

## Rehabilitation of the Posterior Atrophic Maxilla by using the minimal invasive IPG-DET technique with CGF and CD34+ stem cells

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### Abstract

A 54 years old patient, partially edentulous, non-smoker and female was treated with a new innovative and minimal invasive technique (IPD-DET Technique). The patient had a severe bilateral atrophic posterior maxilla. Since now, in cases like that we use extensive surgical protocols like sinus lift elevation with high cost, discomfort for the patients and unstable results. IPG-DET technique introduces the sinus membrane intentional perforation as an alternative. By using this method with an autologous biomaterial (CGF-CD34+Matrix) we can have a safe and stable alternative solution in such difficult cases. In our case we can see the new bone formation after only a few months of the surgical placement of the implants. IPG-DET is simple, safe less painful and cost-effective procedure.

**Keywords:** Maxillary Sinus; Bone Augmentation; IPG-DET Technique; Flapless Surgery; Dental Implants; Sinus Membrane Intentional Perforation; Concentrated Growth Factors; CD34- Positive Stem Cells

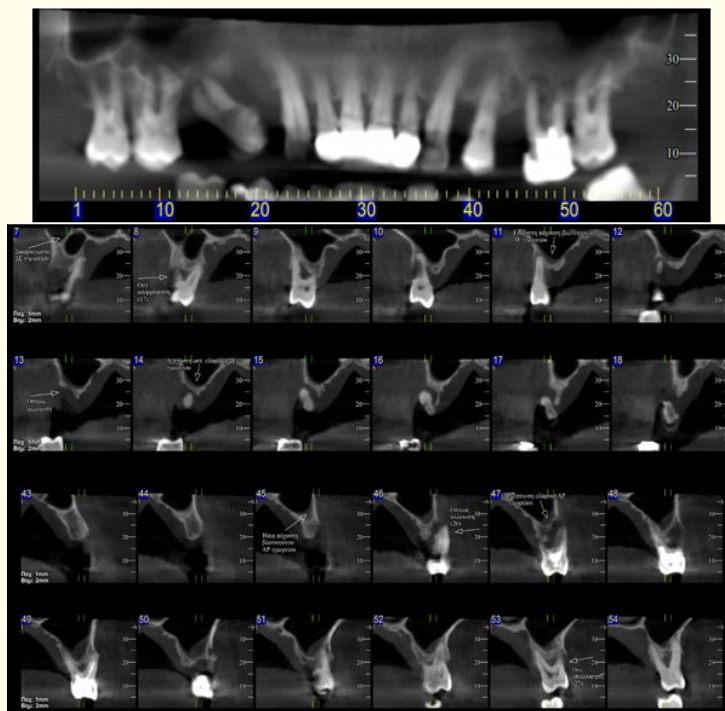
### Introduction

The maxillary sinus, the largest of all paranasal sinuses, is shaped like a pyramid, with dimensions of approximately 2.5 cm in width, 3.75 cm in height, and 3 cm depth [1]. When patients lose teeth in the posterior maxilla, alveolar bone resorption follows, both centripetal, as a consequence of the physiological bone remodeling following tooth loss, and also from sinus cavity pneumatization toward the alveolar crest [2]. These two processes usually result in limited bone availability for implant placement, hence requiring a regenerative procedure, the so-called maxillary sinus lifting procedure. Many complications have been reported by using the classical surgical procedure of sinus lift augmentation. The reported incidence of chronic rhinosinusitis after sinus lifting is low, ranging from 4.2% to 8.4% [3-5]. However its management can be complex and may necessitate removal of the graft material and the implants [6]. The blood supply of the maxillary sinus is provided by the maxillary artery, which provides several branches that perfuse the sinus cavity and its surrounding tissues and structures, such as the infraorbital artery, the anterior superior palatine artery, and the posterior superior alveolar artery. It is common to find several anastomoses between the posterior superior alveolar artery and the infraorbital artery inside the lateral bony wall of the sinus [7, 8]. When the sinus artery is accidentally damaged during surgery, hemostatic measurements have to be applied immediately to control the bleeding. If the vessel course is accessible, it can be clamped with an instrument and sutured on its distal end. However, when the vessel is damaged in close proximity to the window borders, the artery might retract and

not be accessible for clamping. In these situations, the use of hemostatic agents, such as aminocaproic acid or bone wax, can be applied to the bone until hemostasis is achieved. Finally the most frequent intrasurgical complication of open sinus lifting is the perforation of the Schneiderian membrane during its dissection and reflection from the sinus bone walls. The reported incidence varies widely, ranging from 6% to 42%;[9-15]. however, most publications have reported rates between 20% and 25%[37-44]. “IPG-DET Technique” [16-20], which introduces the immediate placement of implants in the sinus cavity with intentional perforation of the sinus membrane by simultaneously employing concentrated growth factors (CGF with stem cells CD34+) and bone grafting. Throughout this study, two (2) implants were placed by a minimally invasive surgery flapless technique named “IPG-DET Technique” in both sinuses on the same patient. After a 5-month healing period, radiographic (Panoramic X-Ray scans) and clinical evaluation (Implant Stability Quotient - ISQ measurement, by Osstell) have shown excellent implant stability.

## Methods

The patient in this case was partially edentulous. Both posterior maxilla were atrophic (Figure 1 up) and we decided with her consent to use the innovative and minimal invasive IPG-DET technique for her rehabilitation. Patient was female, 54-years old, non-smoker and without medical history. We placed six(6) MultySystem (Milan, Italy) implants (4 implants - immediate 3,7/10 mm at regions #12, #15, #25, #26 and 2 implants - immediate 4,2/13 mm at #27 and 4,7/10 mm at #14) in both posterior regions (Figure 1 down) (implants at regions #15 and #27).

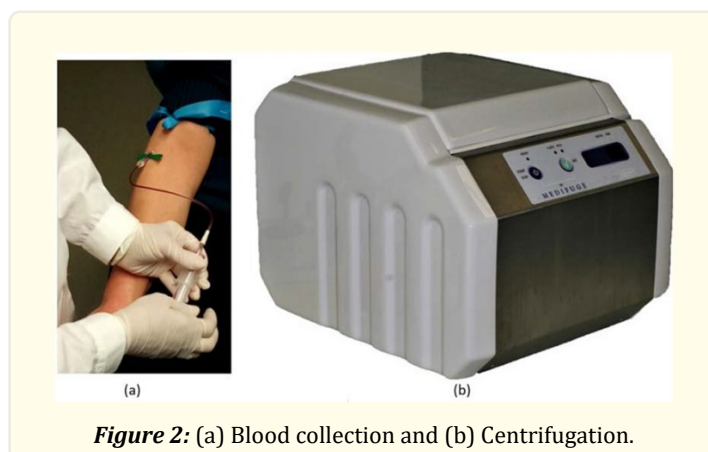


**Figure 1:** Diagnostic X-ray evaluation before surgery with panoramic view (up) and each single implant position cut (down) of initial CBCT.

### *We used the CGF(CGF-CD34+ stem cells) protocol*

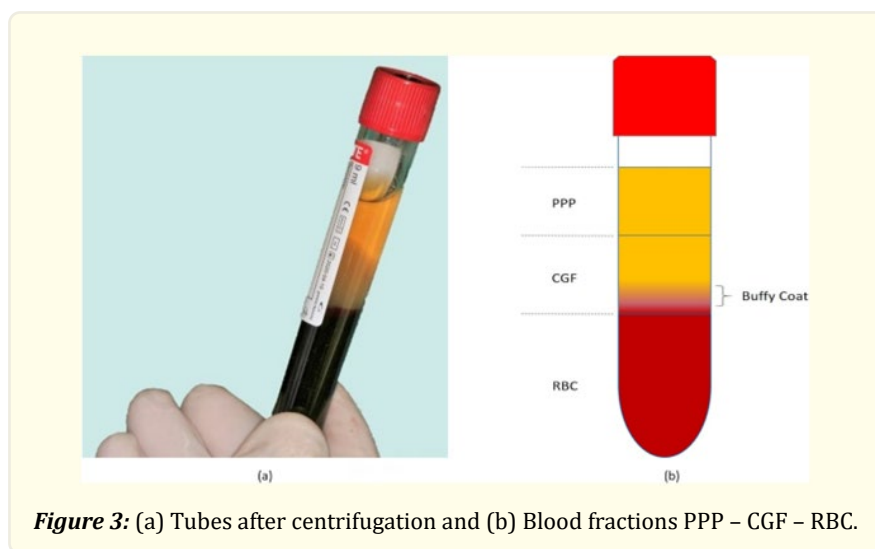
Blood drawing procedure: We collect the blood from the patient by using sterile tube with red caps (Figure 2a). The quantity of the blood needed for the majority of dental activities is around 18-36 ml, which is essentially 2-4 tubes. For more extensive operative cases 54-72ml can be used(about 6-8 tubes).

Placement of the tubes following blood drawing inside the appliance. When the tubes are placed in the aforementioned way, the function “CGF” on the display is chosen in order for the centrifugation to start. Courtesy of: Medifuge (Silfradent, Italy) (Figure 2b) for 15min.



**Figure 2:** (a) Blood collection and (b) Centrifugation.

Cell separation: The tubes vacuates soon after the centrifugation (Figure 3a). three blood fractions were formed: 0,5-0,8 ml serum, 2 ml PPP(Platelet Poor Plasma), 2ml PRP(Platelet Rich Plasma), 0,7ml Buffy Coast(White Layer PRP, RBC + CD34+ stem cells), 4ml RBC(Red Blood Cells) (Figure 3b).



**Figure 3:** (a) Tubes after centrifugation and (b) Blood fractions PPP – CGF – RBC.

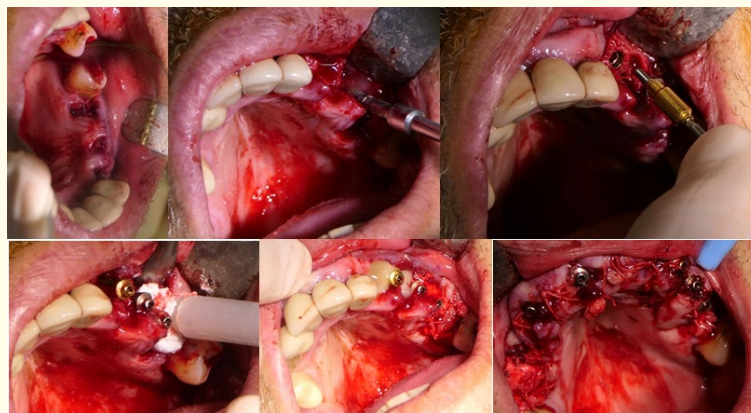
We cut with scissors the RBC red layer in order to obtain CGF. CGF contains autologous osteoinductive platelet growth factors and an osteoconductive fibrin matrix. It is also present in CGF: TGF- $\beta$ 1, VEGF and CD34+ cells. The application of CGF in our case resulted in excellent healing and the new bone formation without using the know method of sinus lift augmentation (Figure 4a and 4b).



**Figure 4:** (a) Separation with scissors from RBC layer in order to acquire (b) CGF-CD34+ matrix.

For the surgical procedure we followed the below stages:

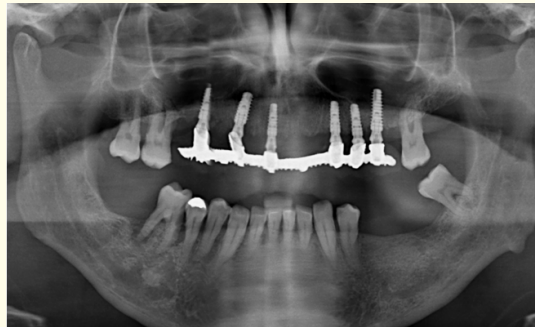
1. Advacement of one CGF-CD34+ Matrix inside the sinus.
2. Insertion of a second CGF-CD34+ Matrix mixed and homogenized with a bone substitute of our choise, into the sinus.
3. Placement of the implant after its impregnation into the liquid phase CGF(LPCGF) for the creation of a CGF bioactive membrane around it.
4. Placement of the cover screws (Figure 5a-5f).



**Figure 5:** Clinical Photos during surgery.

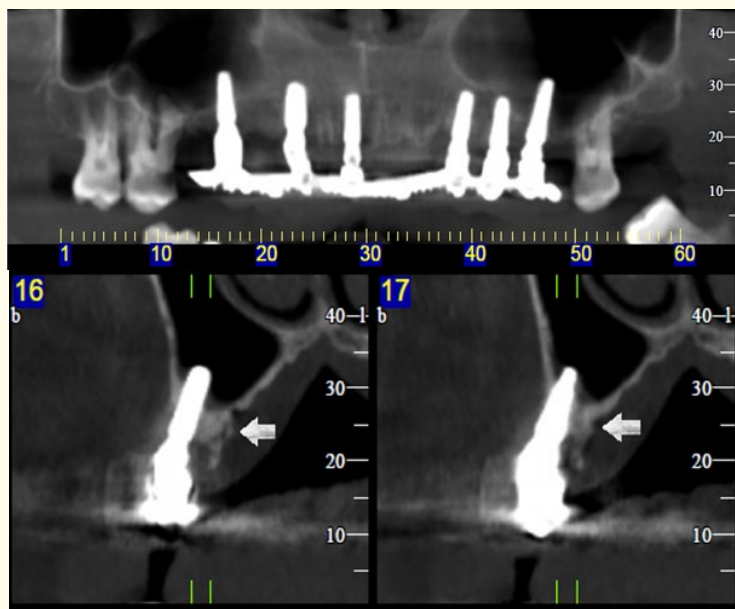
## Results

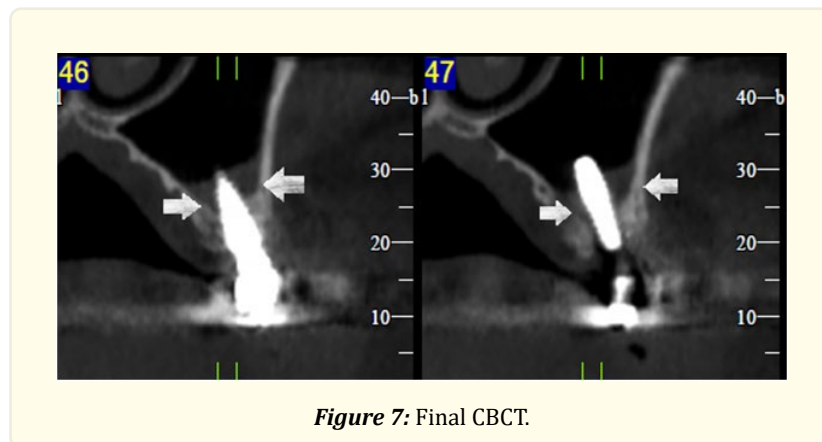
After six months panoramic x-rays shows the new bone formation after the implants placement. Bone regeneration in the sinus, around the implants can be seen. Also there is a total osseointegration and huge bone regeneration in the sinus.



**Figure 6:** OPG X-rays from (up) the day of surgery and (down) after a five-month healing period showing osseointegration of all 6 implants.

Checking the stability of implants with Ostell method, 6 months after its placement the Ostell stability values were between 63-69. Also no symptoms of sinusitis were observed in our patient. CT Scan also shows the completely osteointegration and the huge bone regeneration in the sinus. (Figure 7).





**Figure 7:** Final CBCT.

## Discussion

IPG-DET technique is a new, pioneering regenerative technique of internal traumatic bone regeneration in the sinus without the need for sinus floor elevation (SE). The IPG DET technique uses CGF-CD34+ Matrix, a complex of fibrin, concentrated growth factors and stem cells with simultaneous intentional perforation of the Schneider's membrane.

These two characteristics, the use of CD34+ stem cells from the same patient and the perforation of the sinus membrane, constitute the main differences of the IPG technique as compared to all the other techniques and methods of sinus floor elevation.

Clinical research so far shows that this is a solution to the difficulties that the dentist faces when he/she plans to place implants in the posterior region of the maxilla, an area presented with the highest needs for implant therapy. These areas are usually present with extensive bone resorption and with bone mass of low quality and density.

The need for a technique that gives the dentist the ability to place implants in these regions of the maxilla, in a simple manner, avoiding time-consuming regenerative operations of high cost, was imperative.

The "restriction" of the sinus was obliging all the present worldwide known techniques to operate between the bone ridge and the base of the sinus membrane with great care, in order to avoid membrane rupture. Consecutive to this fact, the use of shorter implants was also employed.

The problem is solved with the IP DET technique, with the intentional perforation of the Schneider's membrane, with the use of special instruments, and the insertion of the pure biomaterial CGF-CD34+ Matrix into the pith, towards the sinus cavity. This way we can place implants at least 8 to 10 mm in length.

## Conclusion

By using IPG-Det technique, we take advantage of the waiting time for bone regeneration, also gaining time and reducing the cost of the procedure, since we avoid long and painful operations. In addition, the trained dentist can therefore treat similar cases in the dental surgery.

This simple technique changes completely what we have so far known about the treatment plan for the exact position and the procedure that is used to place implants in the posterior region of maxilla.

Finally, we need to mention that apart from the 7-year research by the Dentist Education Institute, further studies are required for the validation and documentation of the effectiveness and safety of the method.



We also need to point out that it is necessary for the dentist wishing to apply this method to be trained in the procedures associated with the IPG DET technique.

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