results:** The residual bone height was 3.9-6.8mm in PRF group, and 4.1-6.9mm in gelatin sponge group. After 3 months there was statistically significance difference in bone gain between the two groups and higher in PRF group ( $5.53\pm 1.10$ mm in PRF and  $3.07\pm 1.54$ mm in gelatin sponge). But there was no statistically significance difference in total bone gain after 6 months between the two groups ( $6.55\pm 1.36$ mm) and ( $6.05\pm 1.13$ mm) respectively. All implants in tow groups were clinically stable after 6 months.

**Conclusion:** both of materials could considered appropriate for this kind of procedures when implants are inserted in the same stage. However we think that PRF is better since the bone formation was faster in PRF group.

**Key words:** lateral sinus lift, autologous platelet rich fibrin, gelatin sponge, implant



## INTRODUCTION:

The atrophic posterior maxilla is a challenging site for oral rehabilitation with dental implants due to insufficient bone volume to accommodate dental implants. Crestal approaches or lateral window approaches for sinus augmentation are the most common surgical techniques to overcome vertical deficiencies of the atrophic posterior maxilla.<sup>[1-4]</sup> Using these approaches, implant placement can be performed in one or two surgical stages depending on the residual alveolar bone height. A

minimum of 4 to 5mm was recommended for a one-stage surgical procedure (simultaneous implant placement). Implant stability in the residual bone height is a key issue.<sup>[5-7]</sup>

Recently, a new approach was developed based on the concept of guided bone regeneration.<sup>[8]</sup> Several authors showed that a full sinus lift can be performed using the lateral approach with whole blood as the sole filling material.<sup>[9,10]</sup> This strategy requires the

implants to be stabilized in the residual bone height and to maintain the Schneiderian membrane pushed in the highest possible position using implant tips as tent pegs. Filling the sinus cavity with a stabilized blood clot remains quite difficult to control. The use of blood preparations such as platelet rich fibrin or material serve as a matrix for blood clot formation such gelatin sponge seem an interesting options to improve this sinus-lift approach.<sup>[11]</sup>

Choukroun's platelet-rich fibrin (PRF) was first described by Choukroun et al.<sup>[12]</sup> in France in 2001. The protocol is very simple, and many PRF clots can be produced in <20 minutes.<sup>[13,14]</sup> The use of PRF during sinus- lift procedures has been advocated for many years during lateral sinus-lift.<sup>[15,16,17]</sup>

Due to its hemostatic properties, gelatin sponge has been widely used in surgery as a wound dressing, adhesive and absorbent pad.<sup>[18]</sup> The advantage of gelatin over collagen matrix is its ease of extraction and preparation, which results in a cheaper and high quantity production of gelatin matrix. Furthermore, unlike collagen, gelatin does not express any antigenicity in physiological conditions.<sup>[19]</sup> Due to flexibility in shape, biocompatibility, affinity to proteins, and biodegradability, gelatin-derived sponges may be excellent candidates for bone graft scaffolds in low-load areas or as drug delivery materials. Gelatin sponges were successfully implanted in the defective areas of jaw after cyst enucleation.<sup>[20]</sup>

Also successful new bone formation in cases of sinus membrane elevation with using absorbable gelatin sponge as a sole filling material with immediate implant placement was reported.<sup>[21]</sup>

The objectives were to assess the relevance of both PRF clots and Gelatin sponge as filling materials during a lateral sinus lift procedures with immediate implantation using radiologic analyses in a case series and determine which material is more effective in such procedures.

## **MATERIALS AND METHODS:**

### **Patient Selection and Study Design**

This case series consists of 20 unilateral sinus elevations performed on 20 patients between July 2016 and July 2017 at the Department of Oral and Maxillofacial Surgery, Tishreen University, Lattakia, Syrian Arab Republic.

The patients were randomly divided into two groups. PRF group: consisted of 10 patients in which we used the autologous platelet rich fibrin (PRF) as a sole filling material after sinus membrane elevation, and gelatin sponge group: consisted of 10 patients in which we used the gelatin sponge as a sole filling material after sinus membrane elevation.

The patients were informed about the aim and design of the study, and written consent was obtained.

Patients with contraindicating systemic conditions were excluded. The inclusion criteria included absence of acute maxillary sinus inflammation no or a minor smoking habit (less than five cigarettes per day). The clinical examination and preoperative radiographs showed atrophy of the maxilla in the premolar/molar area that required a sinus lift before implantation. All of the cases in this preliminary series needed relatively small sinus lifts, with only one or two implants required per sinus. For each patient, a presurgical radiologic exam was performed using panoramic x-ray to evaluate the subsinus residual bone height (Fig. 1).

The patients included 10 males (50%) and 10 females (50%) with a mean age of ( $38.4 \pm 5.2$ ) years (range: 23 to 67 years). Presurgical standard blood analyses showed normal blood variables, particularly platelet and leukocyte concentrations.

The mean subsinus residual bone height was ( $5.40 \pm 0.97$  mm) in PRF group and ( $5.46 \pm 0.90$  mm) in gelatin sponge group. The width of the alveolar bone ridges was considered a noninterfering parameter because the width was always sufficient for a secure implantation.

### **PRF Preparation**

PRF clots were prepared as described by Choukroun et al.<sup>[12]</sup> During surgery, 50 ml whole blood was drawn into five glass-coated plastic tubes without anticoagulant and was immediately centrifuged at 3000 r/min for 12 minutes

using preparation kits and a centrifuge specifically designed for this application. The coagulation cascade lead to the formation of a natural fibrin clot in the middle of each tube. Clots were stored in metal cups before sinus filling.

### **Surgical Technique and Postoperative Management**

Surgery was performed with local anesthesia. Access to the buccal maxillary wall was achieved via a mucosal crestal incision, anterior and posterior releasing vestibular incisions, and full thickness flap elevation (Fig. 2A). A bone window was outlined using rounded surgical bur with constant saline irrigation (Fig.2B). After careful elevation of the Schneiderian membrane, the bone window was left attached to the membrane and served as a new sinus floor (Fig. 2C). The size of the window was always kept as small as possible to protect the osteogenic potential of the sinus cavity.

Implant sites were prepared with careful undersized drilling.

The implant is inserted in compression within the residual alveolar bone. The end of the implants always touched the elevated sinus membrane, and served as tent pegs (Fig.2 D and E).

In PRF group: Five PRF clots were inserted in compression inside the sinus cavity to fill all of the volume stabilized with the implants (Fig. 2F).

In gelatin sponge group: 5 pieces of gelatin sponge were inserted inside the sinus cavity to fill all the volume stabilized with the implants.

For postoperative management, medications were prescribed, including chlorhexidine rinses twice a day for 14 days, 1 g amoxicillin two times daily for 6 days (clindamycin, 500 mg · 2, two times daily, was used for penicillin-sensitive patients), ibuprofen (600 mg) three times daily unless medically contraindicated, and pain medication as needed for pain. Patients were not allowed to use any removable prosthesis. The sutures were removed 8 to 10 days postoperatively, and a panoramic x-ray was taken to check the position of the implants (Fig3).

### **Radiographic Follow-Up**

For each patient, a panoramic x-ray was obtained 8-10 days after the procedure and after 3 and 6 months to evaluate the bone gain around each implant in the sinus (Fig. 3, 4 and 5) and validate the next step of the treatment. After surgical uncovering, all implants had healing screws placed at 25 Ncm. At a later date, impressions were taken, and implant supported metal-ceramic crowns were placed within 2 to 4 weeks thereafter.

The aim of the radiographic analysis was to determine, the bone gain around each implant 3 months after sinus-lift surgery and after 6 months. Thus, each Panorama radiograph was analyzed using the Digora software. Two measurements of the residual bone

levels were performed around each implant (1 mm mesial, 1 mm distal) after 8 to 10 days and after 3 months and 6 months. For each implant, the mean bone gain was calculated in every stage.

Also the density of the bone which newly formed in the sinus was measured around each implant after 3 months and 6 months using Digora software.

The data were analyzed statistically using SPSS software. We used t's student test to compare PRF group with gelatin sponge group.

### **RESULTS:**

This case series included 20 unilateral sinus elevations performed on 20 patients who fulfilled the inclusion criteria and were treated with 24 implants. After surgery, healing was uneventful for all patients. Six months after surgery, all implants were clinically stable during abutment tightening.

The residual bone height range between 3.9 and 6.8 mm (mean  $\pm$  SD: 5.40  $\pm$  0.97 mm) in PRF group and between 4.1 and 6.9mm (mean  $\pm$  SD: 5.46  $\pm$  0.90 mm) in gelatin sponge group and there was no statistically significance difference between the two groups regarding the residual bone height. Early postoperative panoramic radiographs (8 to 10 days after surgery) showed implants inserted in the sinus cavity without dense tissue around them, since PRF and gelatin sponge fillings being radio transparent.

After 3 months the mean bone gain was  $5.53 \pm 1.10$ mm in PRF group and  $3.07 \pm 1.54$ mm in gelatin sponge group. P value was 0.001 ( $<0.01$ ) which means that there was statistically significance difference between the two groups regarding bone gain after 3 months and higher in PRF group.

Between 3 and 6 months the main bone gain was  $1.03 \pm 0.80$ mm in PRF group and  $2.98 \pm 1.12$ mm in gelatin sponge group. P value was 0.000 ( $<0.01$ ) which means that there was statistically significance difference between the two groups regarding bone gain in the time between 3 and 6 months after surgery, but this time higher in gelatin sponge group.

The mean of total bone gain was  $6.55 \pm 1.36$ mm in PRF group and  $6.05 \pm 1.13$  mm in gelatin sponge group. P value was 0.375 ( $>0.01$ ) although the mean of total bone gain after 6 months was higher in PRF group there was no statistically significance difference between the two groups. (table1)

After 3 months and using Digora software the density of newly formed bone in the sinus was  $130.37 \pm 5.52$  mm in PRF group and  $118.85 \pm 4.61$  mm in gelatin sponge group. P value was 0.000 ( $<0.01$ ) which means that there was statistically significance difference between the two groups

After 6 months the density according to Digora software was  $147.82 \pm 5.83$  mm in PRF group and  $135.54 \pm 4.14$  mm in gelatin sponge group. P value was 0.000

( $<0.01$ ) which means that there was statistically significance difference between the two groups. (table 2)

In all cases no implant was lost, leading to a 100% success rate after 6 months in tow groups.

## DISCUSSION:

### Sinus lift without bone graft material

Bone graft material was considered a prerequisite for the clinical success of dental implants inserted into the augmented maxillary sinus. Ginnady Pinchasov in 2014 found in his literature review clear radiological evidences to bone formation in the sinus after using lateral window technique for the lift while using blood clot alone for the bone formation.<sup>[22]</sup> The osteoinductive properties of the blood clot alone have been stressed in various studies.<sup>[23]</sup>

In our current clinical study, it was found that new bone can form directly on and around inserted dental implants without the use of bony substitutes and using only either the autologous PRF or the gelatin sponge as filling material in the lifted sinus. Thus, the cost-effectiveness and time-saving benefits are obvious, as instead of using autogenous bone or allografts, which involve a remodeling period of 6 months or 9-12 months, respectively, implants can be placed at the time of sinus lifting and left to osseointegrate without bone substitutes.<sup>[24,25]</sup>

Many studies suggested that the key role to this bone formation lies in Schneiderian membrane and the bone gain does not depend much on the type of grafting material used.<sup>[26]</sup> The leading reason to the bone regeneration is the innate osteogenic potential of the Schneiderian membrane and the basic principle behind bone formation is by guided tissue regeneration. While not all of the factors for this verity are clear, as well as the exact bone formation mechanism, it is possible that efficient space-maintaining management predicts an increase in bone gaining.<sup>[27,28]</sup>

#### **The use of PRF and gelatin sponge in lateral sinus floor lift procedures**

In the first international publication on using the PRF in sinus lift, it was assessed that a sinus grafting material built with an allograft and PRF in equal volume was suitable for implantation after only 4 months and potentially even more mature than a sole allograft after 8 months.<sup>[29]</sup> Another study showed that PRF membranes were easy to use during a Summers osteotomy and offered a good compromise as a filling material and shock absorber during sinus floor elevation and provided healing support for the damaged Schneiderian membrane.<sup>[30]</sup>

Ziv Mazor et al declared in his case series that the use of PRF as the sole filling material during a simultaneous sinus lift and implantation stabilized a high volume of natural regenerated bone in

the subsinus cavity up to the tip of the implants.<sup>[31]</sup>

The results of our study agreed with results of Ziv Mazor's study that PRF is a valid filling material in lateral sinus floor procedures, since the bone formation was clear in all cases in PRF group.

Alain Simonpieri et al 2011 performed Twenty-three lateral sinus elevations on 20 patients with simultaneous implant placement and used the L-PRF as sole filling material under the sinus membrane, The maximum follow-up was 6 years, and all patients were followed up for a minimum of 2 years. No implant was lost during this 6-year experience, and the vertical bone gain was always substantial.<sup>[32]</sup>

The results of our study agreed with the results of Alain Simonpieri 's study, since the bone formation was sufficient in PRF group and all implants were stable during abutment tightening.

Sohn et al performed 9 sinus membrane elevation with using absorbable gelatin as a sole filling material with immediate implant placement in 7 patients and 18 implants were inserted. After uncovering the implants an average of 6 months after placement, new bone consolidation in the maxillary sinus was observed on radiographs without bone graft. Two implants were removed due to failed osseointegration on uncovering. Failures were caused by insufficient initial stability.<sup>[21]</sup>

In our study bone gain was clear in all cases of Gelatin sponge group and all implants were stable after 6 months of healing period, initial stability was crucial in our study.

While the success with this technique is similar to those of conventional procedures, there is less contamination associated with this procedure, as no external grafts and/or additional surgeries are involved. With this line of reasoning, a broad and firm consensus has been established regarding the importance of blood clot formation, which serves as autogenous graft filler material for bone regeneration during graftless maxillary sinus lifting.<sup>[22,23]</sup>

#### **PRF or Gelatin sponge?**

In this study we compared the effectiveness of the natural blood clot which formed in gelatin sponge group with the autologous PRF which considered as optimized blood clot when they used as filling materials in lateral sinus lift simultaneously with implant placement.

We found that new bone formation in the sinus was evident in both groups. After 6 months the main of total bone gain was higher in PRF group comparing with gelatin sponge group [(6.55 ± 1.36 mm) and (6.05 ± 1.13 mm) respectively] but there was no statistically significance difference, both of these materials served as scaffold for formation of blood clot which finally replaced by new bone, we can conclude that the key factors of success of sinus lift are the space

maintenance which achieved in our study by placement the implants in the same stage and stabilized blood clot which was achieved in our study either by using the gelatin sponge or by using the autologous PRF.

After 3 months the main of bone gain in PRF group was statistically higher than gelatin sponge group (5.53 ± 1.10mm and 3.07 ± 1.54mm) respectively. It could be because the properties of PRF which considered as an optimized blood clot. Many research suggested that PRF may improve the healing of Schneiderian membrane and stimulate its periosteum like behavior and perhaps increase or stabilize the bone volume around the implant end.<sup>[33,34]</sup> Moreover PRF releases growth factors, such as transforming growth factor, vascular endothelial growth factor, and platelet-derived growth factor.<sup>[35]</sup> These major growth factors released from platelets stimulate cell proliferation and migration to promote wound healing.<sup>[36]</sup>, and maybe that's why bone gain was higher after 3 months in PRF group comparing with gelatin sponge group. The density of newly formed bone was significantly higher in PRF group comparing with gelatin sponge group after 3 and 6 months that's could be because the PRF has strong matrix architecture which calcified faster and more effectively than natural blood clot.

#### **CONCLUSION:**

We can conclude that both of autologous platelet rich fibrin and gelatin sponge are

suitable as filling materials in lateral sinus floor lifting when there is sufficient residual alveolar bone height to insert the implants in the same procedure. However we found that PRF is more efficient since the healing was more rapid, so we could decrease the healing period for 4 months. And we recommend more researches about this issue.

- Having narrow smile fullness (28% buccal corridor) should be included in the problems list.

- Excessive teeth showing with 2% buccal corridors showed to be not the most attractive smile in this study.

- Medium broad smile fullness (10% buccal corridor) considered to be the most attractive.

- There was no significant difference in judging the effects of buccal corridors on the smile attractiveness between male and female raters.

## REFERENCES:

1. Boyne PJ, James RA. Grafting of the maxillary sinus floor with autogenous marrow and bone. *J Oral Surg.* 1980;38:613–616.
2. Tatum H Jr. Maxillary and sinus implant reconstructions. *Dent Clin North Am.* 1986;30:207–229.
3. Misch CE. Maxillary sinus augmentation for endosteal implants: Organized alternative treatment plans. *Int J Oral Implantol.* 1987;4:49–58.
4. Chanavaz M. Maxillary sinus: Anatomy, physiology, surgery, and bone grafting related to implantology—Eleven years of surgical experience (1979–1990). *J Oral Implantol.* 1990;16:199–209.
5. Browaeys H, Bouvry P, De Bruyn H. A literature review on biomaterials in sinus augmentation procedures. *Clin Implant Dent Relat Res* 2007;9:166-177.
6. Fermergard R, Astrand P. Osteotome sinus floor elevation and simultaneous placement of implants—a 1-year retrospective study with Astra Tech implants. *Clin Implant Dent Relat Res* 2008;10:62-69.
7. Diss A, Dohan DM, Mouhyi J, Mahler P. Osteotome sinus floor elevation using Choukroun's platelet-rich fibrin as grafting material: A 1-year prospective pilot study with microthreaded implants. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2008;105:572-579.
8. Jeong SM, Choi BH, Li J, Xuan F. A retrospective study of the effects of sinus membrane elevation on bone formation around implants placed in the maxillary sinus cavity. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2009;107:364-368.

9. Lundgren S, Cricchio G, Palma VC, Salata LA, Sennerby L. Sinus membrane elevation and simultaneous insertion of dental implants: A new surgical technique in maxillary sinus floor augmentation. *Periodontol* 2000 2008;47:193-205.
10. Thor A, Sennerby L, Hirsch JM, Rasmusson L. Bone formation at the maxillary sinus floor following simultaneous elevation of the mucosal lining and implant installation without graft material: An evaluation of 20 patients treated with 44 Astra Tech implants. *J Oral Maxillofac Surg* 2007;65:64-72.
11. Hatano N, Sennerby L, Lundgren S. Maxillary sinus augmentation using sinus membrane elevation and peripheral venous blood for implant-supported rehabilitation of the atrophic posterior maxilla: Case series. *Clin Implant Dent Relat Res* 2007;9:150-155.
12. Dohan Ehrenfest DM, Rasmusson L, Albrektsson T. Classification of platelet concentrates: From pure platelet-rich plasma (P-PRP) to leucocyte- and platelet-rich fibrin (L-PRF). *Trends Biotechnol* 2009;27:158-167.
13. Choukroun J, Adda F, Schoeffler C, Vervelle A. An opportunity in peri-implantology: The PRF (in French). *Implantodontie* 2001;42:55-62.
14. Dohan DM, Choukroun J, Diss A, et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part II: Platelet-related biologic features. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006; 101:e45-e50.
15. Dohan DM, Choukroun J, Diss A, et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part III: Leucocyte activation: A new feature for platelet concentrates? *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006;101:e51-e55.
16. Choukroun J, Diss A, Simonpieri A, et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part V: Histologic evaluations of PRF effects on bone allograft maturation in sinus lift. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006;101:299-303.
17. 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.
18. Simonpieri A, Del Corso M, Sammartino G, Dohan Ehrenfest DM. The relevance of Choukroun's platelet-rich fibrin (PRF) and metronidazole during complex maxillary rehabilitations using bone allograft. Part II: Implant surgery, prosthodontics and survival. *Implant Dent* 2009;18:220-229.
19. K. TOMIHATA, K. BURCZAK, K. SHIRAKI and Y. Ikada, in "Polymers of Biological and Biomedical Importance", edited by S. W.

- SHALABY, Y. IKADA, R. S. LANGER and J. WILLIAMS (American Chemical Society Symp Series, 1994)
20. M. SELA and R. ARNON, *Biochem. J.* 75 (1960) 91
  21. L. BODNER, *J. Oral. Maxillofac. Surg.* 54(11) (1996) 1282
  22. Sohn et al. Bone Formation Using Absorbable Gelatin. *J Oral Maxillofac Surg* 2010.
  23. Pinchasov G, Juodzbaly G. Graft-Free Sinus Augmentation Procedure: a Literature Review. doi: 10.5037/jomr.2014.5101.
  24. Lundgren S, Andersson S, Gualini F, Sennerby L. Bone reformation with sinus membrane elevation: a new surgical technique for maxillary sinus floor augmentation. *Clin Implant Dent Relat Res* 2004;6:165–73.
  23. Xu H, Shimizu Y, Ooya K. Histomorphometric study of the stability of newly formed bone after elevation of the floor of the maxillary sinus. *Br J Oral Maxillofac Surg* 2005;43:493–9
  25. Hallman M, Sennerby L, Lundgren S. A clinical and histologic evaluation of implant integration in the posterior maxilla after sinus floor augmentation with autogenous bone, bovine hydroxyapatite, or a 20:80 mixture. *Int J Oral Maxillofac Implants* 2002;17:635–43.
  26. Thor A, Sennerby L, Hirsch JM, Rasmusson L. Bone formation at the maxillary sinus floor following simultaneous elevation of the mucosal lining and implant installation without graft material: an evaluation of 20 patients treated with 44 Astra Tech implants. *J Oral Maxillofac Surg* 2007;65:64–72.
  27. Bell GW, Joshi BB, Macleod RI. Maxillary sinus disease: diagnosis and treatment. *Br Dent J.* 2011 Feb 12;210(3):113-8.
  28. Johansson LÅ, Isaksson S, Adolfsson E, Lindh C, Sennerby L. Bone regeneration using a hollow hydroxyapatite space-maintaining device for maxillary sinus floor augmentation--a clinical pilot study. *Clin Implant Dent Relat Res.* 2012 Aug;14(4):575-84. Epub 2010 Jun 2.
  29. Kaneko T, Masuda I, Horie N, Shimoyama T. New bone formation in nongrafted sinus lifting with space-maintaining management: a novel technique using a titanium bone fixation device. *J Oral Maxillofac Surg.* 2012 Mar;70(3):e217-24.
  30. Choukroun J, Diss A, Simonpieri A, et al. Platelet-rich fibrin (PRF): A second-generation platelet concentrate. Part V: Histologic evaluations of PRF effects on bone allograft maturation in sinus lift. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006;101:299-303.
  31. Diss A, Dohan DM, Mouhyi J, Mahler P. Osteotome sinus floor elevation using Choukroun's platelet-rich fibrin as grafting material: A 1-year prospective pilot study with microthreaded implants. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2008;105:572- 579.

32. Ziv Mazor et al .Sinus Lift With Platelet-Rich Fibrin as Sole Grafting Material J Periodontol 2009;80:2056-2064.
33. Alain Simonpieri, SIMULTANEOUS SINUS-LIFT AND IMPLANTATION WITH L-PRF, Implant Dent 2011;20:2–12
34. van Hinsbergh VW, Collen A, Koolwijk P. Role of fibrin matrix in angiogenesis. Ann N Y Acad Sci 2001;936:426-437.
35. Clark RA. Fibrin and wound healing. Ann N Y Acad Sci 2001;936:355-367.
36. Sohn DS, Heo JU, Kwak DH, et al. Bone regeneration in the maxillary sinus using an autologous fibrin-rich block with concentrated growth factors alone. Implant Dent 2011 Oct;20:389–395.
37. Su CY, Kuo YP, Tseng YH, Su CH, Burnouf T. In vitro release of growth factors from platelet-rich fibrin (PRF): A proposal to optimize the clinical applications of PRF. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009 Jul;108:56–61.

**TABLES:**

P-value	T	SE	SD	Mean	No	Group	
*0.001	-4.117	0.49	1.54	3.07	10	Gelfom	Bone gain after 3 months
		0.35	1.10	5.53	10	PRF	
*0.000	4.460	0.36	1.12	2.98	10	Gelfom	Bone gain between 3 and 6 months
		0.25	0.80	1.03	10	PRF	
0.375	-0.909	0.36	1.13	6.05	10	Gelfom	Total bone gain after 6 months
		0.43	1.36	6.55	10	PRF	

Table 1: bone gain

\*:P-value <0,01 which means there is significance difference between the two groups

P-value	T	SE	SD	Mean	No	Group	
**0.000	-5.065	1.46	4.61	118.85	10	Gelfom	Bone density after 3 months
		1.75	5.52	130.37	10	PRF	
**0.000	-5.432	1.31	4.14	135.54	10	Gelfom	Bone density after 6 months
		1.84	5.83	147.82	10	PRF	

Table 2: bone density according to Digora software

\*\* : P value <0.01 which means that there is significance difference between the two groups

**FIGURES:**



Figure 1: preoperative panoramic x-ray

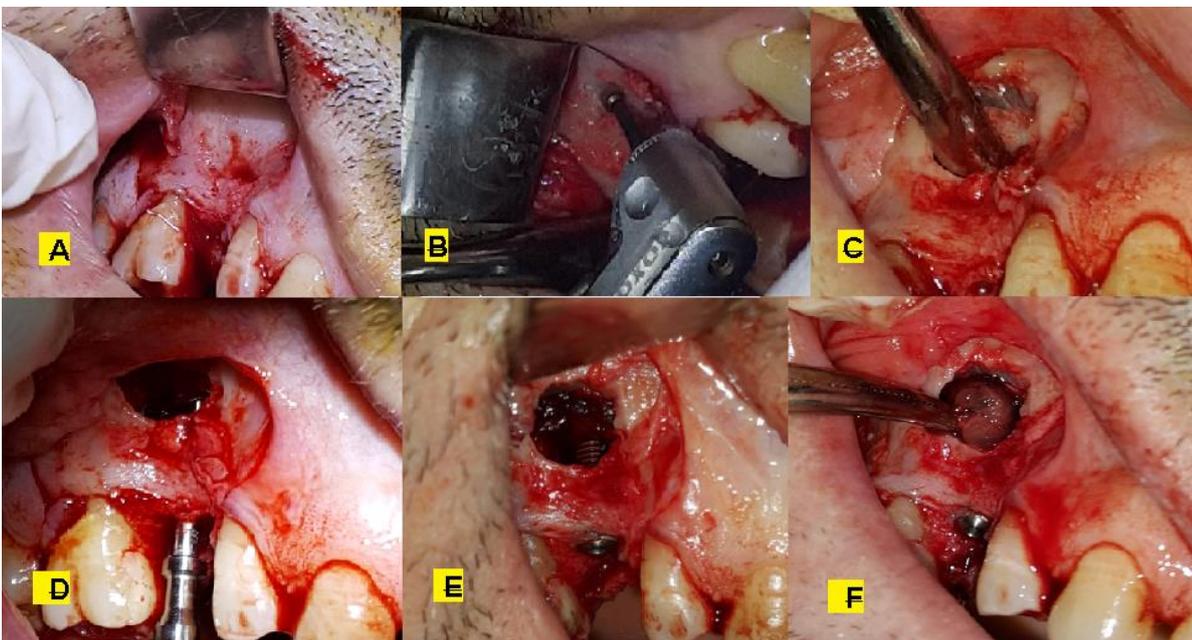


Figure 2: A: a buccal flap was created, B: outline the lateral bone window, C: sinus membrane elevation, D: osteotomy was prepared for implant, E: implant was inserted, F: filling the new compartment under the elevated sinus membrane with PRF clots.

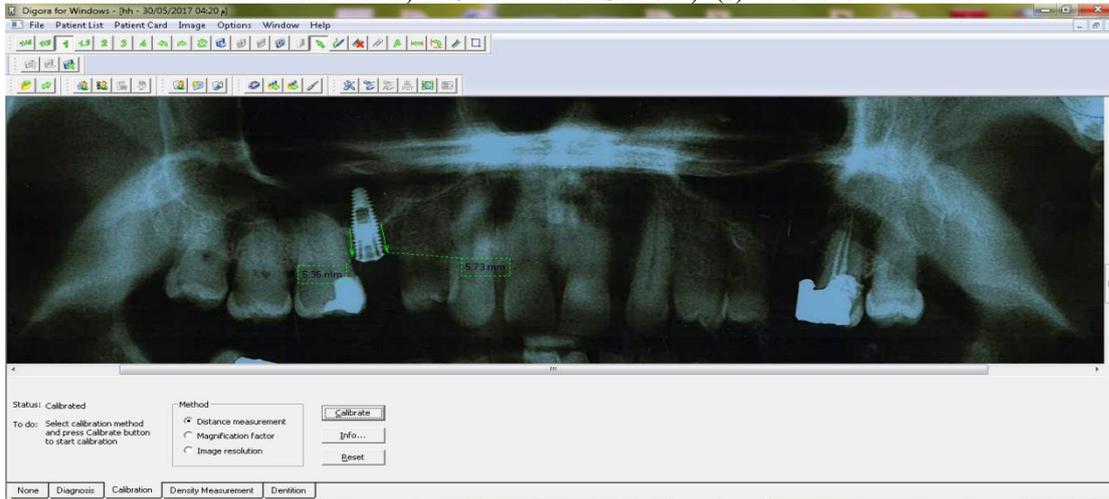


Figure 3: panoramic x-ray 8 days after surgery showing the residual alveolar bone height in implant site measured by Digora software, since PRF is radiolucent.

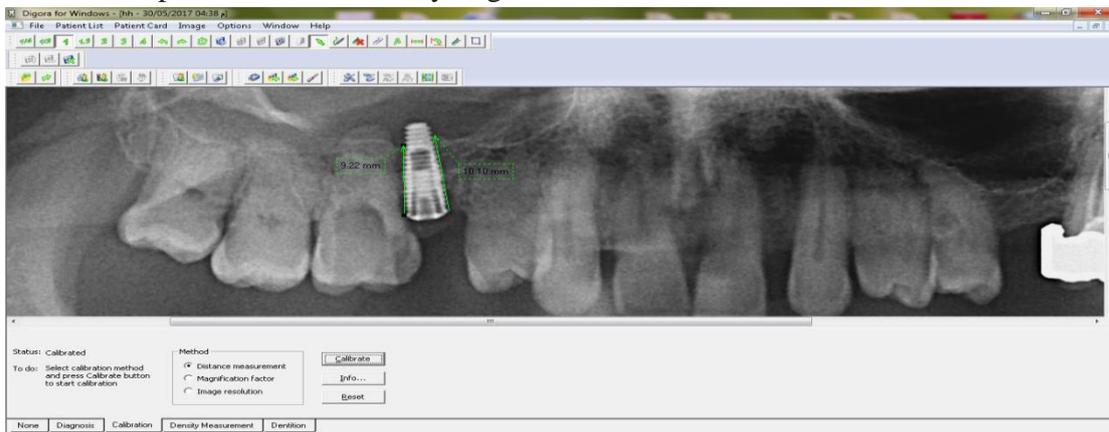


Figure 4: panoramic x-ray 3 months after surgery demonstrating bone gain around implant intra sinus measured using Digora software.

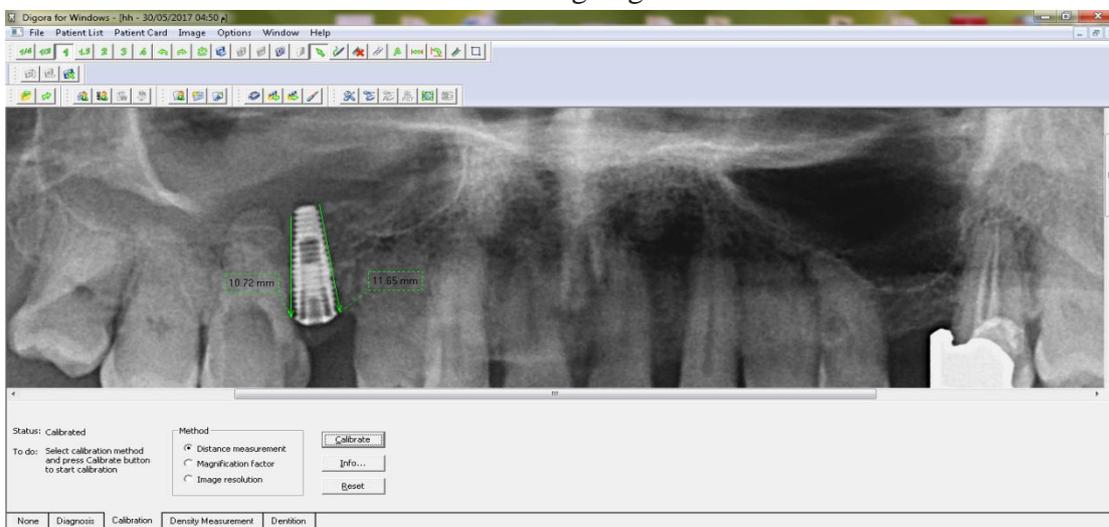


Figure 5: panoramic x-ray 6 months after surgery showing the new sinus floor approximately at the level of implant tip.