ECRONICON OPEN ACCESS

EC DENTAL SCIENCE
Case Report

Guided Bone Regeneration with the Use of CGF and Bone Graft in Areas of Bone Resorption in Posterior Maxilla

Georgiou Michelle[1]*, Zafeiri Triantafyllio[2], Xhanjanka Edit[3], Georgakopoulos Ioannis[2,4], Georgakopoulos Panagiotis[2], Inchingolo Francesco[4] and Dipalma Gianna[4]

[1]Postgraduate Student, Interdisciplinary Department of Medicine, University of Bari Aldo Moro, Bari, Italy

[2]WAGRO (World Academy of Growth Factors and Stem Cells in Dentistry), Athens, Greece

[3]Department of Prosthodontics, Faculty of Dental Medicine, University of Medicine Tirana

[4]Professor, Interdisciplinary Department of Medicine, University of Bari Aldo Moro, Bari, Italy

***Corresponding Author:** Georgiou Michelle, Postgraduate Student, Interdisciplinary Department of Medicine, University of Bari Aldo Moro, Bari, Italy.

Received: November 23, 2020; **Published:** January 30, 2021

Abstract

Introduction: Concentrated Growth Factors (CGF) consisting of a pure biomaterial indicate a high and special regenerative performance on both hard and soft tissues and possess many special properties. Guided bone generation (GBR) is one of the most popular methods for bone augmentation at the exact site of implant placement. Several factors are required however for a successful outcome including wound closure, angiogenesis, space maintenance and clot stabilization. During the GBR procedure, the use of Concentrated Growth factors and stem cells CD34 at the osteotomy site as well as the subsequent immersion of the implant in the Liquid Phase Concentrate Growth Factors (LPCGF) aims at providing excellent and fast healing.

Case Report: This case report evaluates and represents the accelerated effect that the use of Concentrated Growth Factors (CGF) and stem cells CD34 combined with Guided Bone Regeneration (GBR) via the simultaneous use of alloplastic bone graft and titanium barrier membrane, can have on maxillary bone augmentation following immediate implant placement.

Conclusion: As a result of the use of GBR and Concentrated Growth Factors and stem cells CD34 combined with the simultaneous use of alloplastic bone graft and barrier membrane, accelerated, fast and uneventful regeneration of maxillary bone is succeeded facilitating successful osseointegration with no complications at all.

Keywords: *Concentrated Growth Factors (CGF); Guided Bone Generation (GBR); Titanium Barrier Membrane; Immediate Implant Placement*

Abbreviations

CGF: Concentrated Growth Factors. They accelerate new bone formation; CD34: A transmembrane glycoprotein expressed extensively on blood vessels and hematopoietic stem cells; GBR: Guided Bone Generation. One of the most popular methods for bone augmentation at the exact site of implant placement.

Introduction and Case Report

Concentrated Growth Factors consisting of a pure biomaterial, with many special properties can be obtained from the patient's venous blood. This case report describes the placement of two implants on the upper maxillary alveolar ridge of a 61-year-old female utilizing surgical flap technique, GBR and CGF and stem cells CD34. The 61-year-old lady presented to the clinic complaining of inability to chew on URQ due to pain on biting on UR6/UR7 which were previously individually endodontically treated due to Acute Apical Abscesses many

years ago. During the initial consultation, full intra-oral examination and extra-oral examination as well as radiographic evaluation was conducted for proper diagnosis and treatment planning. Also written consent was obtained.

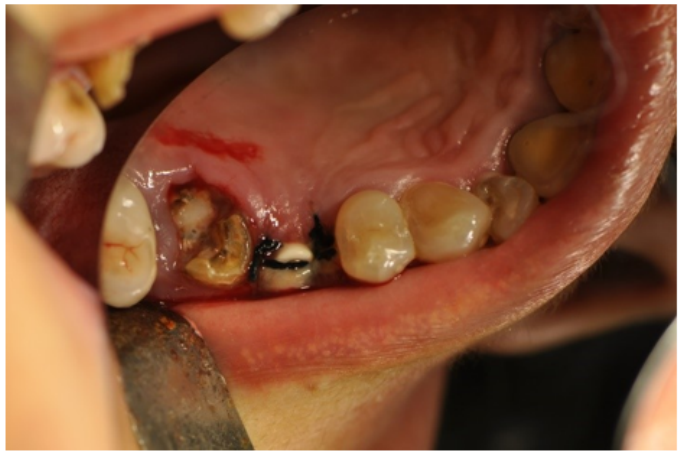

Figure 1: *Pre-op clinical image.*

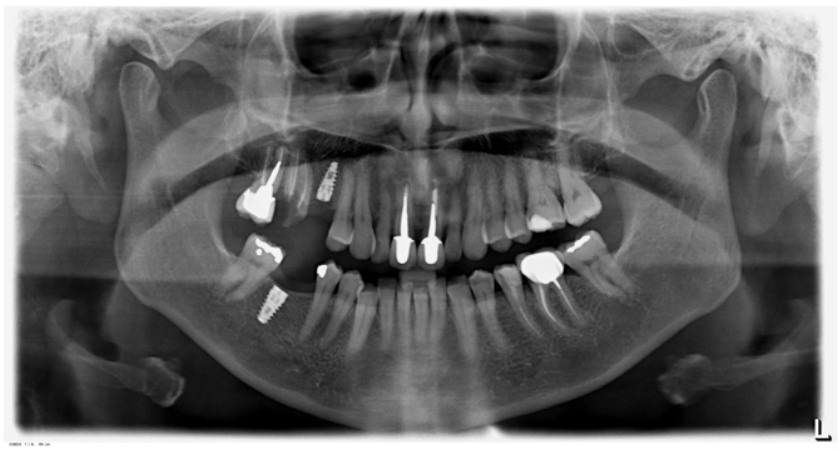

Figure 2: *Pre-op X-ray.*

Justification:

1. Dental clinical diagnosis and adequate treatment planning for multiple extractions and prosthetic rehabilitation.
2. Detection of soft tissue abnormalities - wide view of the teeth, jaws and surrounding structures and tissues
3. Assessment of extent of apical pathology prior to surgical procedures.

Clinical Observations:

1. UR6/UR7 tender to percussion but not painful to palpation
2. No evidence of sinus tract
3. Teeth non mobile
4. Healthy gingival tissue.

Clinical diagnosis

UR6/UR7 Apical Pathology - Chronic apical periodontitis symptomatic (acute exacerbation of CAP) on occasions mainly under pressure when tearing food.

Treatment plan

Despite the fact that the patient did not experience any excruciating pain or flare ups, the patient was complaining of inability to bite down adequately on URQ without any discomfort. The primary wish of the patient was restoring chewing capacity and removing the discomfort and dull pain that appeared with chewing and biting. Patient was happy to be advised of the treatment options to avoid future problems. The main management options were given as follows:

1. Leave and monitor - non advisable
2. Extraction of UR6/UR7 and denture
3. Extraction of UR6/UR7 and implant prosthesis.

Written consent

The patient was subsequently highlighted of the risks and benefits of Implant placement and pre-operative warnings were given regarding the current success/failure rates of Implant Surgery. The patient after understanding the risks and possible complications as well as success rates was happy to proceed with extractions and Implant Prosthesis treatment and informed consent was provided. Medical History was reviewed carefully before proceeding. Following discussion with the patient, the consent process was recorded using an approved private consent form. Written and verbal consent was obtained (according to GDC Standards) and the patient was deemed to have full capacity to provide consent (MHA 2007).

Materials and Methods

Prior to the procedure, the areas of candidate implantation on URQ were carefully examined with the use of Cone Beam Computed Tomography. Full Cone Beam Computed Tomography (CBCT) examination was performed prior to implant placement. CBCT together with digital panoramic x-ray, revealed first of all a maxillary mucous retention cyst on Slide 7 and also an extensive bone resorption of the maxillary Apical areas of UR6/UR7 due to Chronic Apical Periodontitis. Special attention was given to the position of the sinus as well as to the deformity apically of UR7 as evident on slide 8 (Figure 3). The maxillary bone around those teeth was of decreased thickness and height and was obvious by intraoral examination prior to any device result examination. The procedure was therefore directed towards enlarging and increasing the size, extent, and subsequently the quality of maxillary bone for proper osseointegration to take place following immediate implant placement.

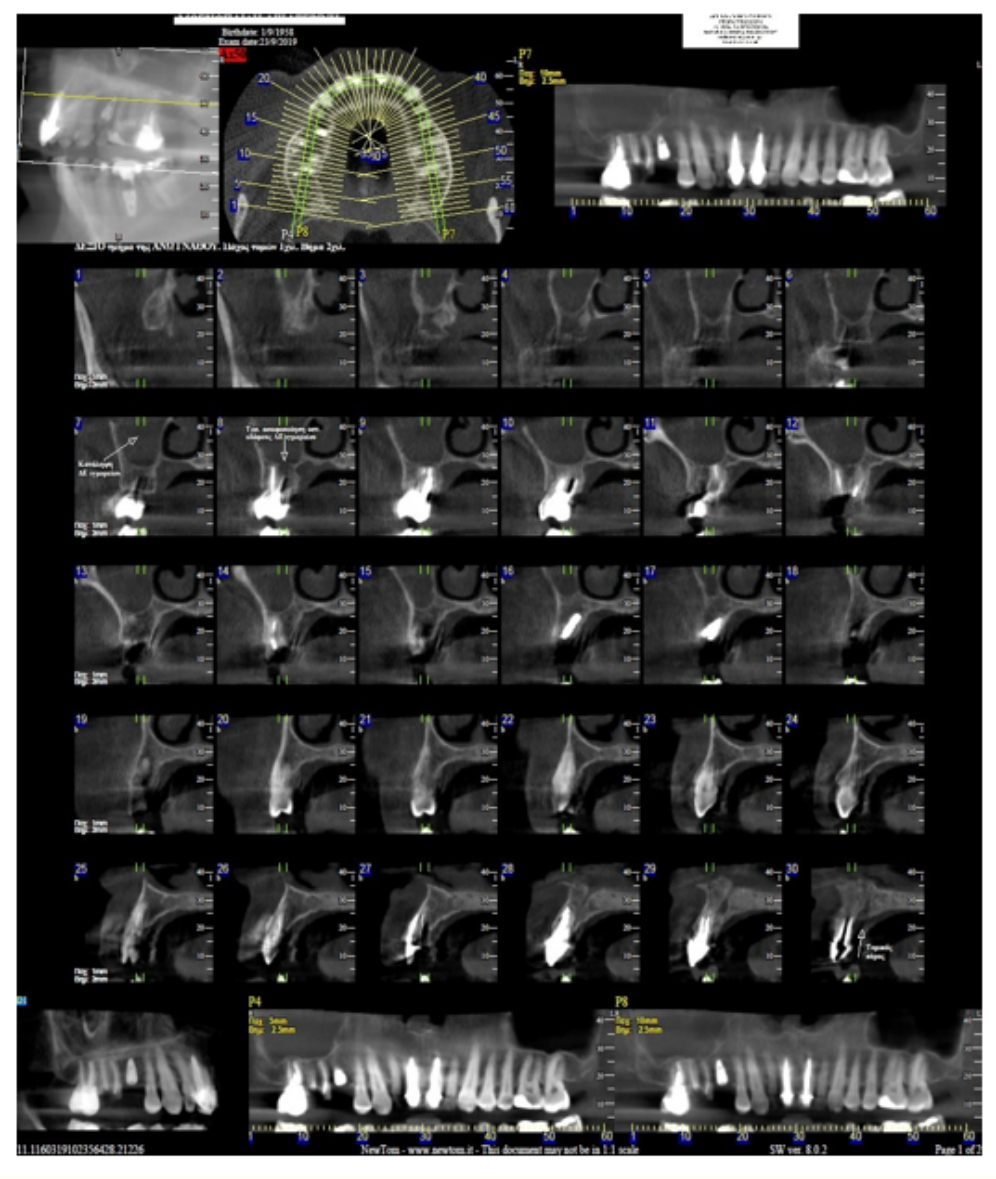

Figure 3: *Cone Beam Computed Tomography (CBCT) upper right quadrant slides 1-30.*

The results of radiographic examination thereby revealed a need for implant placement areas 14 and 10 of the CBCT. The chosen sizes of the implants were based on the findings of the individual slides and relatively shorter implants were used to prevent perforation or absorption of the implants into the sinus. The chosen implants were of size 3.5 mm in diameter and 8 mm length.

Local anesthesia was firstly performed with 2 x 2.2 ml Lignospan Special; Lidocaine Hydrocholoride 2% and adrenaline 1;80 000, Buccal Infiltration and Palatal Infiltration. UR6 and UR7 teeth were extracted conventionally with elevators and forceps. Following extractions of the teeth the alveolar sockets were curetted carefully to remove all defective tissue defects.

Following careful curettage of both sockets (Figure 4) a crestal flap approach was performed to the gum areas involved and then the osteotomy followed. The osteotomy sites were prepared step by step with the help of sequential order of drills of different diameters in order to ensure efficient and atraumatic widening of the implant site (Figure 5). Drill stops were used with each drill in order to place the implants at the chosen length and in order to ensure safety and avoid perforation of the sinus membrane.

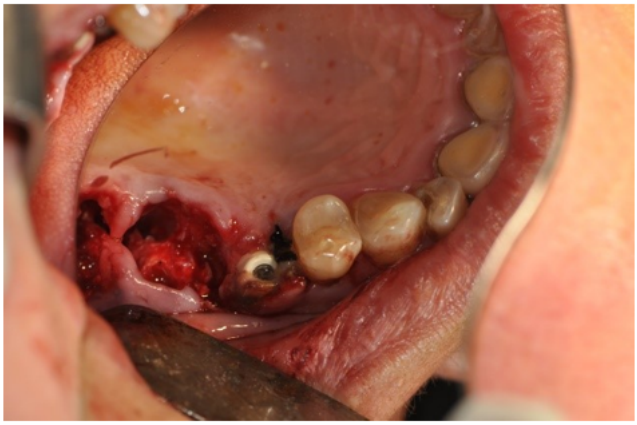

Figure 4: *Extraction sockets UR6 and UR7.*

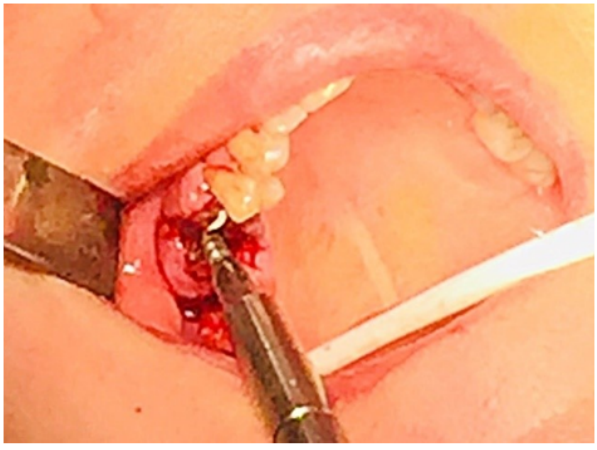

Figure 5: *Preparation of the osteotomy sites with the drills and drill stop in place.*

Subsequently, the fibrin injector instrument was used to insert the CGF matrix into the alveolar bone areas following the osteotomy prepared for implantation (Figure 6 and 7).

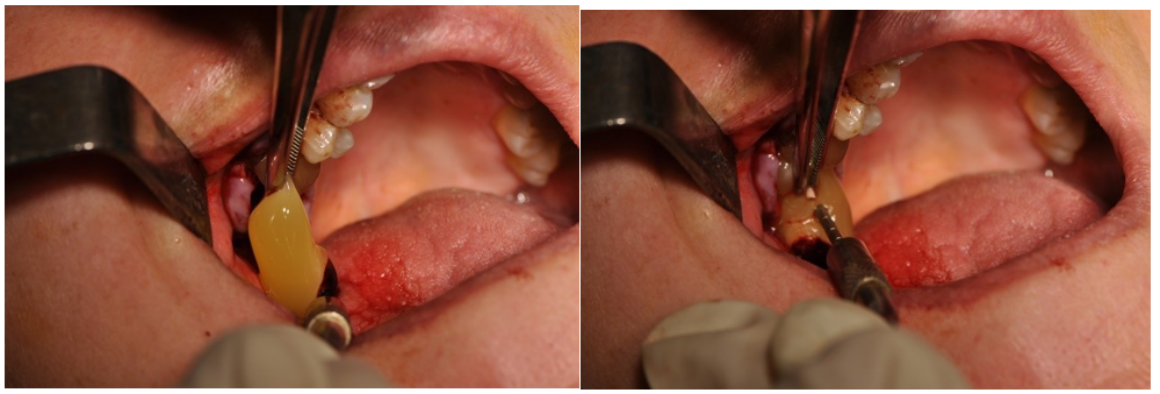

Figure 6 and 7: *CFG matrix placement into alveolar socket.*

Both implants were placed 1mm below the maxillary alveolar bone (Figure 8). The insertion torque was measured to be 35 N/cm which is considered to be the minimum required for adequate primary stability. Following the placement of implants, the primary stability of each implant was checked using the Ostell, which showed expectedly low ISQ values.

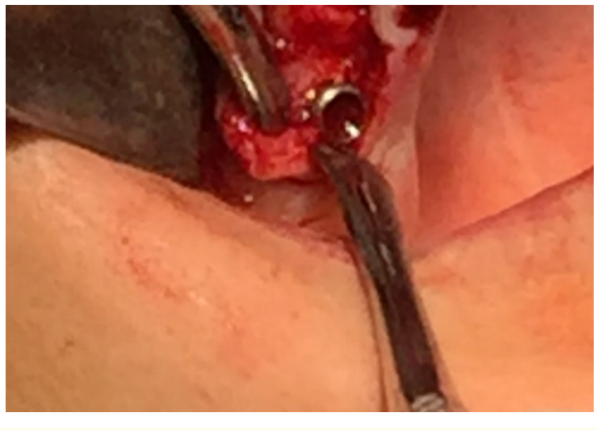

Figure 8: *Insertion of the implant into the osteotomy site; Both implant depths were checked in order to ensure their placement 1 mm below the bone.*

Moreover, the alloplastic bone grafting material was packed in the maxillary bone defects so that the deficiencies were completely filled. The bone graft was also placed into the space between the implants and the fresh extraction sites (Figure 9).

Space maintenance during GBR, which is of paramount importance for successful completion of bone augmentation, was achieved with the use of a Titanium reinforced membrane (Figure 10). Small pieces of CGF matrix were cut and mixed with Combioss alloplastic bone graft for immediate placement below the barrier membrane.

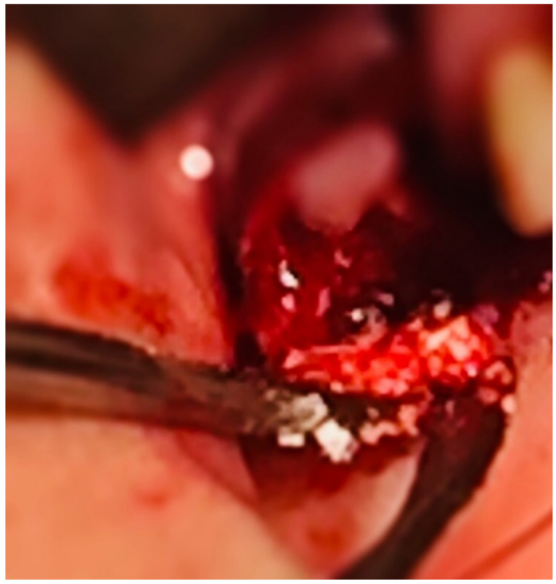

Figure 9: *Combioss alloplastic bone graft used to fill the defects.*

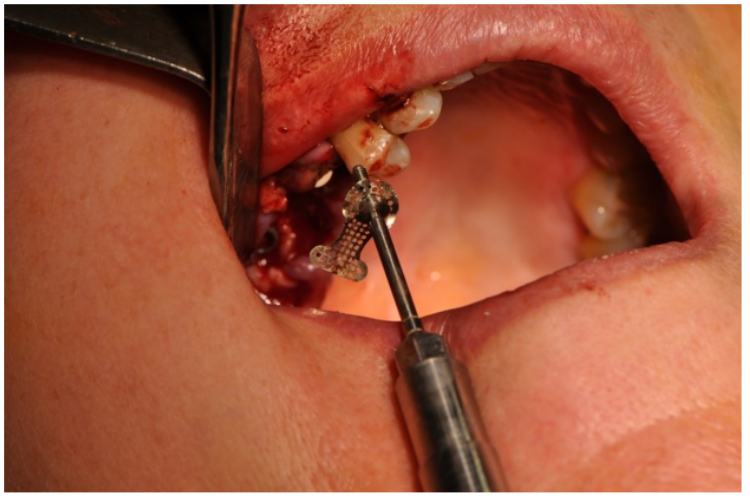

Figure 10: *Titanium reinforced membrane.*

The non-resorbable and reinforced Titanium barrier membrane which was carefully inserted and stabilized against the vestibular part of the patient's gums allowed for the bone grafting material to be kept in place during the osteo-conductive phase and acted as a barrier separating the soft from the hard tissues. The mixture of Combioss alloplastic bone graft material and CGF matrix, were placed carefully under the titanium membrane with the latter kept in place with the aim of providing faster bone formation. Since a two-stage implant

placement was the treatment plan chosen, a cover screw was then inserted into each implant, keeping also the membrane safe in place. The Titanium Reinforced Membrane secured in place by mini screw. More mixture of bone grafting material and CGF were placed on the superior part of the membrane. Moreover, sufficient wound closure and accelerated soft tissue healing can be reached by the use of compressed Concentrated Growth Factors (CGF) in the form of a barrier Biological Membrane (Figure 11).

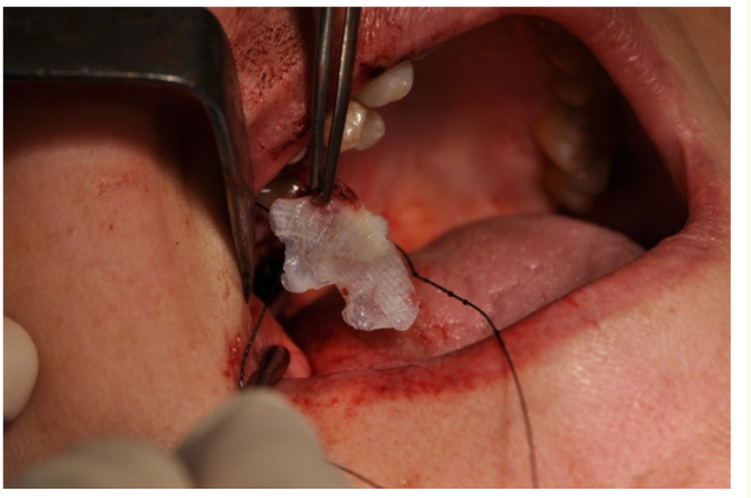

Figure 11: *Biological membrane; compressed concentrated growth factors.*

Results

None of the patients sinuses presented any postoperative complications of infection.

The implant exposure after 12 weeks showed success, in the absence of any adverse inflammatory post-operative complications and brand new bone formation around both implants. The degree of new bone formation was evaluated with the clinical use of Ostel, Panoramic and as well as CBCT scans.

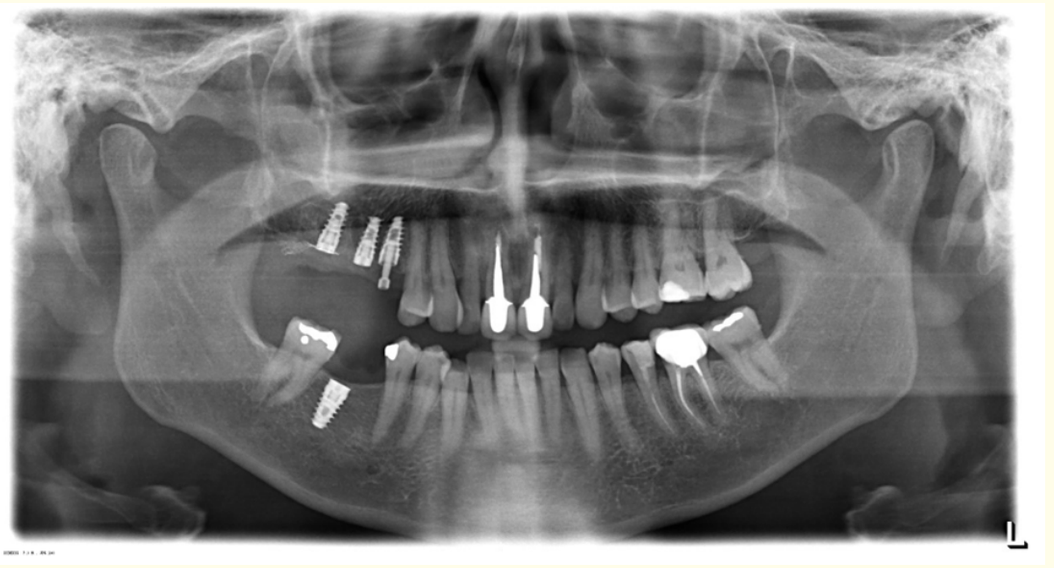

Figure 12: *Post-op X-ray.*

Discussion

Maxillary bone resorption is a common problem amongst elder people and can also be periapically observed in cases of Chronic Apical Periodontitis. Unfortunately, it can have an impact on the patient's inner psychology and a decline on the quality of eating and chewing habits [1].

For patients who suffer from extensive bone resorption, bone augmentation is of paramount importance for the future success of implant placement in that adequate volume of bone should exist at the sites of implantation in order to ensure sufficient good and long-standing prognosis of the osseointegrated implants [2]. Over the years several bone augmentation techniques have been adapted including bone grafting techniques and Guided Bone Regeneration (GBR) in order to allow the lost bone to be fully integrated and maintained during functional loading of the implant. Guided bone generation (GBR) consists of a surgical reconstructive procedure of alveolar ridge involving the use of barrier membranes and bone grafting material and is one of the most popular methods for accelerated and excellent bone augmentation at the exact site of implant placement and results in faster bone formation.

In order to achieve bone defect regeneration, it is important that osteogenesis from the bone adjacent to the defect exceeds the actual rate of fibrogenesis growing in from the neighboring connective tissue [3-5]. This was firstly described by Dahlin., *et al*. whose studies proved that the main idea behind the application of a membrane in GBR is to create space. This space would actually exclude migration of epithelial cells and fibroblasts (fast growing cells) and prevent connective tissue formation at wound site inhibiting those cells from interfering thereby with bone regeneration and allowing slower growing cells like osteoblasts to occupy the space adjacent to the resorbed area [1]. In other words, during GBR no soft tissue migration is possible to the overlying mucosa but only hard tissue migration from the neighboring bone. Other various important contributing factors are required for a successful bone regeneration outcome including wound closure, angiogenesis, and ample blood supply as well as clot stabilization [6].

Furthermore, accelerated and excellent bone augmentation can be successfully achieved with the use of Concentrated Growth Factors (CGF) in combination with alloplastic bone grafting material, in the process of Guided Bone Regeneration, resulting in faster bone formation and there are new studies that found that it enhances implant stability in the critical early recovery period (first 6 weeks). Since CGF contains autologous osteoinductive platelet growth factors and an osteoconductive fibrin matrix it plays a major role in the cellular events of bone regeneration and healing [7].

Following close consideration of the above factors and taking into account the bone quantity and quality of the posterior UR6/UR7 areas as well as the fact that considerable bone loss was evident due to Chronic Apical Periodontitis, the preferred approach was the simultaneous/combined approach through which GBR was performed simultaneously with the placement of the implants and the use of CGF and CD34 Stem Cells [2]. During the prosthetic rehabilitation of posterior areas of the maxilla with implants, special attention must always be given to the sinus membrane and evaluation should always be performed in line with a CBCT to determine whether a lift is required and also to identify any major pathological abnormalities which would deem the procedure non desirable. The areas of candidate implantation on URQ were carefully examined with the use of Cone Beam Computed Tomography prior to implant placement. Special attention was given to the position of the sinus. The results revealed a need for implant placement on tooth areas UR6/UR7.

The first step was the collection of blood from the patient via 4 sterile tubes of 9 mL each. Successful centrifugation was completed with the use of Medifuge device (Silfradent, Italy). The yellow phase containing the Concentrated Growth factors was immediately separated from the red phase by the use of scissors. Following conventional extractions of UR6 and UR7, a crestal flap approach was performed to the gum areas involved and then the osteotomy followed. The fibrin injector instrument was used to insert the CGF matrix into the alveolar bone areas prepared for implantation. Moreover, small pieces of CGF matrix were cut and mixed with Combioss alloplastic bone graft. The implants were subsequently immersed within the Liquid Phase Concentrate Growth Factors, in order to succeed a bio-active

surface with specific growth proteins. This immersion of implants within Growth Factors, allows the creation of Bioactive Membrane which according to animal studies, improves the osseointegration by 134%, thus more implant bone contact leads to much more stability. Following the placement of the Implants, the primary stability was checked, using Ostell which showed low ISQ values.

As already mentioned, Space maintenance during GBR, is of paramount importance for successful completion of bone augmentation and can be achieved through the use of barrier membranes, in this case, Titanium reinforced membrane. The use of Titanium reinforced membranes is deemed a reliable treatment modality for regeneration and reconstruction of a severely deformed alveolar ridge [8-10] and owing to its reinforcement, it can achieve excellent space maintenance and clot stabilization preserving the alveolar ridge in optimum condition [11]. Over the years, a considerate amount of membranes has been described for both experimental as well as clinical verification. Membrane materials possess several properties which are amenable to modification and careful consideration according to the individual circumstances of each case should be done prior to choosing a membrane in GBR [11]. While GBR is designed to aid in treating extensive and moderate bone defects, the key to its success is the response of the tissues to the membrane of choice. Unfortunately, due to the physical tendency of the membrane to collapse towards the bone deformity mainly due to pressure from the soft tissues, the reconstruction of the bone is deemed quite questionable. Titanium reinforced membranes are a gold standard of choice in the reconstruction of serious defects in that GBR principles are religiously followed. The main downside is that a second surgery is required to remove the barrier membrane [12]. However, space maintenance is achieved with this non-resorbable, regenerative, flexible and reinforced Titanium barrier membrane allowing the bone grafting material to be kept in place during the osteo-conductive phase [11]. Taking careful consideration of the circumstances of the patient, Titanium reinforced barrier mesh membrane was chosen, which is absolutely biocompatible to oral tissues. The non-resorbable, regenerative and reinforced Titanium barrier membrane allows the bone grafting material to be kept in place during the osteoconductive phase. Also, perforation of the membrane with mini holes prevented interference with the blood supply from the periosteum to the underlying tissues and bone-grafting material. The Titanium membrane was carefully inserted and stabilized against the vestibular part of the patient's gums. Moreover, mechanical support of the membrane, space maintenance and membrane collapse was prevented by the placement of alloplastic bone graft. The mixture of Combioss alloplastic bone graft material and CGF matrix, were placed carefully under the titanium membrane with the latter kept in place. Stabilization of the membrane was succeeded with a mini screw.

Since CGF contains autologous osteoinductive platelet growth factors and an osteoconductive fibrin matrix, it plays a major role in the cellular events of bone regeneration and healing [7]. Therefore, more mixture of bone grafting material and CGF were placed on the superior part of the membrane, as this can promise faster bone formation. Sufficient wound closure and accelerated soft tissue healing can be reached by the use of compressed Concentrated Growth Factors (CGF) in the form of a barrier biological membrane. The preparation of the biological membrane was the last step of the process. The Biological membrane can be prepared via two ways either by using the special Silfradent pincer obtaining thus Biological Membrane and LPCGF (Liquid Phase CGF) or by the use of a Sterile Gauze obtaining only Biological membrane. The preparation of the membrane in our case report took place by the use of sterile gauze and was placed on the superior part of the bone grafting material the bone graft to exclude soft tissue in growth and accelerate bone regeneration and soft tissue healing. It was then sutured in place safely. The use of the membrane promises a painless post-surgical healing, reduction of post-surgical complications, the improvement of the guided bone and tissue regeneration as well as the osseointegration improvement.

Conclusion

At present times, available data strongly suggest that GBR is a successful technique for mandibular and maxillary ridge reconstruction in large horizontal bone defects in cases where insufficient bone volume would not otherwise permit successful implant placement. Concentrated Growth Factors consisting of a pure biomaterial with many special properties indicate a high regenerative performance on both the bone and the soft tissues in GBR and can greatly accelerate the osseointegration process tremendously successfully. Accelerated and excellent bone augmentation was achieved with the use of Concentrated Growth Factors, titanium barrier membrane and alloplastic

bone grafting material. All in all, CGF barrier has proved its effectiveness in regenerating bone formation associated with GBR and GTR procedures. In addition, the mixture of CGF and bone graft reduced the healing time compared to conventional Guided Bone Regeneration.

Bibliography

1. Elgali Ibrahim., *et al*. "Guided Bone Regeneration: Materials and Biological Mechanisms Revisited". *European Journal of Oral Sciences* 125.5 (2017): 315-337.

2. Bernstein Simon., *et al*. "Vertical Bone Augmentation: Where Are We Now?" *Implant Dentistry* 15.3 (2006): 219-228.

3. Dahlin C., *et al*. "Healing of Maxillary and Mandibular Bone Defects Using a Membrane Technique. An Experimental Study in Monkeys". *Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery* 24.1 (1990): 13-19.

4. Dahlin C., *et al*. "Generation of New Bone around Titanium Implants Using a Membrane Technique: An Experimental Study in Rabbits". *The International Journal of Oral and Maxillofacial Implants* 4.1 (1989): 19-25.

5. Gher ME., *et al*. "Bone Grafting and Guided Bone Regeneration for Immediate Dental Implants in Humans". *Journal of Periodontology* 65.9 (1994): 881-891.

6. Wang Hom-Lay and Lakshmi Boyapati. "PASS" Principles for Predictable Bone Regeneration". *Implant Dentistry* 15.1 (2006): 8-17.

7. Sohn Dong-Seok. "New Bone Formation in the Maxillary Sinus With/Without Bone Graft". *Implant Dentistry - The Most Promising Discipline of Dentistry* (2011).

8. Steflik David E., *et al*. "*In Vivo* Evaluation of the Biocompatibility of Implanted Biomaterials". *Implant Dentistry* 7.4 (1998): 338-350.

9. Malchiodi L., *et al*. "Rigid Fixation by Means of Titanium Mesh in Edentulous Ridge Expansion for Horizontal Ridge Augmentation in the Maxilla". *The International Journal of Oral and Maxillofacial Implants* 13.5 (1998): 701-705.

10. Sumi Y., *et al*. "Alveolar Ridge Augmentation with Titanium Mesh and Autogenous Bone". *Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics* 89.3 (2000): 268-270.

11. Jovanovic SA., *et al*. "Supracrestal Bone Formation around Dental Implants: An Experimental Dog Study". *The International Journal of Oral and Maxillofacial Implants* 10.1 (1995): 23-31.

12. Nevins M and JT Mellonig. "Enhancement of the Damaged Edentulous Ridge to Receive Dental Implants: A Combination of Allograft and the GORE-TEX Membrane". *The International Journal of Periodontics and Restorative Dentistry* 12.2 (1992): 96-111.

Volume 20 Issue 2 February 2021