Volume 10, No. 2 February 2018

JIACD

The Journal of Implant & Advanced Clinical Dentistry

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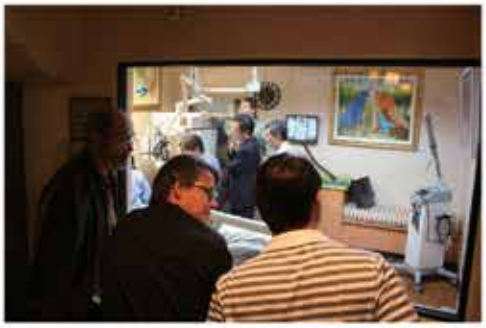

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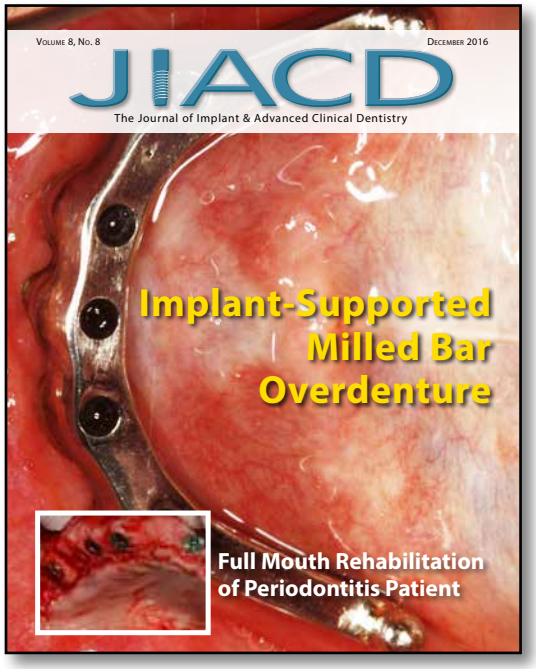

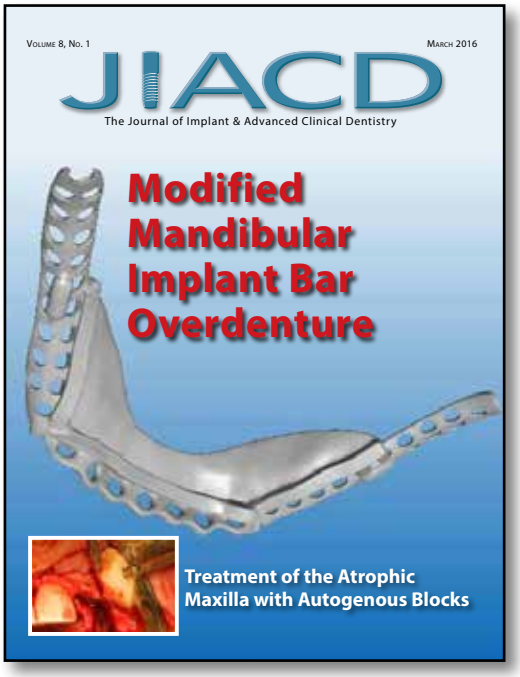

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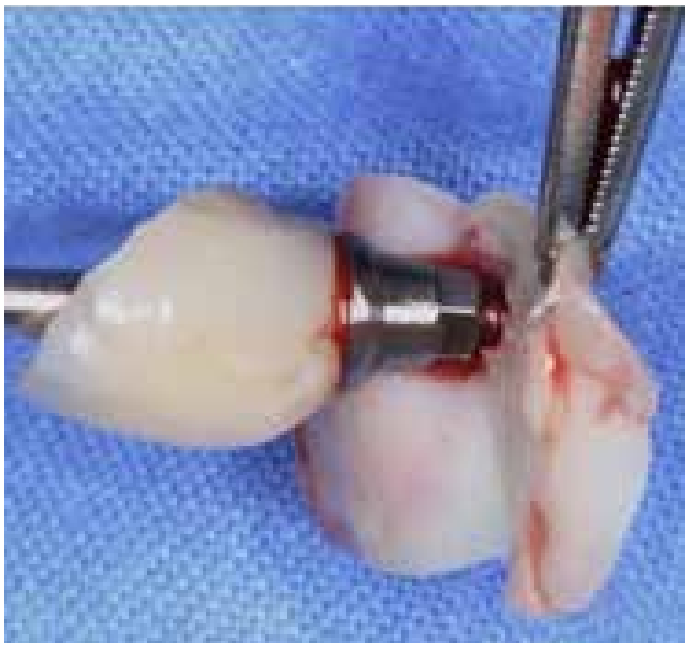

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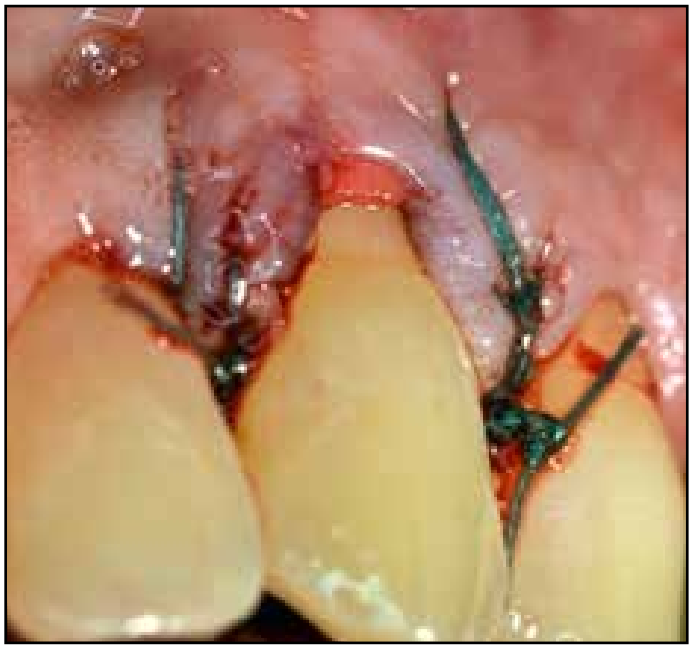

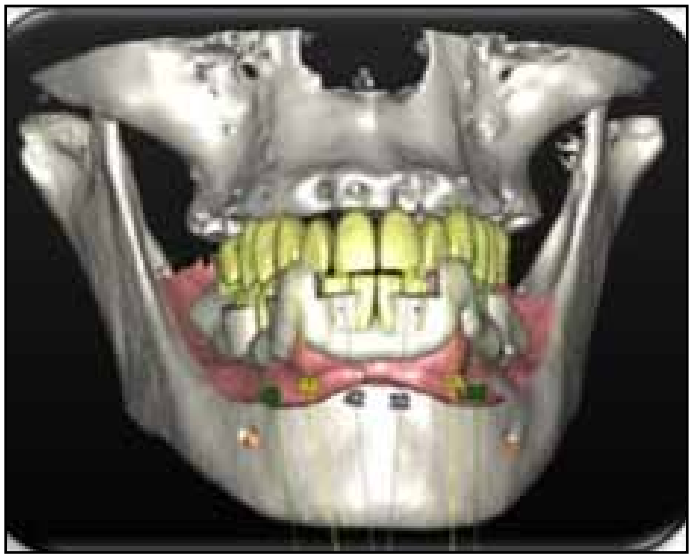

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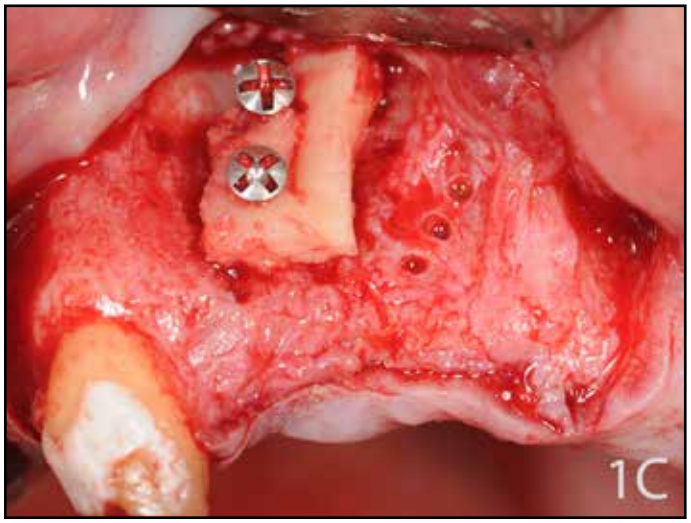
JIACD
The Journal of Implant & Advanced Clinical Dentistry

Bone Augmentation with Platelet Rich Fibrin, Particulate Bone and Cortical Plates

Dr. Oscar Maldonado Molina[1]

Abstract



Background: Complex bone defects could be challenging and treatment planning confusing with multiple alternatives available for treatment. The aim of this study is to evaluate clinically the result of bone augmentation mixing platelet rich fibrin with particulate bone and cortical plates.

Methods: Different bone defects were treated with the mixture of fibrin glue from PRF with particulate bone, cover with cortical plates and PRF membranes.

Results: Clinical success was achieved with this bone augmentation technique for different bone defects. 6 months after grafting, vascularity and integration were clinically observed.

Conclusion: The combination of PRF, particulate bone and cortical plates is a reliable and predictable technique for intraoral bone augmentation.

KEY WORDS: PRF, bone graft, dental implants

1. Private practice

INTRODUCTION

Bone regeneration is a complex, well-orchestrated physiological process of bone formation, which can be seen during normal fracture healing, and is involved in continuous remodeling throughout adult life. However, there are clinical conditions in which bone regeneration is required, such as for skeletal reconstruction of bone defects.[1] The advent of osseointegration and advances in biomaterials and techniques have contributed to increased application of dental implants in the restoration of partial and completely edentulous patients.[2] Dental implants require sufficient bone to be adequately stabilized. For some patients implant treatment would not be an option without horizontal or vertical bone augmentation.[3,4] Good surgical technique is imperative to the success of bone augmentation procedures.[5] And dental Implants shall be placed in a prosthetic driven position, even in cases of post extractions sockets and subsequent alveolar ridge remodeling.[6,7,8,9,10] Primary wound closure, adequate angiogenesis, space creation, space maintenance and wound stability, are necessary to reduce the risk of membrane exposure and subsequently microorganism colonization, thus diminishing the amount of bone regeneration.[11] Evidence based treatment, to achieve the best possible result, for the patient's benefit, should include: (i) long-term performance of dental implants placed in augmented bone; (ii) the clinical performance of dental implants placed in augmented or pristine sites; and (iii) the clinical benefits of bone augmentation with respect to alternative treatment.[12] Alveolar ridge defects can be predictably augmented using autogenous block grafts. Significant alveolar bone resorption can occur shortly after dental extractions. In non-grafted sites, more than 20% of the buccal plate could be lost. Various onlay grafts have been used for placement and successful integration of endosseous implants like autogenous bone, allografts, xenografts and alloplastic materials. However, autogenous bone is considered to be the gold standard for grafting hard tissue defects.[13] Platelet-rich fibrin (PRF), developed in France by Choukroun et al., is a second generation platelet concentrate widely used to accelerate soft and hard tissue healing. Its advantages over the platelet-rich plasma (PRP) include ease of preparation/application, minimal expense, and lack of biochemical modification (no bovine thrombin or anticoagulant is required). PRF is an autologous fibrin matrix containing a large quantity of platelet and leukocyte cytokines.[14,32] Platelets are known to release several growth factors which stimulate tissue regeneration. Platelet rich fibrin (PRF) and concentrated growth factors (CGF), utilizes patient's venous blood alone to trigger platelet activation and fibrin polymerization. PRF and CGF can be used as alternative to traditional barrier membrane over bone graft.[13,14,15,16,17,32] PRF uses constant centrifugation speed, CGF utilizes altered centrifugation speed, both to produce fibrin matrix containing growth factors.[18,19,20,32] Growth factors-enriched bone graft matrix (sticky bone) using autologous fibrin glue has been demonstrated since 2010. Sticky bone provides stabilization of bone graft in the defect, and therefore, accelerates tissue healing and minimizes bone loss during healing period.[18 19,20,21,32] Sticky bone has several advantages: 1) it is flexible and compressible, well adapted over any bony defect. 2) Stability of grafted material and volume is maintained during healing period, minimizing the need for a thin cortical block or titanium-mesh. 3) Fibrin network entraps platelets and leukocytes to

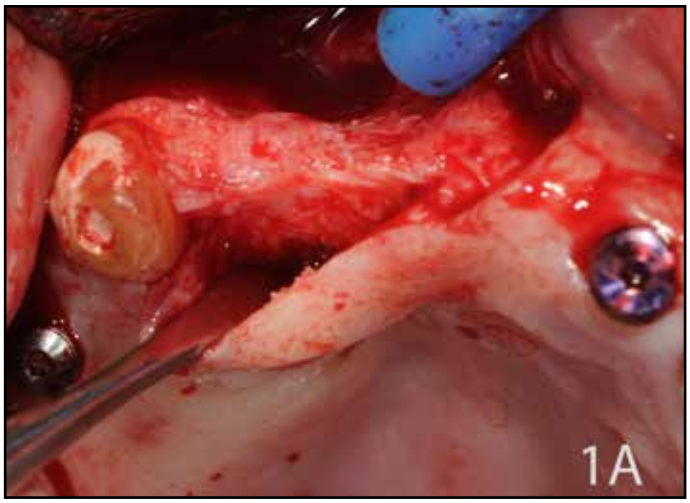


Figure 1a: Pre-op. Narrow ridge with buccal depression.

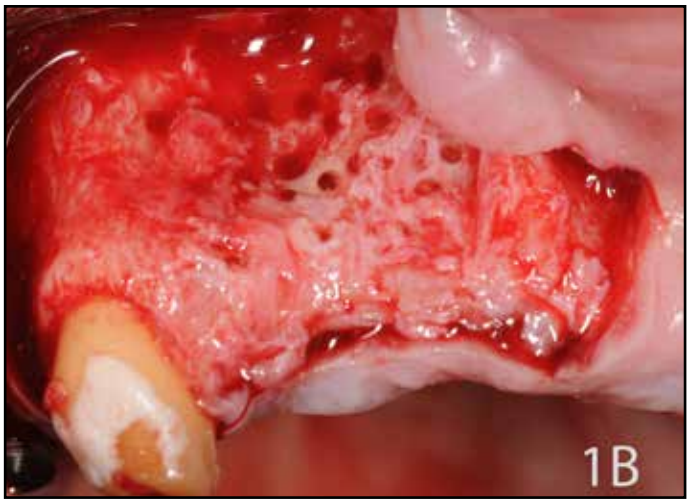


Figure 1b: Perforations on cortical bone to increase vascularity.

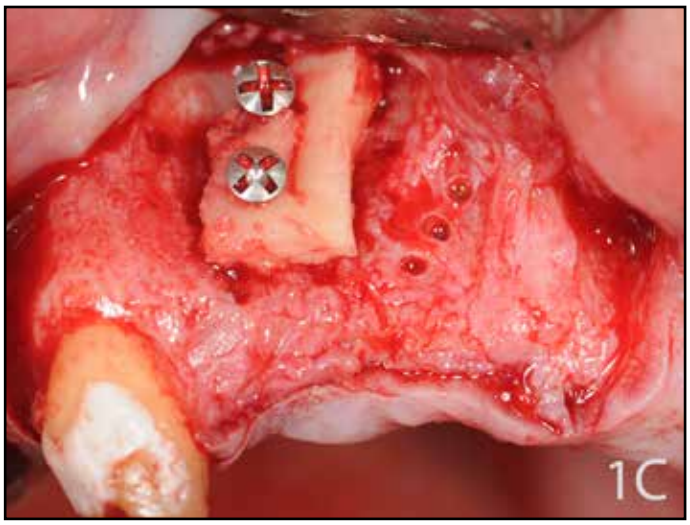


Figure 1c: Cortical block graft with fixation screws.

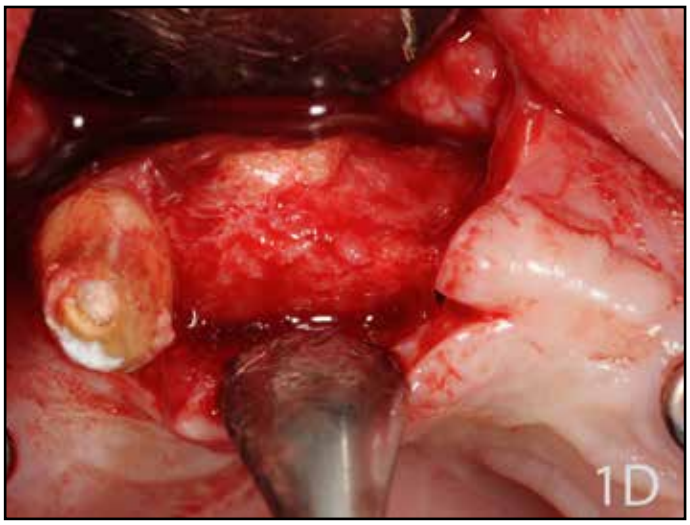


Figure 1d: 6 month post op. Occlusal view of bone formation.

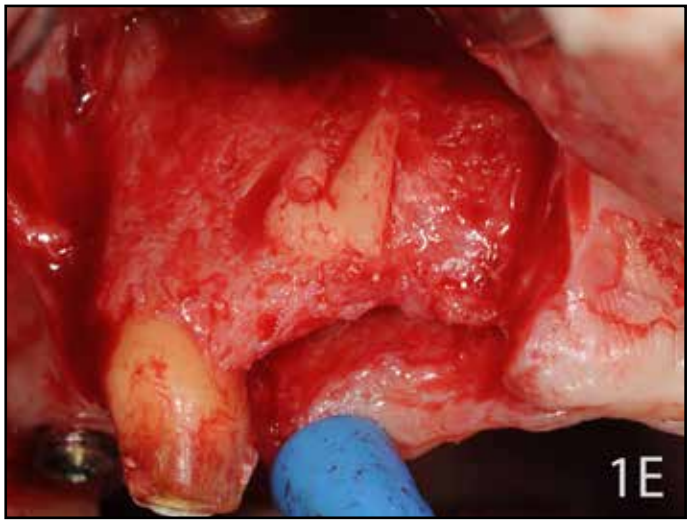


Figure 1e: Post op. Buccal view shows successful bone augmentation.

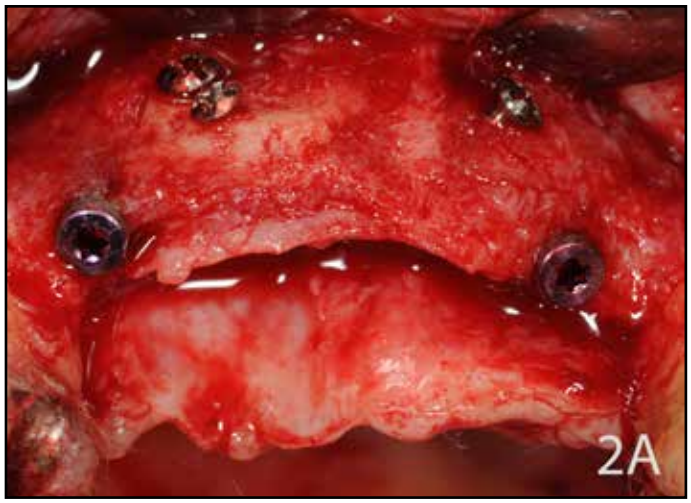


Figure 2a: 6 month post op. Bone augmentation with cortical plates and sticky bone.

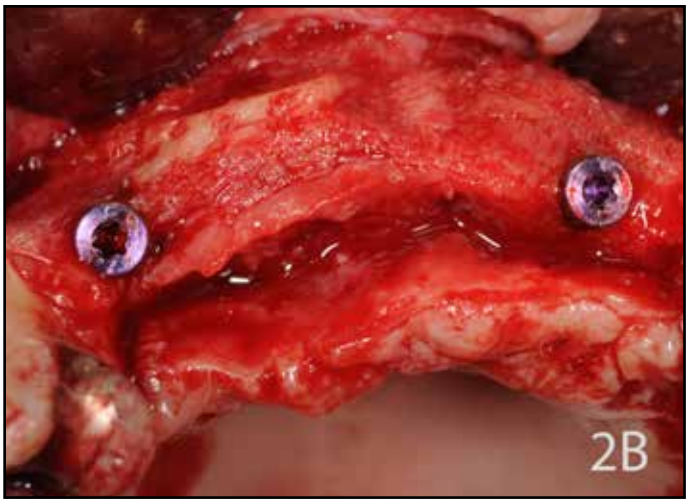


Figure 2b: Occlusal view shows increased width.

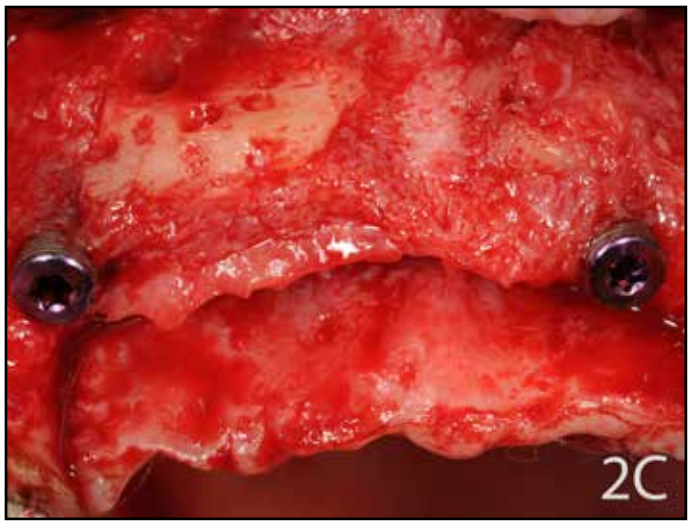


Figure 2c: Buccal view shows good vascularity and bone maturity of cortical bone plates and sticky bone.

release growth factors, promoting bone regeneration and soft tissue healing. 4) No chemical additives are needed. 5) Fibrin meshwork minimizes soft tissue integration into sticky bone.[21] The major role of fibrin in wound repair is hemostasis, but fibrin also provides a matrix for the migration of fibroblasts and endothelial cells that are involved in angiogenesis and responsible for remodeling of new tissue. To better understand the biologic effect of this fibrin matrix, it is important to divide clinical observations into four aspects of healing: angiogenesis, immune control, harnessing the circulating stem cells and wound protection by epithelial cover.[22,23,24] Platelet activation, in response to tissue damage and vascular exposure, results in the formation of a platelet plug and blood clot, as well as the secretion of biologically active proteins, that bind to trans-membrane receptors of target cells, to activate intracellular signaling proteins. This result in the expression of a gene sequence that: directs cellular proliferation, collagen synthesis, and osteoid production.[14,25]

MATERIALS AND METHODS

The objective of this article, is to evaluate clinically, the use of platelet rich fibrin, in addition to particulate bone (sticky bone), in conjunction with cortical plates, from autogenous bone grafts. Thin cortical block grafts, from autogenous bone, could be obtained from mandibular ramus and chin,[26] by piezoelectric surgery or rotary instru-

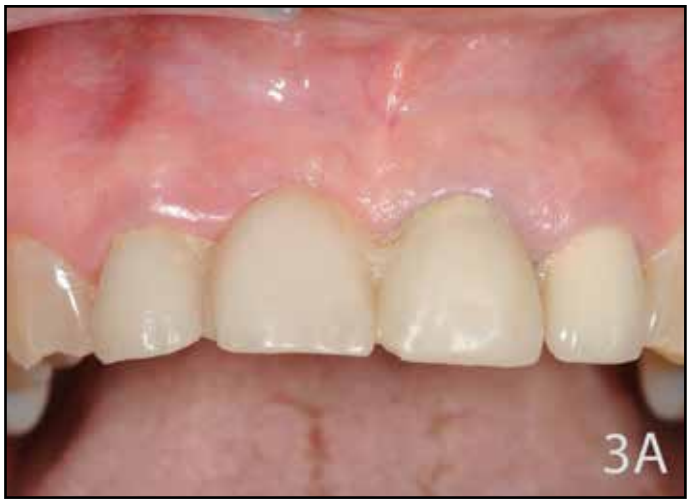


Figure 3a: Pre-operative temporary acrylic bridge for upper right central.

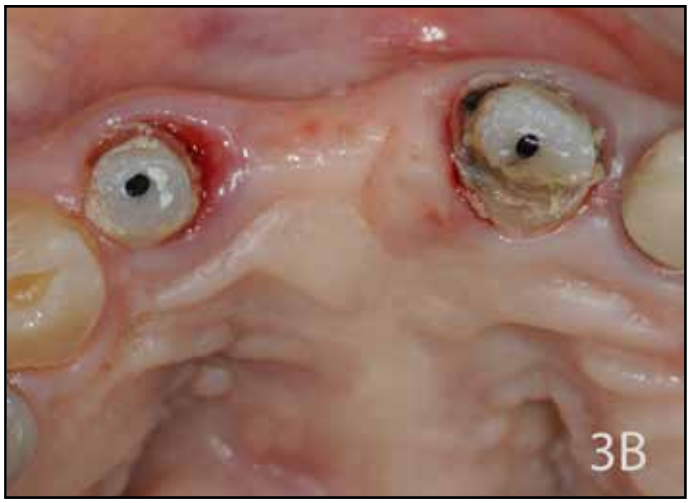


Figure 3b: Occlusal view shows buccal depression.

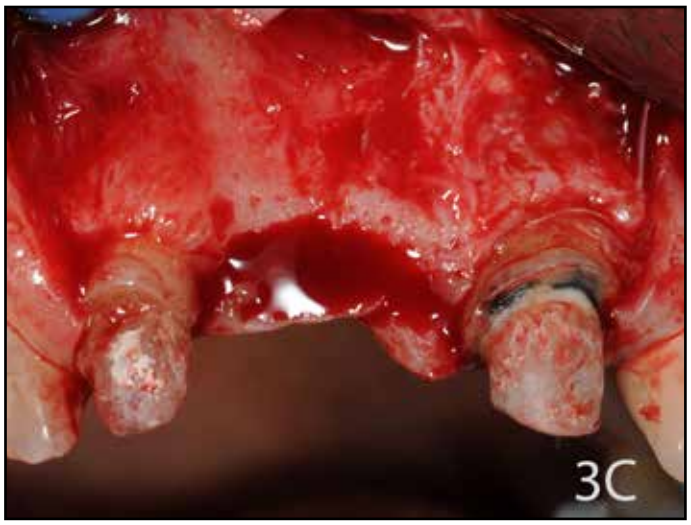


Figure 3c: Full thickness flap uncovers thin cortical ridge.

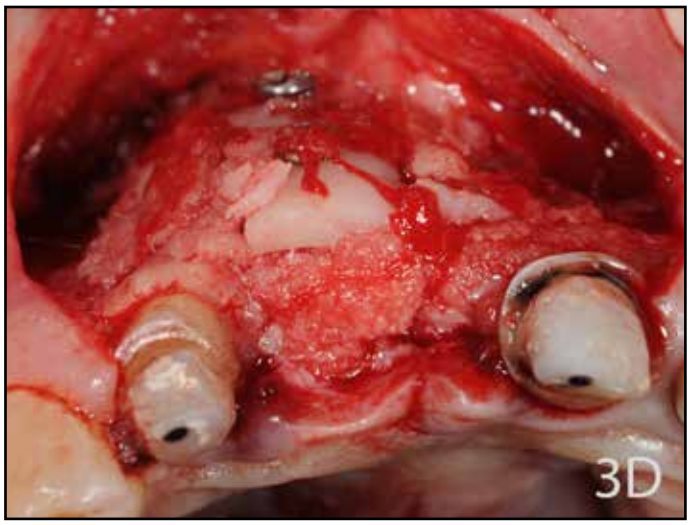


Figure 3d: Onlay bone graft with cortical plate and sticky bone with fixation screws.

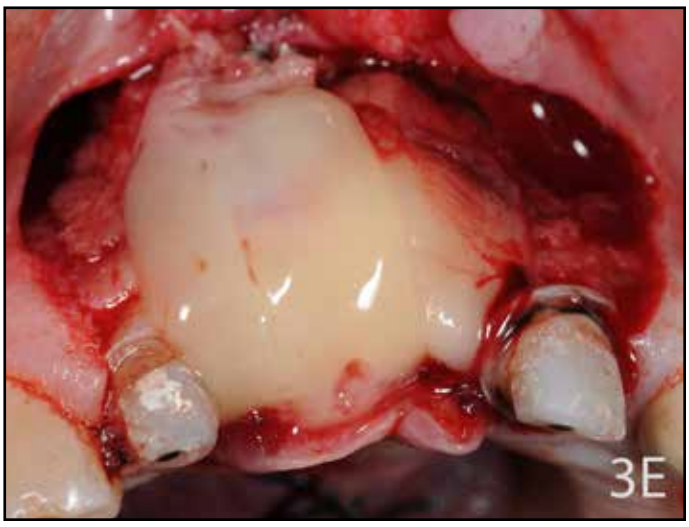


Figure 3e: PRF membranes to cover graft.

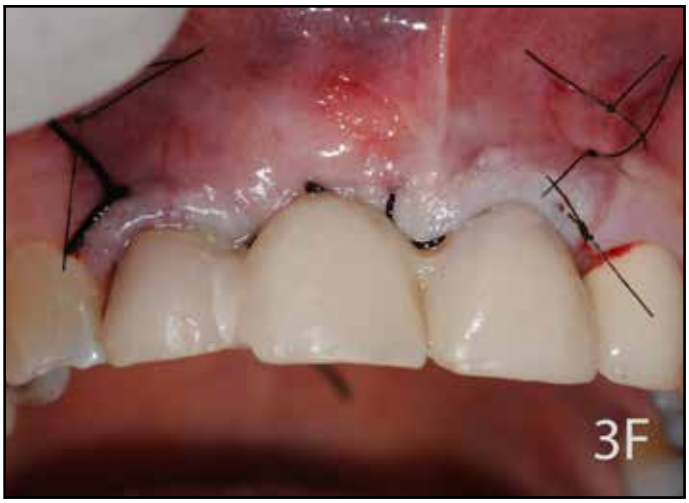


Figure 3f: Tension free primary closure with non resorbable sutures.

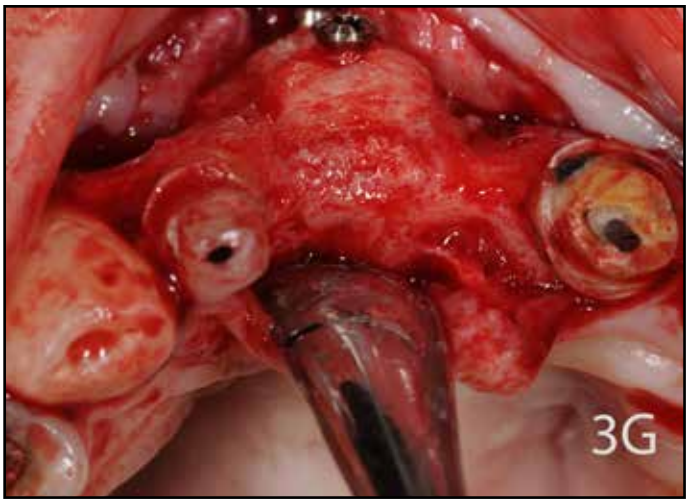


Figure 3g: 6 month post op. Graft shows good vascularity and integration.

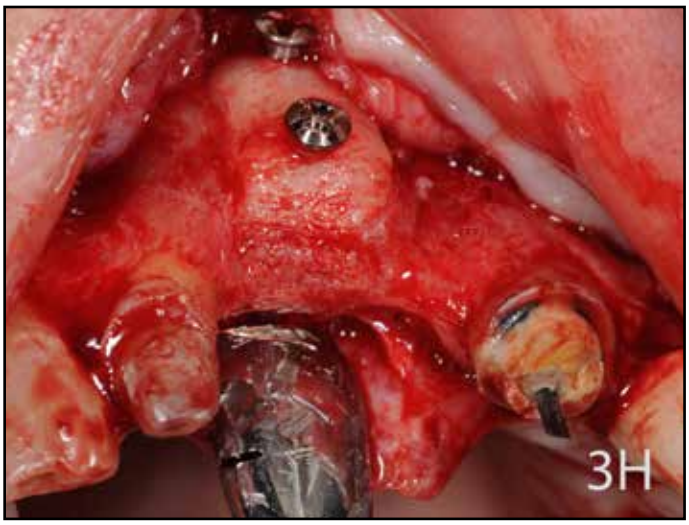


Figure 3h: 6 month post op. Onlay grafted bone with fixation screws.

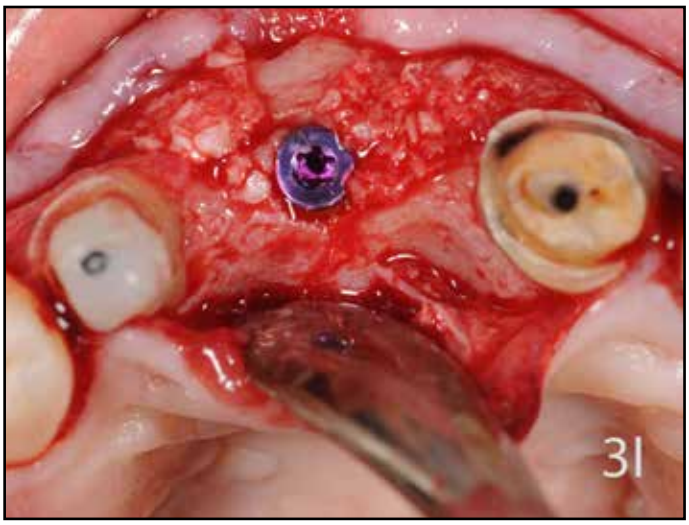


Figure 3i: Implant placed and sticky bone added to improve ridge reconstruction.

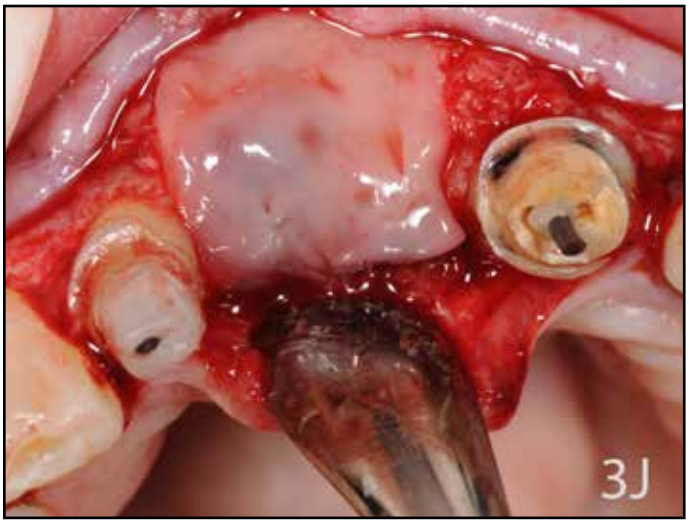


Figure 3j: PRF membrane covering the graft and implant.

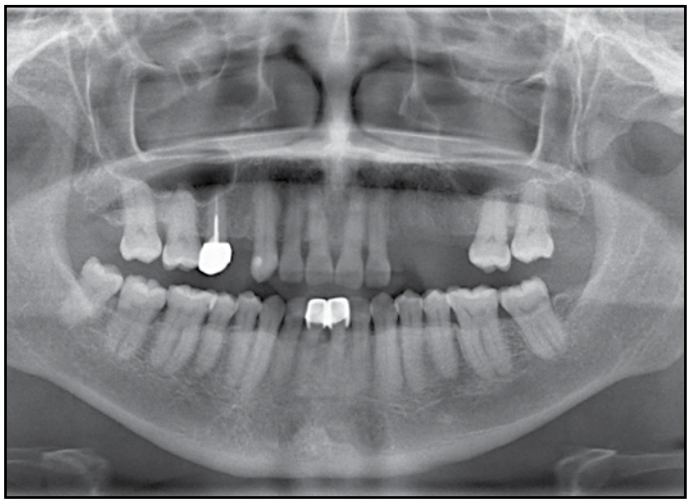


Figure 4a: Panoramic x-ray.

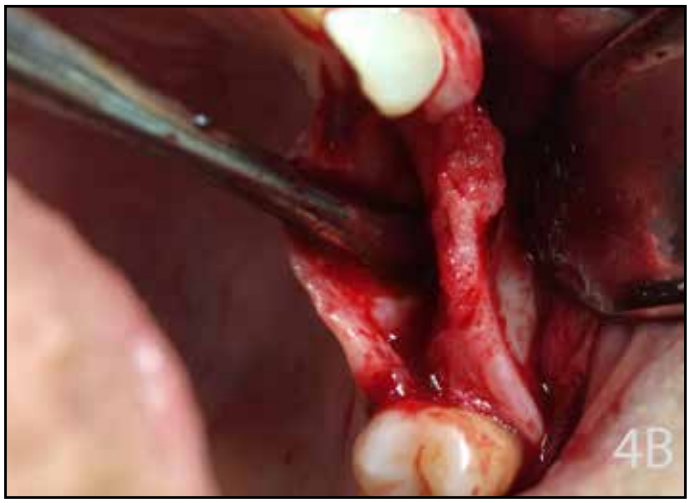


Figure 4b: Knife edge ridge.

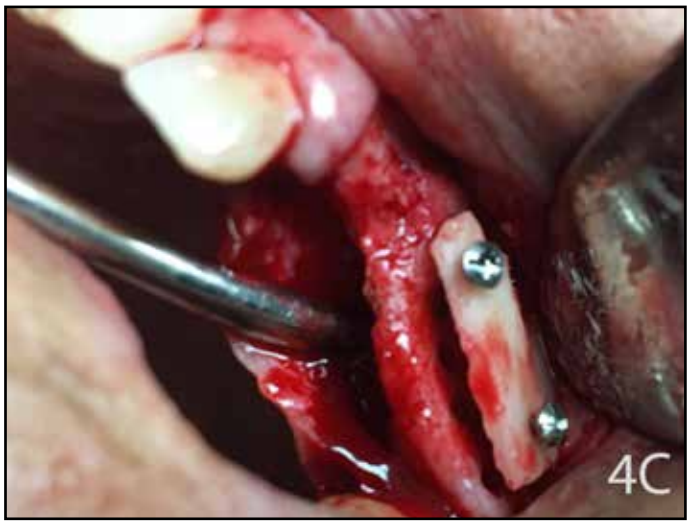


Figure 4c: Autogenous thin cortical plate with fixation screws from mandibular ramus.

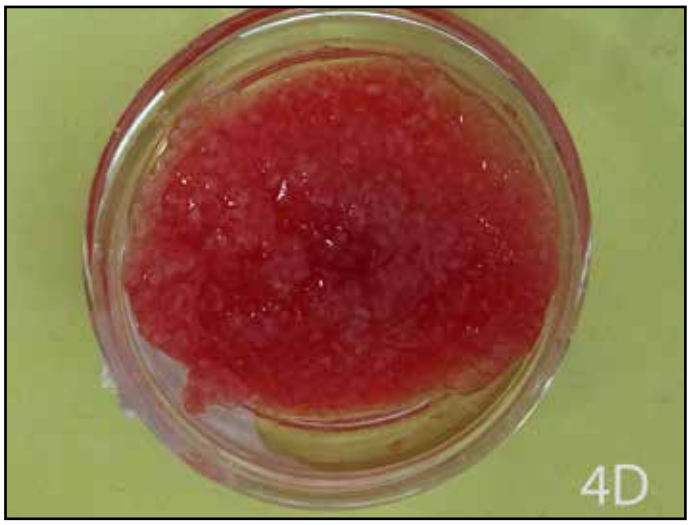


Figure 4d: Sticky bone.

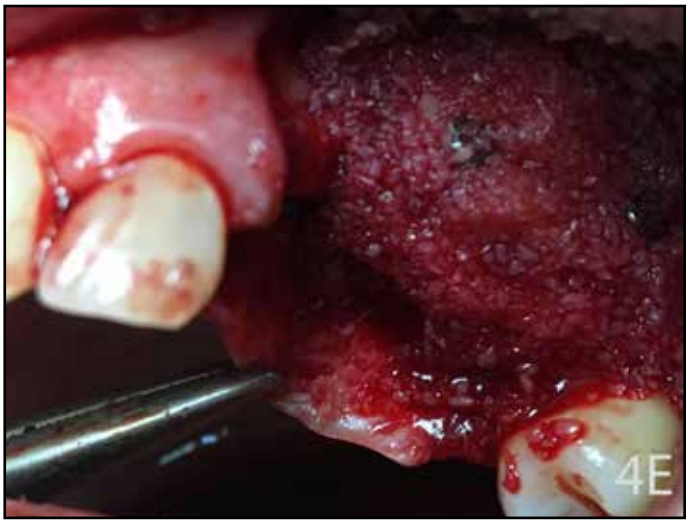


Figure 4e: Sticky bone made from fibrin glue with particulate bone autogenous and allograft.

Figure 4f: PRF membrane preparation.

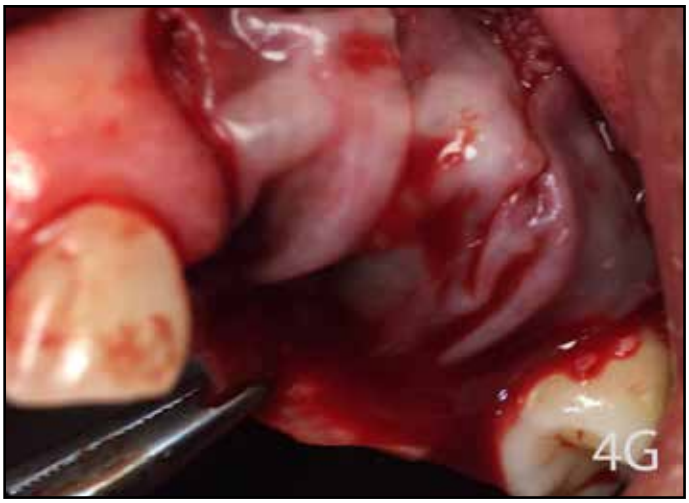


Figure 4g: PRF membranes to cover graft.

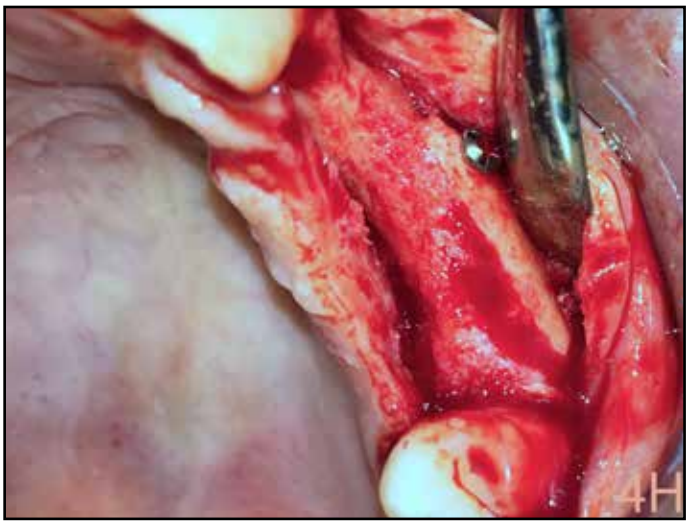


Figure 4h: 6 month post op ridge augmentation.

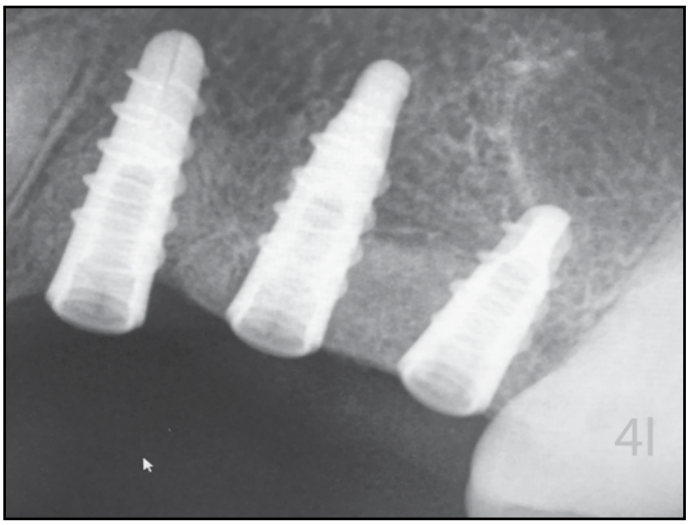


Figure 4i: Implants placed in grafted bone.

ments like surgical discs and #557 or #702 surgical burs. Then, the cortical blocks are remodel and thinned to adapt to the recipient site, as described from F. Khoury.[26,27,28,29] After obtaining cortical block grafts, bone is harvested from donor site via trephine or a bone scraper, then particulated and crushed with a bone mill. Chips are mixed with fibrin glue and concentrated growth factors drawn from patient's blood and prepared in a medical centrifuge at 3700 rpm during 12 minutes for platelet rich fibrin membranes and 3 minutes at 800 rpm for injectable platelet rich fibrin preparation for the sticky bone.[14,23] If necessary, allograft, like mineralized cortical bone, could be added to the sticky bone preparation to obtain the volume required to complete the graft for the recipient site.[13,14,18,23] Full thickness flap is raised at recipient site, cortical bone is cleaned and per-

forations are made in the buccal plate with a #4 or #557 surgical bur. Cortical block grafts are adapted and fixated with 1.5 mm diameter stainless steel screws. Gaps within the recipient site and the cortical plates are filled with particulate bone and fibrin glue with concentrated growth factors.[13,14,18,26,27,29] Metronidazole could be mixed with particulate bone graft or added in situ to prevent graft colonization with anaerobic bacteria.[30,31,32] Platelet rich fibrin membranes are placed on top of the bone graft, being certain that the totality of the graft is covered and protected. Then a released periosteal incision is made at the base of the flap, in order to be able to achieve a primary closure without any tension. One or two horizontal mattress sutures are made with a non-resorbable material.[13,14,18] 14 to 21 days after surgery, sutures are removed and graft is checked with a radiographic image. If healed without complications, fixation screws are removed 6 month after grafting surgery. Bone vitality and vascularization are checked and dental implants are placed. Bone grafting material, usually sticky bone and platelet rich fibrin membranes or connective tissue grafts could be added if needed at this time to improve the hard and soft tissue biotype.[2,3,13,14,15,18]

DISCUSSION

Oral implants are a means to anchor dental prostheses in situations of partial or complete edentulism. Over the years, implant dentistry has developed into a field supported by preclinical and clinical evidence based. Through the evolved clinical concepts and treatment strategies, patients may now benefit from excellent solutions for improving quality of life.[33] The study of the bone defect morphology is critical for the selection of a reconstruction technique, and the assessment of factors that could or will present a risk for the esthetic results. Treatment expectations, smoking habits, height of the lip line on smiling, gingival biotype, shape of the missing and surrounding teeth, infection of the implant site, bone level at adjacent teeth, restorative status of adjacent teeth, character of the edentulous space, width of the hard and soft tissues, height of the hard and soft tissue, are factors to consider.[34] Alveolar ridge augmentation using autologous block grafts is a predictable method for enhancing deficient alveolar ridge before implant placement. The intraoral block graft is the preferred choice over extra oral sites due to increased resorption, high cost and increased morbidity.[13] Khoury et al. states that autogenous bone superiority has been documented. And shall be consider, as, the gold standard in bone augmentation, however the use of particulate bone alone is unstable. Thin cortical bone blocks acts as a biological membrane for stabilization of the particulate part.[26,29] Platelets are known to release high quantities of growth factors, which stimulate cell proliferation, matrix remodeling, and angiogenesis. Kim et al, found in rabbits that the addition of PRP, PRF and CGF had significantly increased bone formation at the 6th week. The effect of PRP, PRF, and CGF was similar and may be improve the success rate of bone grafting.[18,37,38] Simonpieri et al, states that the use of platelet and blood concentrates during bone grafting offers the following four advantages: 1) The fibrin clot plays an important mechanical role, with the PRF membrane maintaining and protecting the grafted biomaterials and PRF fragments serving as biological connectors between bone particles.2) The integration of this fibrin network into the regenerative site facilitates cellular migration, particularly for

endothelial cells necessary for the angiogenesis, vascularization and survival of the graft. 3) The platelet cytokines are gradually released as the fibrin matrix is resorbed, thus creating a perpetual process of healing. 4) The presence of leukocytes and cytokines in the fibrin network can play a significant role in the self-regulation of inflammatory phenomena within grafted material.[14,35] In a study that evaluate the use of fibrin glue in addition to bone grafts to correct alveolar clefts, The authors conclude that the fibrin glue significantly diminishes bone resorption, allowing improved graft integration and quality.[36]

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Disclosure
The authors report no conflicts of interest with anything in this article.

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Simplified Ridge and Extraction Socket Augmentation using Sohn's Poncho Technique

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Abstract

Bone augmentation is essential before placing a dental implant in an atrophic edentulous ridge. Guided bone regeneration techniques have recently incorporated autologous fibrin membranes with concentrated growth factors to enhance healing. This article presents Sohn's Poncho Technique which is a method to utilize the healing capacity of CGF or PRF autologous membranes in an open wound when performing localized guided bone regeneration techniques. This technique stabilizes the the GCF membrane by using a healing abutment or prosthetic abutment at the implant site to perform minimally invasive GBR procedures as a one stage technique. Multiple different cases are presented in this article.

KEY WORDS: Dental Implant, Sinus Lift, Sohn Poncho Technique, GCF

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INTRODUCTION

Bone augmentation is essential before placing an implant in an atrophic edentulous alveolar ridge. Various bone augmentation techniques have been introduced over time.[1] Ridge augmentation using an autologous block bone graft can be a predictable augmentation method, but due to the invasiveness of this procedure, its application for localized ridge augmentation is restricted clinically. Guided bone regeneration (GBR) is one of the most commonly used augmentation procedures in localized bone augmentation.[2-4] When performing GBR, autologous bone graft, bovine bone, allogenic bone graft and alloplastic bone graft are used to create space. The autologous bone graft is considered the gold standard of bone grafts.[5] However, harvesting of autologous bone reveals disadvantages such as donor site morbidity, increased surgical time and increased postoperative discomfort. As alternatives to autologous bone grafts, various bone substitutes are used as space makers for localized ridge augmentation, and resorbable or non-resorbable barrier membranes are placed over the bone substitutes to prevent soft tissue ingrowth to the bone graft.[4.5] As alternatives to allogenic or alloplastic barrier membrane, autologous fibrin membranes including Leukocyte-platelet-rich fibrin membrane (L-PRF) and concentrated growth factors membrane (CGF) have been introduced when performing a GBR procedure.[6] Sohn et al. reported successful guided bone generation using a CGF barrier membrane combined with primary wound closure.[7] To perform minimally invasive GBR, a one staged procedure combined with bone augmentation is recommended. Tension free primary sutures are required in order to achieve successful ridge augmentation. However, early exposure of resorbable or non-resorbable membrane can cause delayed wound healing, infection and graft failure after augmentation procedures when performing a one stage procedure.[3-4] According to Lim et al. in a systemic review on GBR, the high rate (16.8%) of soft tissue complications was reported after performing guided bone regeneration.[8] On the other hand, early exposure of CGF or PRF membrane reveals fast wound regeneration because these membranes contain diverse growth factors to accelerate wound healing in an augmented ridge.[9-12] Even when a CGF or PRF membrane is exposed and stabilized intraorally, wound closure is accelerated without inflammatory reaction unlike collagen-based resorbable or non-resorbable membranes. Sohn's poncho technique is a surgical method to utilize the healing capacity of CGF or PRF membranes in an open wound when performing localized ridge augmentation.[13] This technique stabilizes CGF membrane by using a healing abutment or prosthetic abutment at the implant site to perform the minimally invasive GBR procedure as a one stage procedure. This article will demonstrate how to use Sohn's poncho technique for localized bone augmentation with simultaneous implant placement. Indications of Sohn's poncho technique are below: 1) For simple management of sound extraction without a bone graft when performing immediate implant placement; 2) For simple surgical management of an extraction socket defect with bone graft when performing immediate implant placement; 3) For simple management of a horizontal bony defect with simultaneous implant placement; 4) For

Figure 1: A centrifuge device to prepare CGF membrane. This device utilizes altered and controlled speed from 2,400 to 2,700 rpm for 12 minutes.

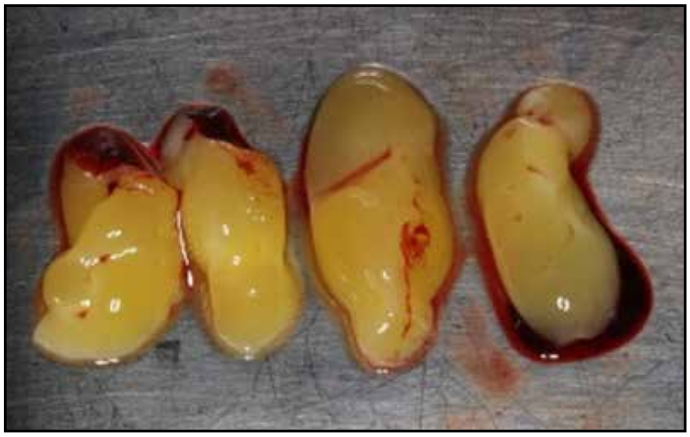

Figure 3: CGF layer placed in the sterilized metal storage box before compression.

Figure 2: A) Patient's venous blood taken in vacutainer. B) A silica coated vacutainer showing 3 different phases after 12-minutes centrifugation. The middle layer is the fibrin buffy coat layer containing concentrated growth factors. The upper and bottom layers are discarded.

simple management of unfavorable bone regeneration revealed at the uncovering procedure; 5) For socket preservation using open membrane technique; 6) For management of peri-implantitis; 7) For simple management of the site after the removal of failed implant. Sohn's poncho technique is not recommended when vertical bone augmentation is needed because primary soft tissue closure is required. In addition, Poncho technique is not indicated when the initial stability of implant is not less than 20Ncm because one stage procedure cannot be performed.

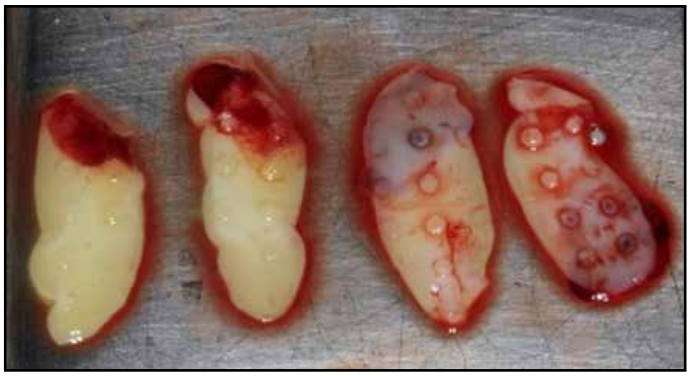

Figure 4: CGF membrane after compressing fibrin block with metal cover. This membrane is used as a barrier membrane as an alternative to collagen membrane.

Figure 5: A small opening to be pierced into healing or prosthetic abutment is made in the middle of the membrane with cotton pliers.

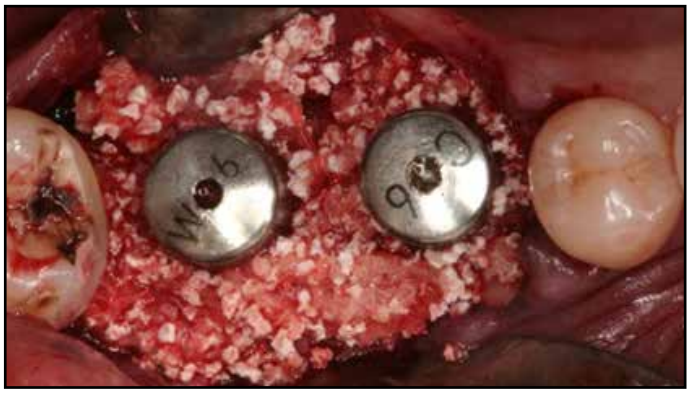

Figure 6: Sticky bone graft is placed on the bony defect after placement of healing abutment or implant mount to prevent displacement of bone graft to screw hole of implant body.

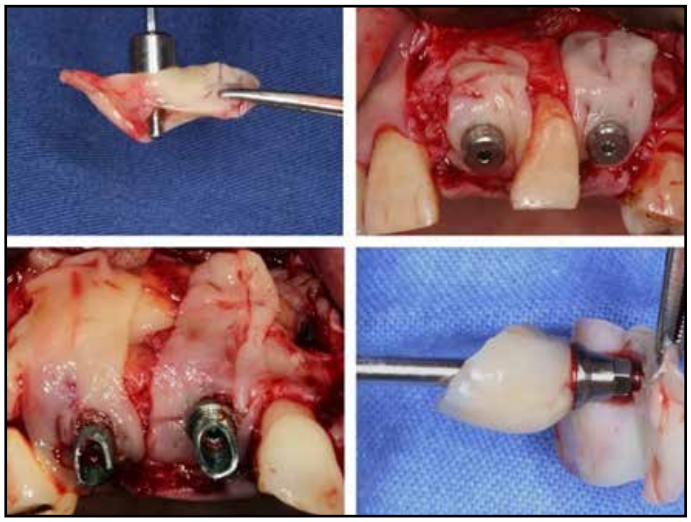

Figure 7: Methods to stabilize CGF membrane. A) Placement of screw of healing abutment through CGF membrane before placement on implant platform, B) Placement of CGF membrane through the head of healing abutment after placement of healing abutment on implant platform, C) Placement of CGF membrane through prosthetic abutment, D) Placement of CGF membrane through screw for temporary restoration

SURGICAL PROCEDURE

Preparation of CGF/PRF membrane

CGF membrane is prepared according to Dr. Sacco's protocol.[14] PRF membrane is prepared according to Dr. Choukroun's protocol before surgery.[10] Silica-coated vacutainers are used to collect the patient's venous blood from the patient's forearm. The blood in vacutainers is centrifuged at 2400-2700 rpm using a specific centrifuge (Medifuge, Silfradent srl, Sofia, Italy) with a rotor turning at alternating and controlled speed for 12 minutes to prepare the CGF membrane.

Altered centrifugation speed allows for the production of much larger, denser fibrin matrix and richer growth factors in the fibrin matrix than PRF using single rpm.[11] The centrifuged blood in the

vacutainer has 3 layers. The uppermost layer is the serum (blood plasma without fibrinogen and coagulation factors) and the 2nd layer is the fibrin buffy coat layer represented by a very large and dense polymerized fibrin block. The lowest red layer represents platelet-rich coagulation which will be discarded. The 2nd layer is used for the poncho technique as a barrier membrane. The dense, polymerized fibrin block is taken out of the vacutainer and placed in a sterile metal storage box. The fibrin block is compressed with a metal cover to be converted to CGF membrane (Figures 1-3).

The Placement and Stabilization of CGF Membrane at Implant Site

Once the CGF is prepared, a small slit or opening is made in the middle of the membrane with the help of a 15c blade or cotton pliers. A healing abutment or prosthetic abutment is used to stabilize the CGF membrane at implant sites. Before performing bone grafting in the defect, a regular-sized healing abutment or an implant insertion mount is placed to prevent displacement of the bone graft into the inside of the implant body. After placing the bone graft in the bony defect, the prepared CGF membrane is placed through the top of a regular healing abutment or a prosthetic abutment when delivering immediate temporary restoration. When a wide healing abutment (> 6mm) is placed on the platform of an implant, the CGF membrane is placed through the screw portion of a wide healing abutment, not through the head of a wide healing abutment, to avoid tear-off of the CGF membrane. The complex of the CGF membrane and a wide healing abutment is positioned on the implant platform. The healing abutment or prosthetic abutment is tightened with at least 20Ncm to avoid loosening of healing/prosthetic abutment during the healing period (Figures 4-7). If necessary, sutures can be done.

CASE REPORT 1

Simplified Management of Sound Extraction Socket with Sohn's Poncho Technique (Figures 8-18)

A 42-year-old female patient presented with a severely decayed left mandibular 2nd premolar, 1st and 2nd molar. She wanted implant-supported fixed restoration after extraction of these decayed teeth. The surgical procedure was performed under local anesthesia after administration of preoperative antibiotics (Amoxicillin/clavulanic acid, Augmentin®, Ilsung Pharm, Korea, 1.2g i.v.) on December 10th, 2010. A piezoelectric extraction tip, connected to a piezoelectric device (Surgybone®, Silfradent srl, Sofia, Italy) was inserted to widen the periodontal ligament space. Next, a thin elevator was placed to luxate the teeth without damaging the extraction socket. An osteotomy with a 1.8mm wide round piezoelectric tip was done at the septum because piezoelectric insert does not slip down at a narrow septum. The initial osteotomy was followed by an under-osteotomy using an implant drill to achieve favorable initial stability of the implant. Three implants (Legacy implant, Implant Direct LCC, Calabasas, CA, USA) were placed 1mm subcrestally at the buccal extraction socket. Bone graft was not placed at the extraction defect in order to utilize natural healing capacity.

Healing abutment was connected on each implant platform, and tightened them at 20Ncm, and CGF membrane was placed through the head of healing abutment to accelerate wound healing at extraction socket. Interproximal sutures were added for tissue approximation. The patient

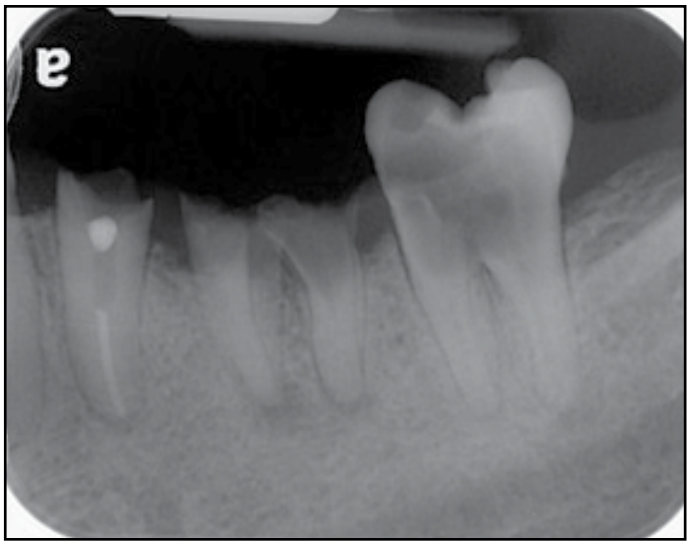

Figure 8: Left mandibular 2nd premolar, 1st and 2nd molar were severely decayed. Immediate implant placement was planned after extraction of these teeth.

Figure 10: Piezoelectric round carbide tip was utilized to guide osteotomy at septum

complained of very mild discomfort the following day. Provisional restoration was delivered after 2 months of healing. To get ridge of pulling of buccal frenum, a free gingival graft (FGG) was performed. The buccal flap in the recipient site was carefully dissected apically without exposing underlying bone and no mobility of the soft tissue in the recipient site was confirmed. The apically

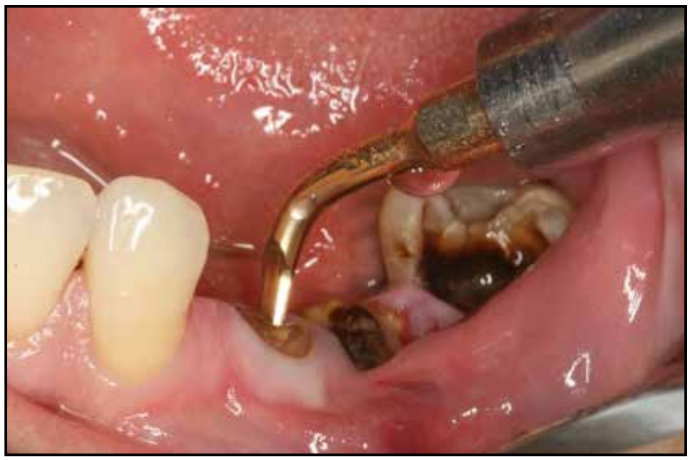

Figure 9: Piezoelectric extraction tip was inserted into periodontal ligament space for facilitation of extraction elevator.

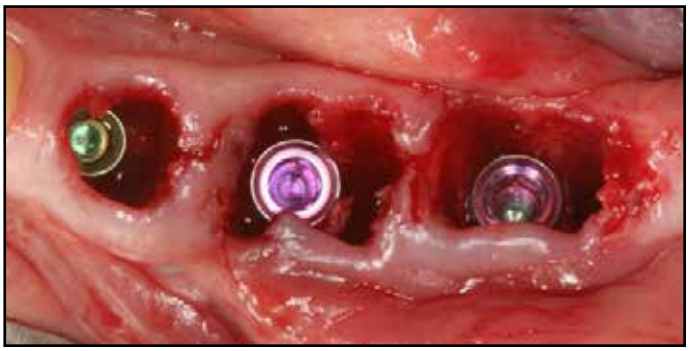

Figure 11: Placement of implant with good initial stability after under-osteotomy. Note wide extraction defect. Bone graft was not placed in the defect. The buccal flap was not elevated to maintain blood supply to extraction socket.

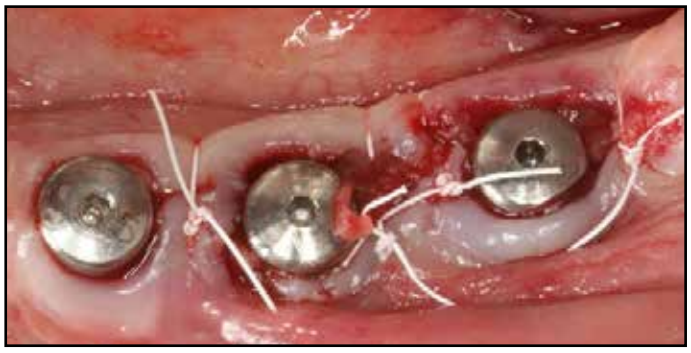

Figure 12: The complex of CGF membrane and healing abutment (poncho technique) was placed on implant platform. Interproximal suture was performed. Note exposed CGF membrane in the extraction socket.

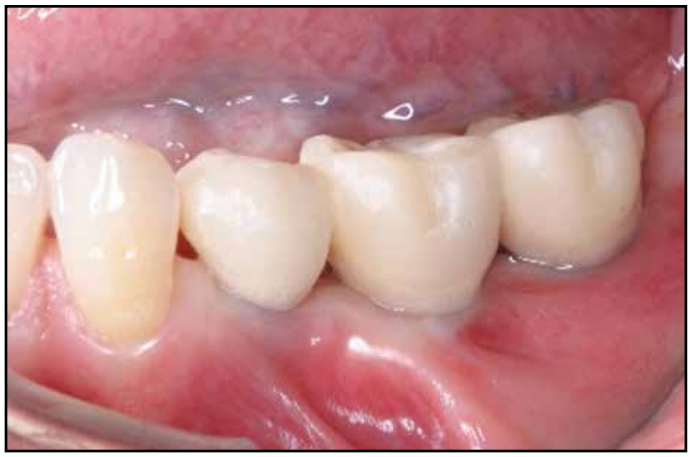

Figure 14: Placement of provisional restoration after 2 months of healing. Note pulling of buccal frenum.

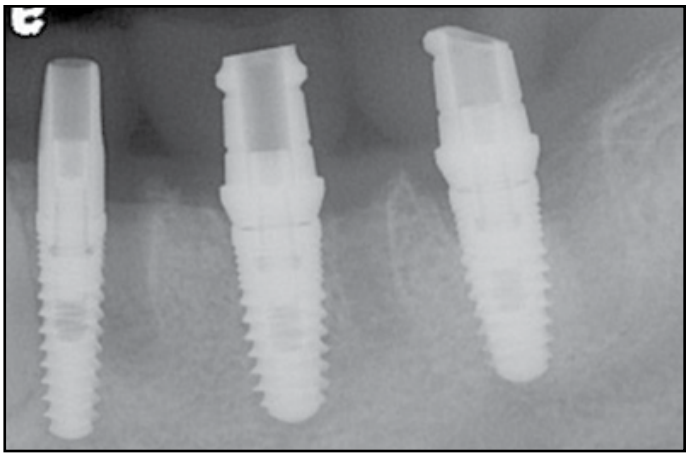

Figure 15: A periapical radiogram taken after delivery of provisional restoration.

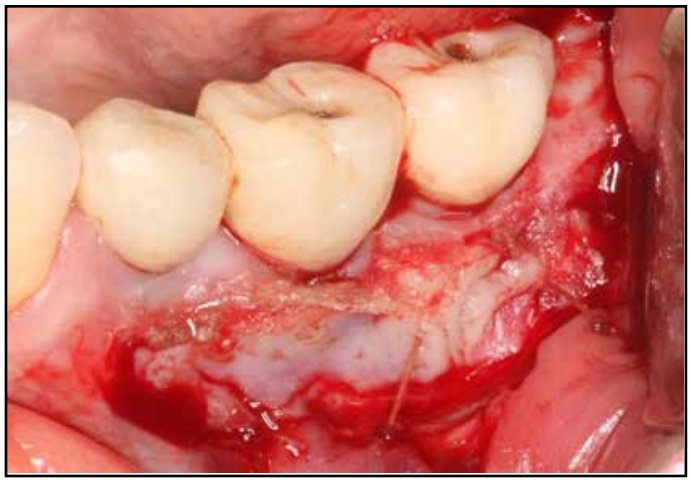

Figure 16: FGG was performed to provide attached keratinized gingiva around implants. The FGG was stabilized with medical grade tissue cyanoacrylate on recipient area.

Figure 17: Intra oral view after 5 years of loading. Note well maintained keratinized gingiva around implant restoration.

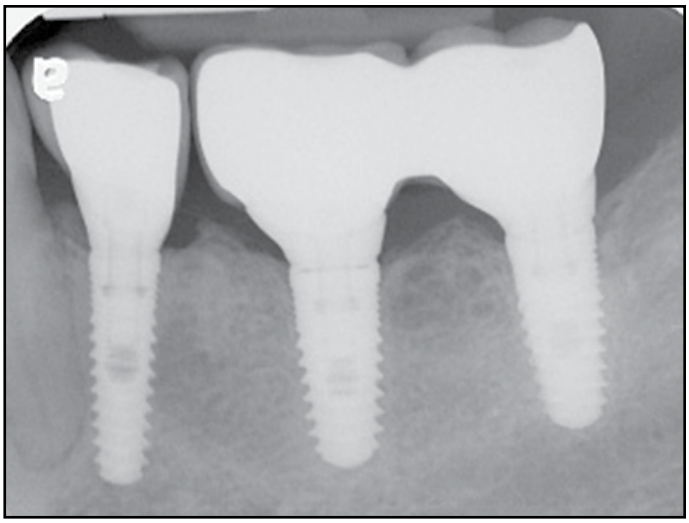

Figure 18 (right): Note vertical bone regeneration without bone grafting after 5 years of loading.

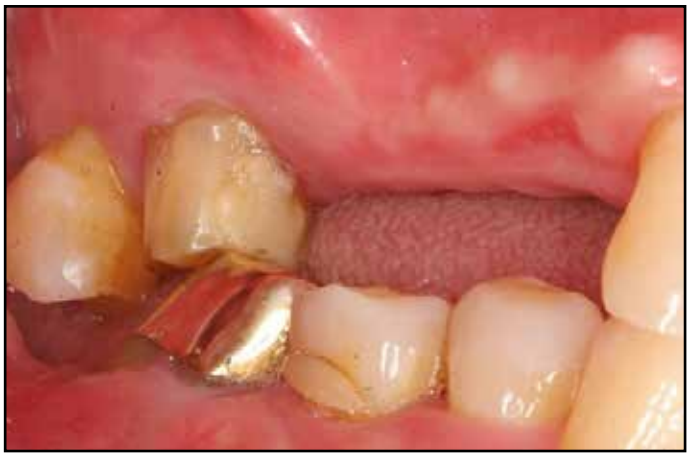

Figure 19: Upper right 1st and 2nd molar revealed mobility and dull pain on mastication.

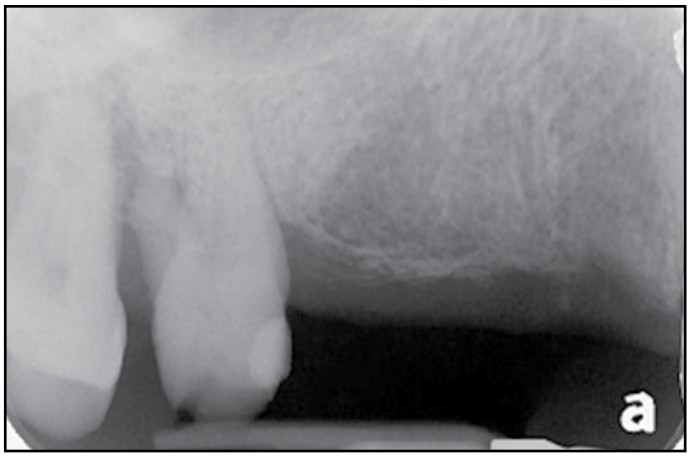

Figure 20: A periapical radiogram showing bone resorption at teeth. All extracted teeth were prepared and used for autologous tooth bone graft at chairside.

repositioned flap was stabilized on the buccal periosteum with interrupted sutures. A thin FGG (less than 0,5mm thick) using a 15c blade was placed on the recipient site. To stabilize the FGG on the recipient site, a few drops of medical grade tissue cyanoacrylate (Histoacryl L, B Brown surgical SA, Rubi, Spain) were applied and dried gently with an air syringe. Final restoration was delivered after 2 months' loading of provisional restoration.

CASE REPORT 2

Simplified Extraction Socket Augmentation with Bone Resorption using Sohn's Poncho Technique (Figures 19-28)

A 69-year-old female patient visited our department with a complaint of severe mobility of upper right 1st and 2nd molar. She wanted implant-supported fixed restoration after extraction of these teeth. Implant placement was done immediately after extraction of the teeth under local anesthesia on Dec 13th, 2015. The extracted teeth were prepared for osteoinductive tooth bone graft at chairside. All soft tissue adherent to the extracted teeth and pulp tissue was removed using a pear-shaped carbide bur. Chairside preparation to make autologous tooth particulate bone, including demineralization, washing, buffering and sterilization, was completed according to the manufacturer's instructions (VacuaSonic® Cosmobiomedicare, Seoul, Republic of Korea), by using an ultrasonic vibration and vacuum compression. The patient's venous blood was taken from the forearm to make autologous fibrin glue (AFG) and CGF membrane. Sohn's Sticky Bone™, using particulate tooth bone, was prepared as described by Sohn et al.[15] All granulation tissue at the extract socket was completely curetted. Flapless surgery was planned because a preoperative cone beam computed tomogram (CBCT) revealed 7mm bone width at the site of the 1st premolar. After excision of soft tissue using a 4mm-wide tissue punch at the implant site, gingival depth from gingival crest to alveolar bone was measured and recorded. As a 3-dimensional positioning guide, BonePen (Acrodent Co, Kimhae, Korea), corresponding to the diameter of

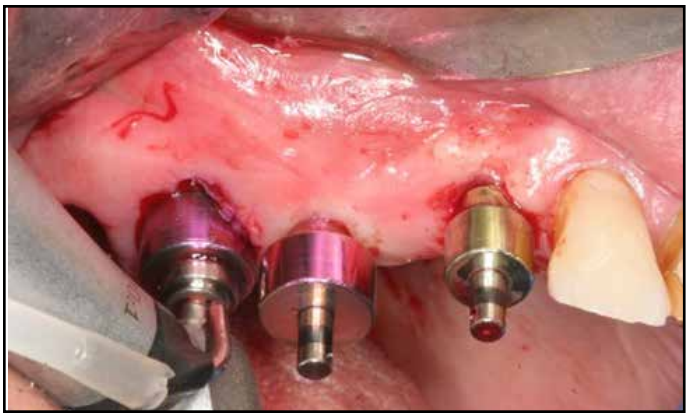

Figure 21: As a 3-D surgical guide, BonePen was utilized to perform initial osteotomy at ideal implant site, and BonePin was placed at osteotomy sites to verify parallelism of each implant and occlusion.

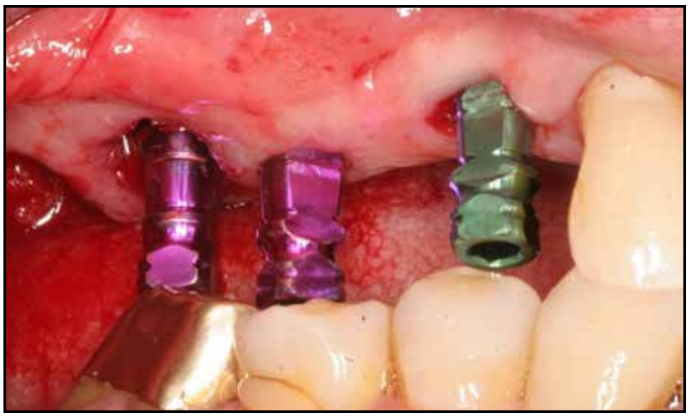

Figure 22: All implants were placed with good stability. An implant was not needed at the 2nd molar site due to there being no opposing tooth.

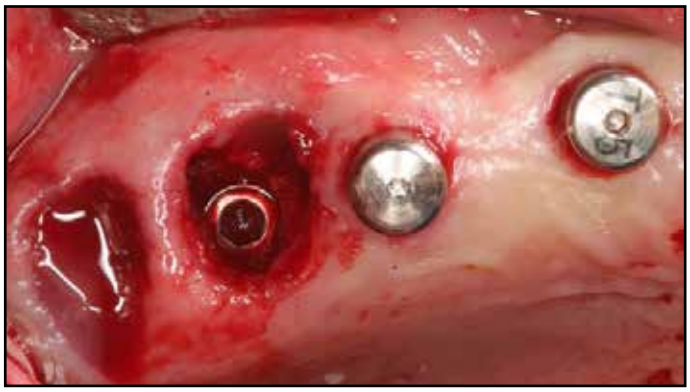

Figure 23: Vertical bony defect was revealed at 1st and 2nd molar sites.

Figure 24: Sticky autologous tooth bone was grafted onto the extraction defect without elevation of a full thickness buccal flap.

each tooth, was utilized when performing the initial osteotomy at the implant sites. After the osteotomy using BonePen , the same sized BonePen was placed at the osteotomy site to ensure parallelism of each implant and verify mesio-distal distance between implants. Occlusion was verified after placing BonePen at the all osteotomy sites. Under-osteotomy was applied to obtain initial stability of all implants. Three implants (HA-coated Zimmer implant, CA, USA) were placed with good stability. The implant platforms were placed 1mm lower to buccal alveolar crest. A vertical bone defect was verified at the mesial defect of extraction socket of the 1st and at the extraction socket of 2nd molar site. The buccal flap was not elevated and the prepared sticky tooth bone was grafted at the extraction defect of 1st molar for socket augmentation. Poncho technique was performed to accelerate wound healing and to increase the width of keratinized gingiva around the implant

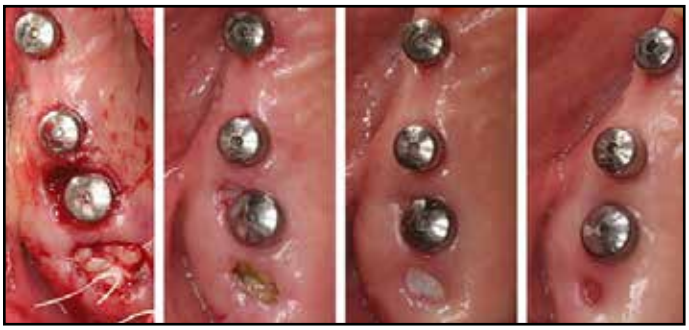

Figure 25: A) Immediately after implant surgery. B) One-week healing C) CGF membrane is visible after at 2nd molar site after 4 weeks of healing, D) 3 months of healing.

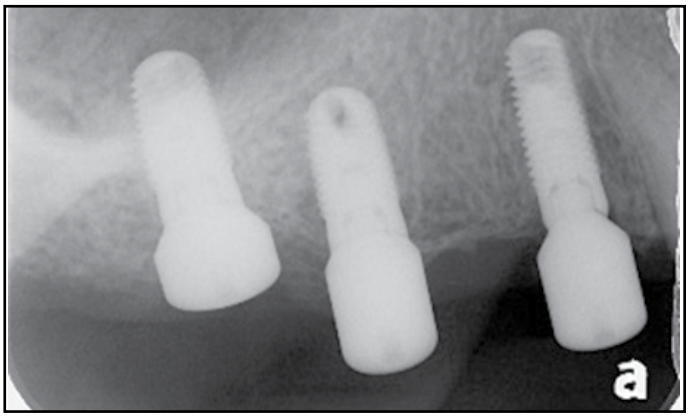

Figure 26: Postoperative radiogram after augmentation procedure.

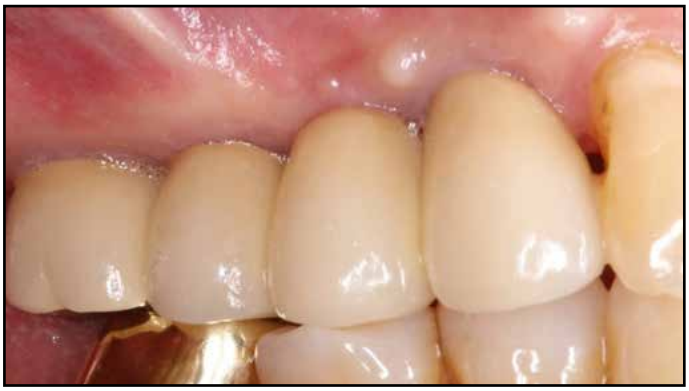

Figure 27: Final restoration after 2 years in function.

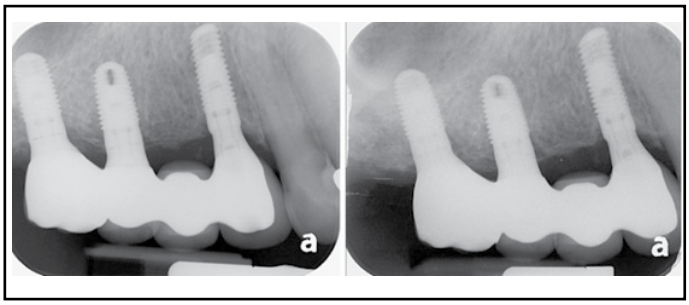

Figure 28: A) Periapical radiogram at delivery of final restoration. B) Periapical radiogram reveals well-maintained socket augmentation after 2 years in function.

at the 1st molar site. For socket augmentation at the extraction socket of the 2nd molar, sticky tooth bone was grafted and folded CGF membrane was applied to cover the bone graft using an open membrane technique. The sutures to stabilize the CGF membrane were performed. Primary wound closure, which can cause postoperative swelling at the site of the 2nd molar site, was not performed. Very minor postoperative discomfort was observed by the patient the next day because the full thickness flap was not elevated and the periosteal releasing incision was not performed for the purpose of primary wound closure. The wound healing at the extraction socket was uneventful. Wound healing at socket of 1st molar was revealed after 3 weeks. The CGF membrane was visible after 4 weeks of healing at the 2nd molar site. Provisional restoration was delivered after 13 weeks of healing. The final restoration was delivered after 2 months' loading of provisional restoration. Favorable maintenance of the augmented socket was revealed after 2 years in loading.

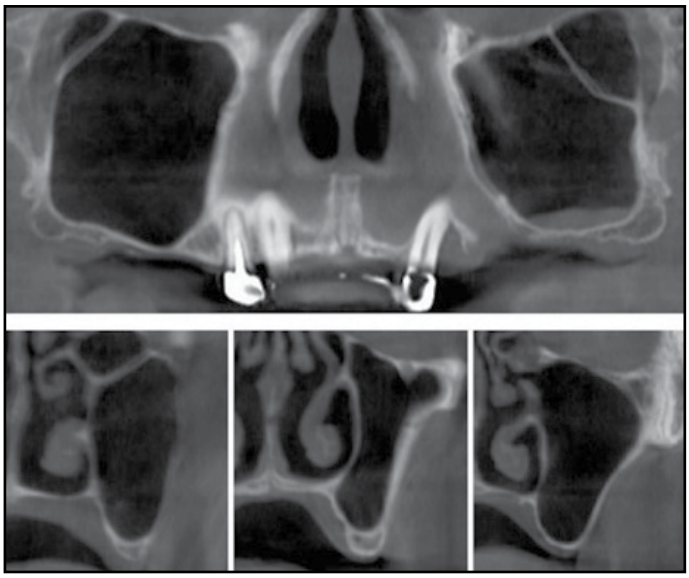

Figure 29: Preoperative CBCT reveals very unfavorable bone volume at both upper edentulous areas.

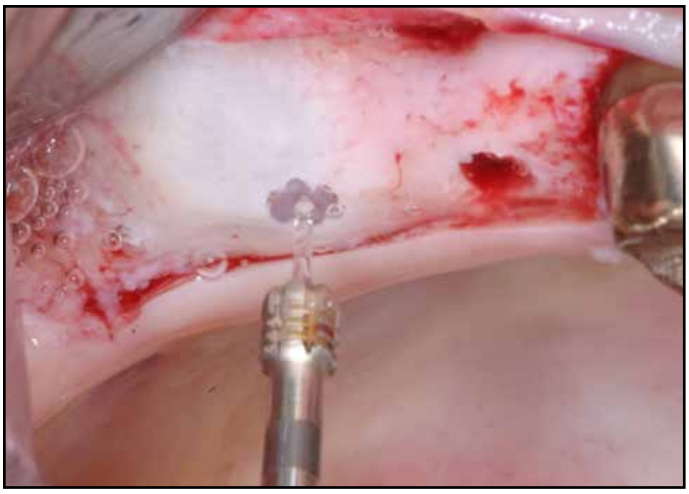

Figure 30: HPISE was performed to elevate sinus membrane.

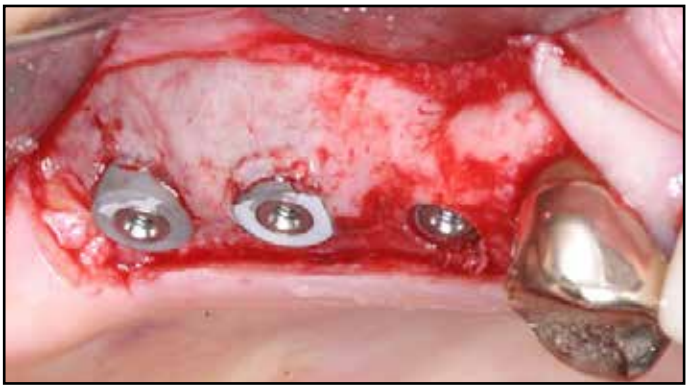

Figure 31: Implants were placed at the same time after sinus bone graft. Note bone defect around implants.

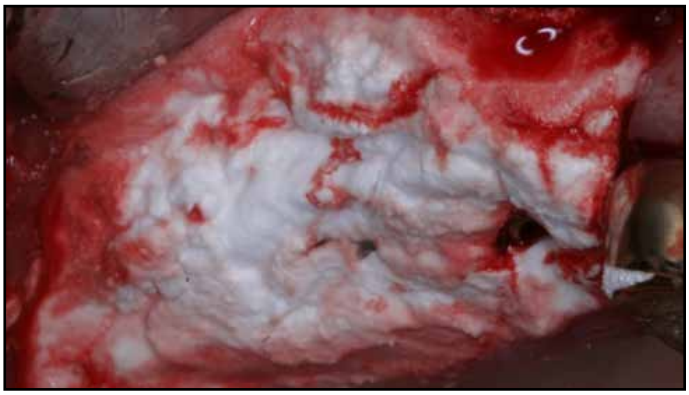

Figure 32: Injectable synthetic bone graft was placed for ridge augmentation. Same surgery was done at left edentulous area.

CASE REPORT 3

Simplified Management of Unfavorable Bone Regeneration Revealed at the Uncovering (Figures 29-38)

A 55-year-old female patient visited our department for restoration of the bilateral upper posterior edentulous ridge with dental implants in February, 2012. A preoperative radiogram and CBCT scan revealed 1-3mm of residual bone height at upper right 2nd molar, 1st molar and 2nd premolar. The residual bone height at the left posterior edentulous ridge was 1-2mm. She was informed about crestal sinus elevation using hydrodynamic piezoelectric internal sinus elevation (HPISE) for both sinus augmentations. The surgical procedure was performed under local

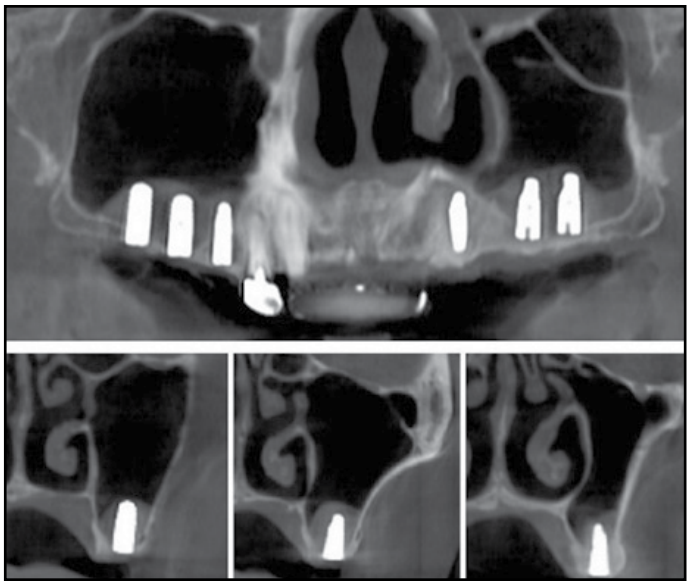

Figure 33: Postoperative CBCT at right edeulous area reveals bone graft in both sinus and edentulous ridge.

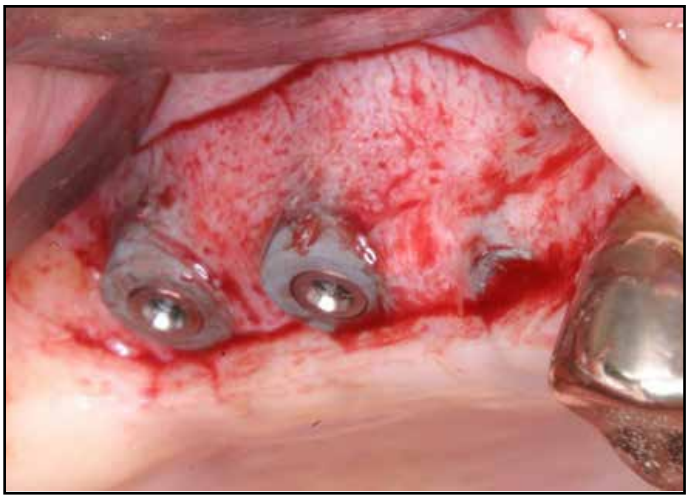

Figure 34: Note complete resorption of augmented alloplast after 8 months of healing. However, osseointegration of implant was achieved.

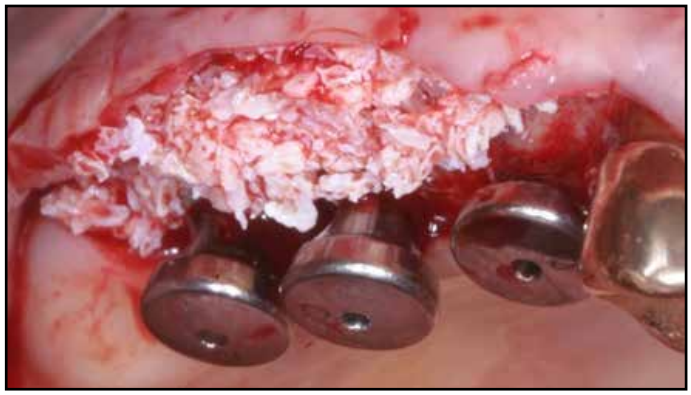

Figure 35: Sticky bone was placed on the alveolar defect and poncho technique was utilized to accelerate wound healing.

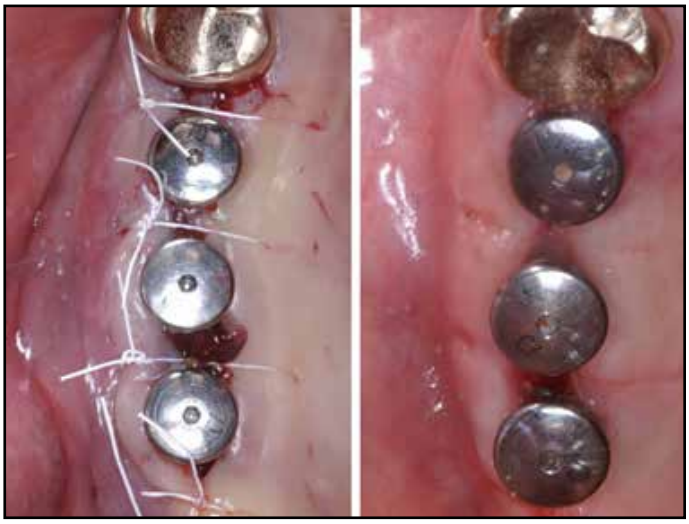

Figure 36: A) Note exposed CGF membrane at interproximal area. Attached gingiva was not sacrificed because primary wound closure was not done.
B) Note favorable wound closure at interproximal area after 2 weeks of healing.

anesthesia after administration of preoperative antibiotics (Amoxicillin/clavulanic acid, Augmentin®, Ilsung Pharm, Korea, 1.2g i.v.) in February of 2012. A full thickness mucoperiosteal flap was elevated to expose the right edentulous ridge. A cylindrical HPISE tip (S-Dental Co, Daegu, Korea) attached to a piezoelectric surgical device was used to break the sinus floor using ultra-

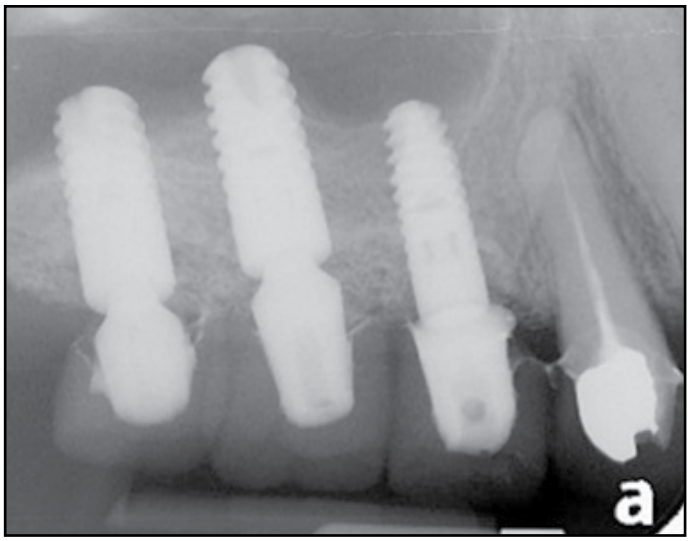

Figure 37: Periapical radiogram reveals bone graft at interproximal area.

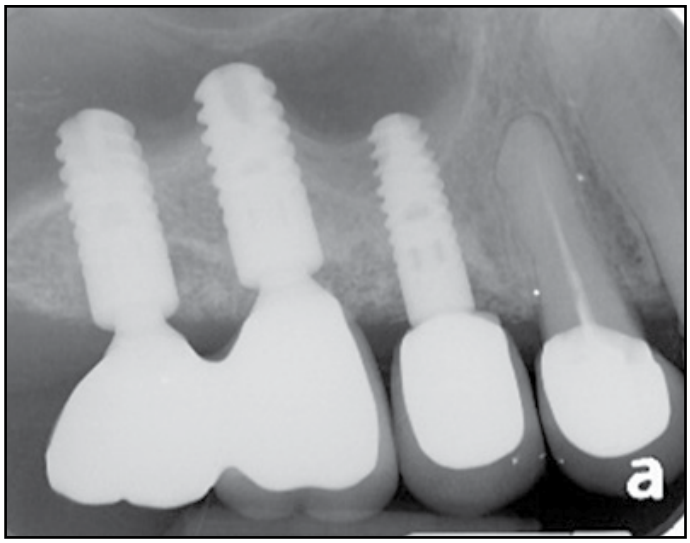

Figure 38: Periapical radiogram after 3 years in function reveals favorable maintenance of bone graft interproximally.

sonic vibration and elevate the sinus membrane using hydraulic pressure. After completion of mucosal elevation using hydraulic pressure, a gel-conditioned allograft (OrthoBlast II®, IsoTis OrthoBiologics Inc, California, USA) was placed in the new compartment under the elevated sinus mucosa. Dental Implants (Ankylos implant, Friadent, Germany) were placed at the same time. Injectable synthetic bone graft (Fortosss® Vital, Biocomposites, Staffs, England) was grafted for horizontal ridge augmentation. The initial stability of implants were less than 20Ncm, so two-stage procedure was planned. A tension-free primary wound closure was performed. The same surgical procedure was performed on the left side. Healing was uneventful. The implant site was exposed under local anesthesia after 8 months of healing. However, the injectable synthetic bone graft showed early complete resorption without inflammatory response on both edentulous sides. The healing abutment was connected to the implant platform because osseointegration was successfully achieved. Sticky Bone™ using inorganic bovine bone (Inducera, Seoul, Oscotec, Korea) was grafted onto the bony defect and the healing abutment was placed on the implant platform. CGF membrane was placed through the head of healing abutment. Wound closure was done without periosteal releasing incision. The flap was sutured but the CGF membrane was exposed at the interproximal area. Very minor discomfort was noted the next day. Sutures were removed after 2 weeks and favorable soft tissue healing was revealed at the interproximal area. An impression was taken on the same day and provisional restoration was delivered after 1 week. Final restoration was delivered after 6 weeks' loading of provisional restoration.

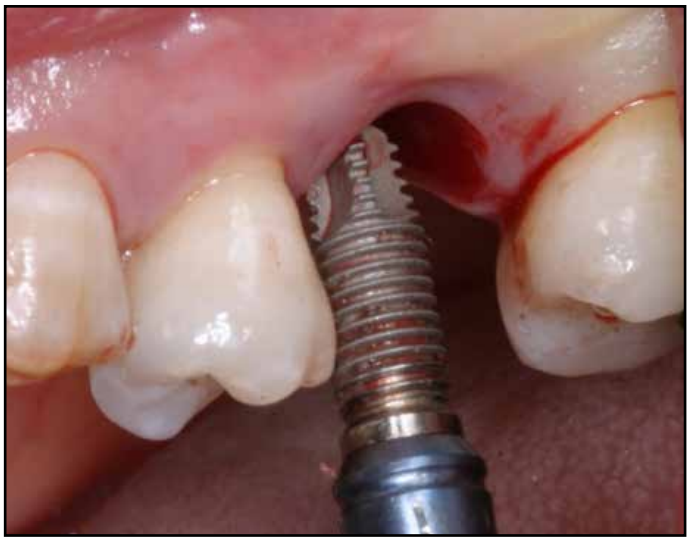

Figure 39: A failed implant at site of upper left first molar was removed with forceps.

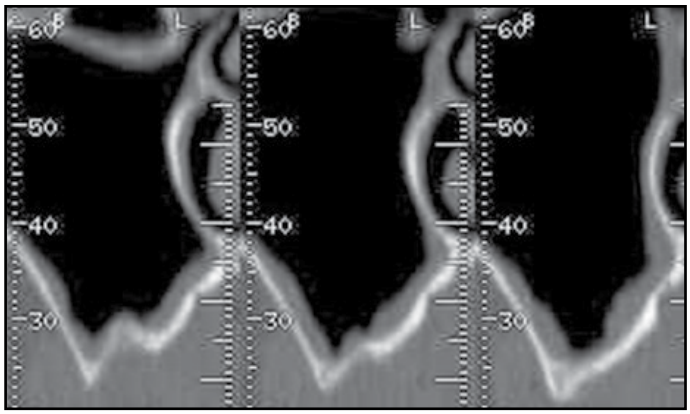

Figure 40: Preoperative CBCT shows unfavorable bone volume.

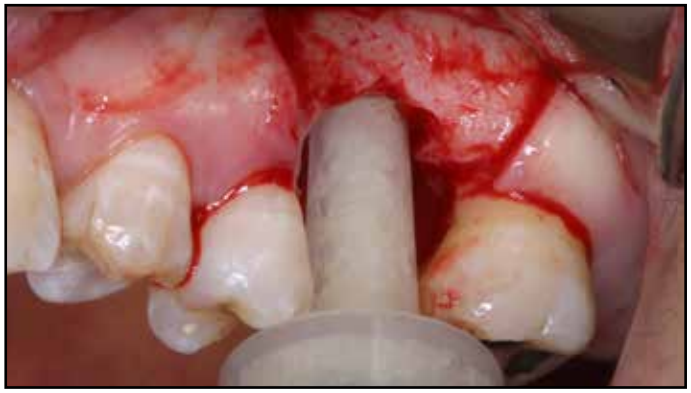

Figure 41: HPISE was done for sinus elevation.

CASE REPORT 4

Simplified Management of Peri-implantitis using Sohn's Poncho Technique (Figures 39-58)

A 45-year-old female patient presented with mobile an implant-supported restoration at site of upper left 1st molar on August 5th, 2008. This restoration was removed with extraction forceps. She came back to our department to restore the missing upper left 1st molar with an implant in October, 2008. A preoperative CT revealed 1mm residual bone height at the edentulous site. HPISE, as demonstrated in case report 3 of this article, was performed. After mucosal elevation using water pressure, the CGF membrane and gel conditioned allograft were grafted through the osteotomy site and a 4.7mm wide and 13mm long implant (Legacy implant, Implant Direct LCC, Calabasas, CA, USA) was placed at the same time. Bovine bone was grafted onto the palatal bony defect and the CGF membrane was covered the bone graft as alternative to a collagen barrier membrane. A primary closure was performed. The uncovering of implant was done after 6 months' healing and final restoration was delivered after 6 weeks' loading of provisional restoration. The implant had been functioning well for 3 years. However, she visited our department with complaints of gingival swelling after 4 years' loading in December 2014. Suppuration and bleeding on probing was shown and 8mm pocket depth was verified. No attached keratinized gingival zone existed around the implant. A full thickness

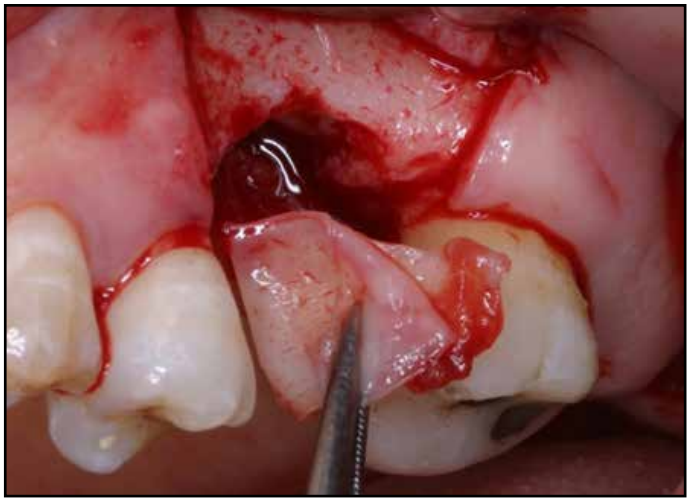

Figure 42: CGF membrane was placed in the sinus to accelerate bone regeneration and prevent accidental perforation of sinus mucosa during bone graft in the sinus.

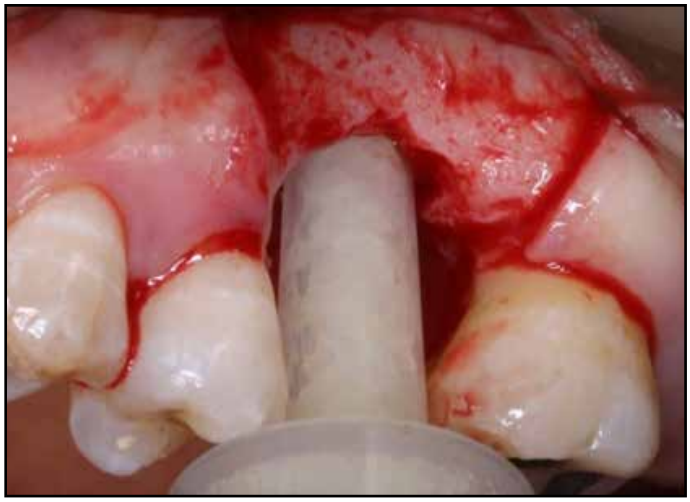

Figure 43: Gel-conditioned allograft was placed after elevation of sinus membrane using HPISE.

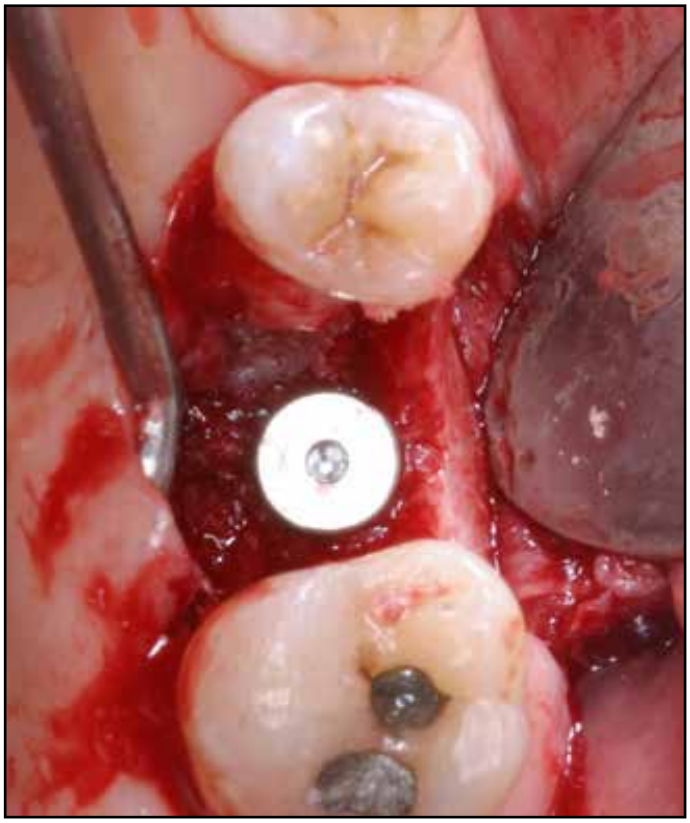

Figure 44: An implant was placed simultaneously. Note palatal bone defect.

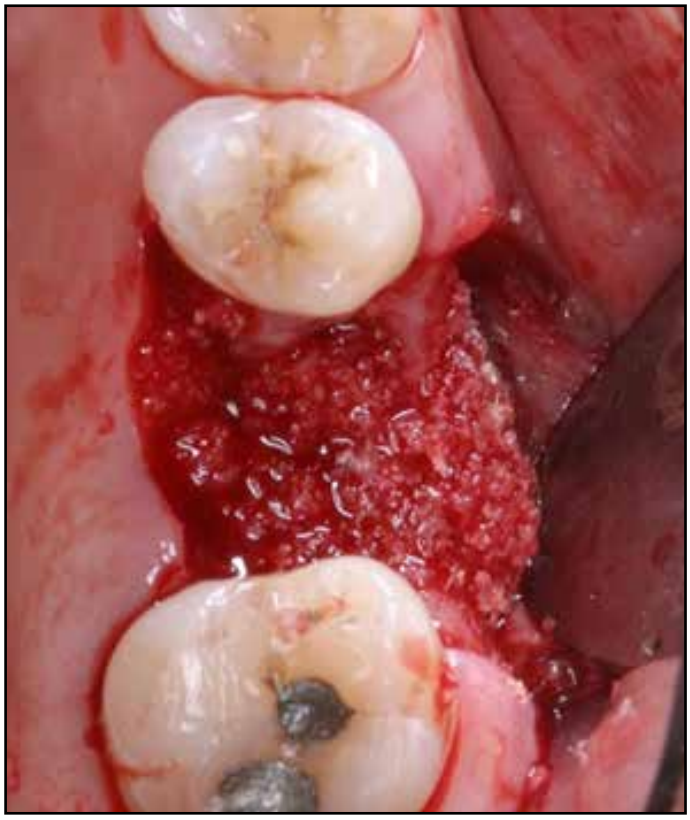

Figure 45: Bovine bone was grafted onto palatal defect.

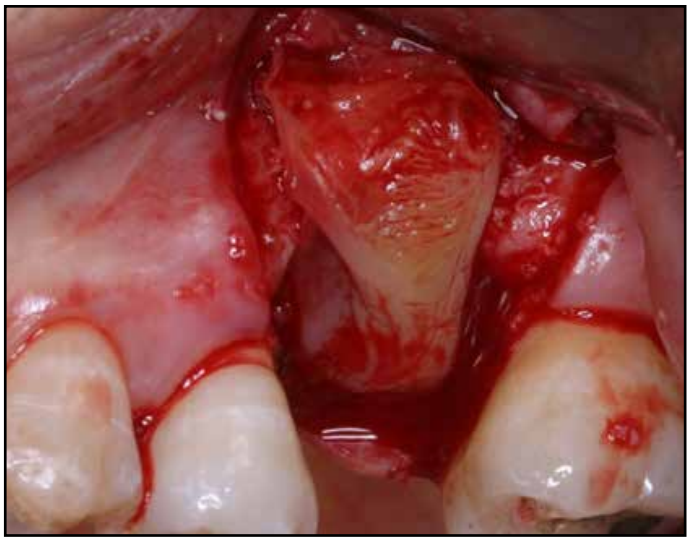

Figure 46: CGF membrane was placed on the bone graft as an alternative to collagen barrier membrane.

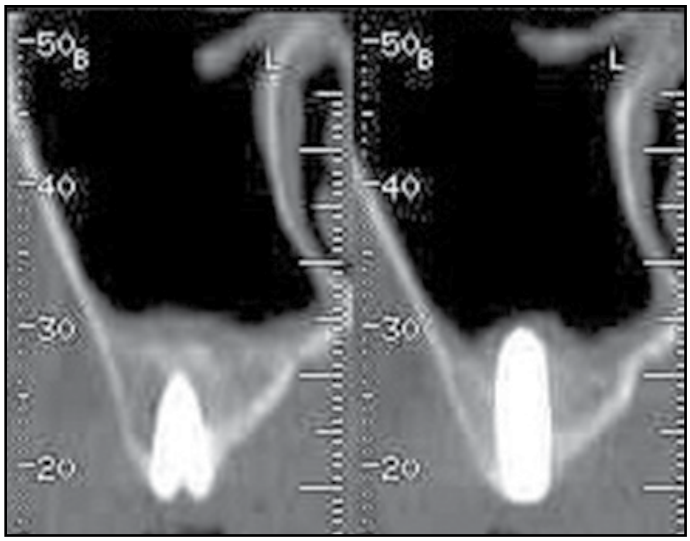

Figure 47: CBCT after 6 months of healing reveals bone regeneration in sinus and ridge.

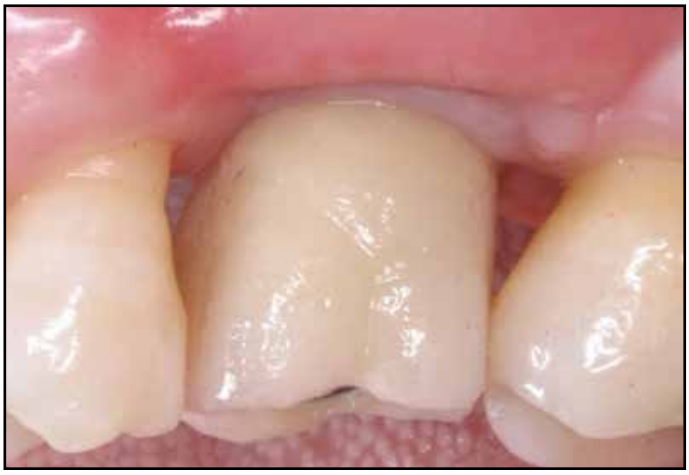

Figure 48: Final restoration.

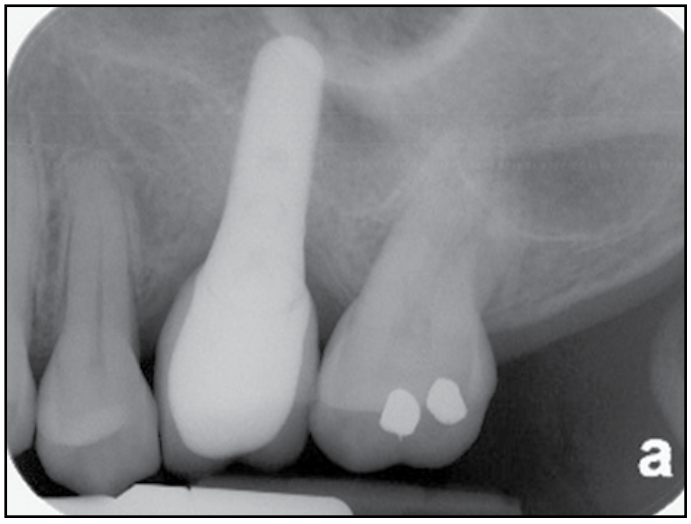

Figure 49: A periapical radiogram after 3 years in function.

flap was elevated to expose the infected implant surface and bony defect. An iBrush™ (NeoBiotech implant co, Seoul, Korea) with metal bristles, attached to a low speed handpiece with continuous irrigation, was utilized to remove granulation tissue in the bony defect and on the surface of the implant. After complete cleaning of granulation tissue at the implant site, a cotton pellet soaked with Tetracyline HCl was applied to the infected implant surface for about 3 minutes to detoxify the infected implant surface. Sticky bovine bone was grafted along the exposed implant surface and bony defect, and the complex of CGF membrane and healing abutment (poncho tech-

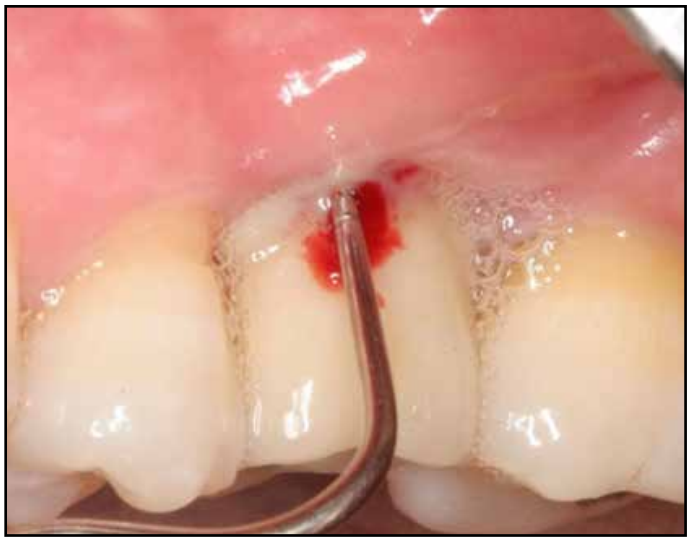

Figure 50: Note suppuration and bleeding on probing after 4 years in function. Attached keratinized gingiva was absent.

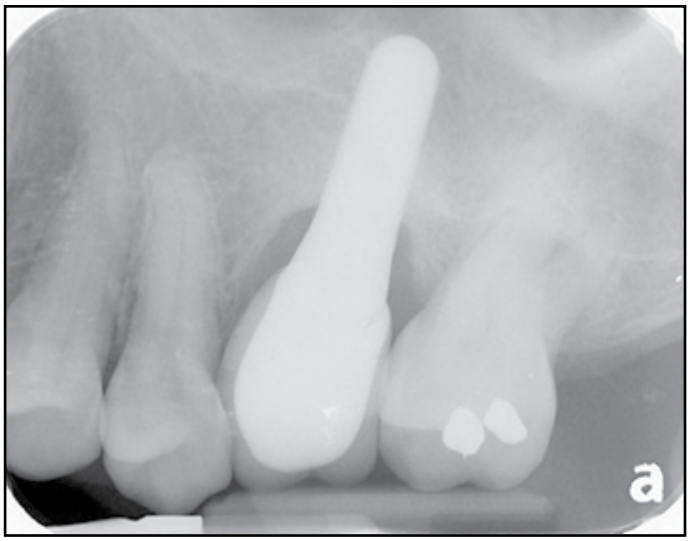

Figure 51: Infrabony pocket is revealed in a periapical radiogram after 4 years of loading.

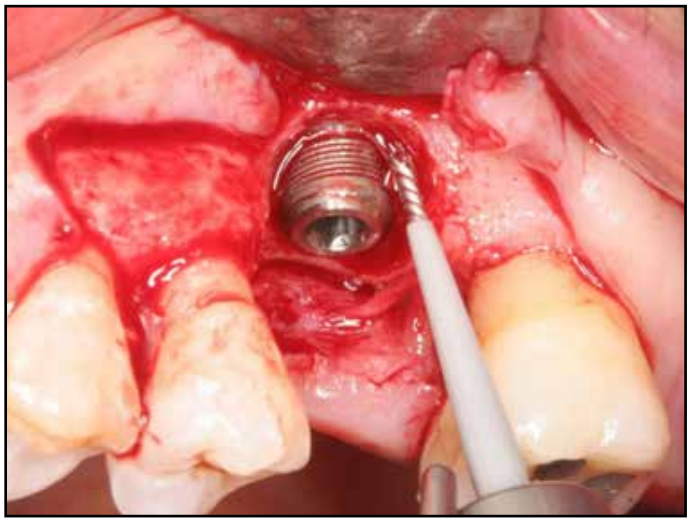

Figure 52: A metal brush was used for debridement of granulation tissue.

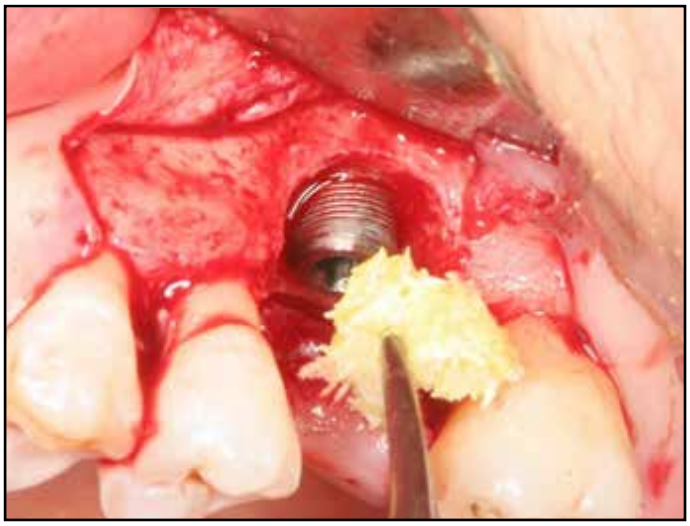

Figure 53: Tetracycline HCl was scrubbed on infected implant surface for about 3 minutes to detoxify infected implant surface.

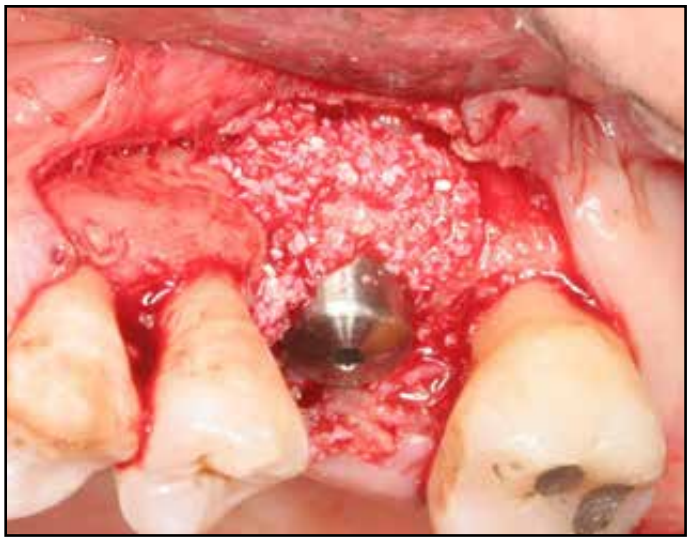

Figure 54: A healing abutment was connected to the implant and bovine Sticky Bone was grafted along exposed implant surface and on the bony defect. CGF membrane was pierced with head of healing abutment and sutures were done as one stage procedure.

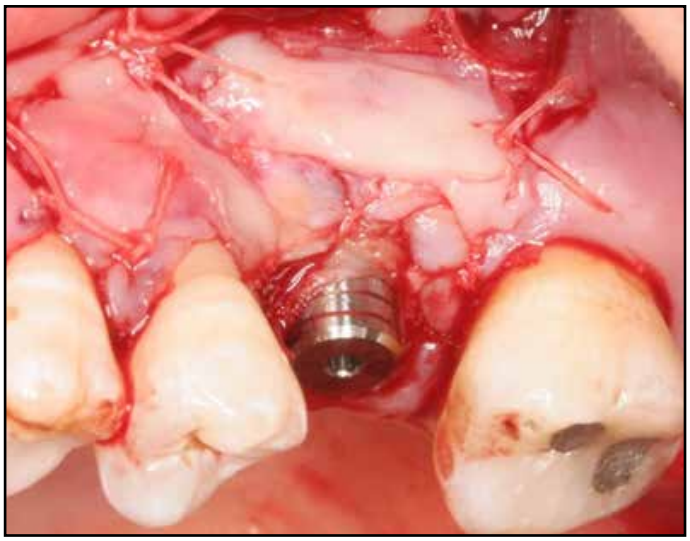

Figure 55: Wound was sutured as one stage procedure and FGG was performed to widen attach keratinized gingiva around implant.

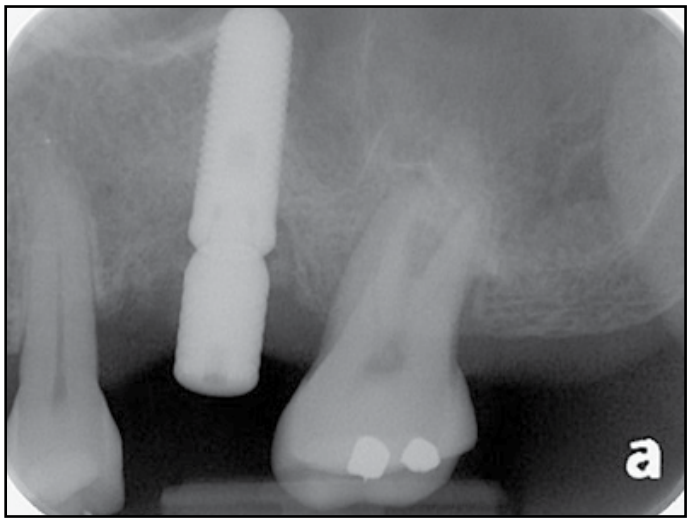

Figure 56: A postoperative radiogram reveals bone graft placed in bony defect.

nique) was placed on the implant platform to contain the bone graft and to accelerate tissue regeneration. To attach keratinized gingiva to the buccal mucosa on the same day, ARF was prepared with 15c blade, and it was secured with interrupted periosteal suture. FGG harvested from the palate was grafted and stabilized with sutures on the recipient site. The patient's old restoration was delivered again after one month of healing. 3-year follow up was uneventful.

DISCUSSION

GBR is considered the most commonly utilized augmentation method associated with implant placement in a resorbed alveolar defect. When performing GBR, bone grafts and resorbable and non-resorbable barrier membranes are essential. The success of bone regeneration using GBR can be influenced by the surgeon's tech-

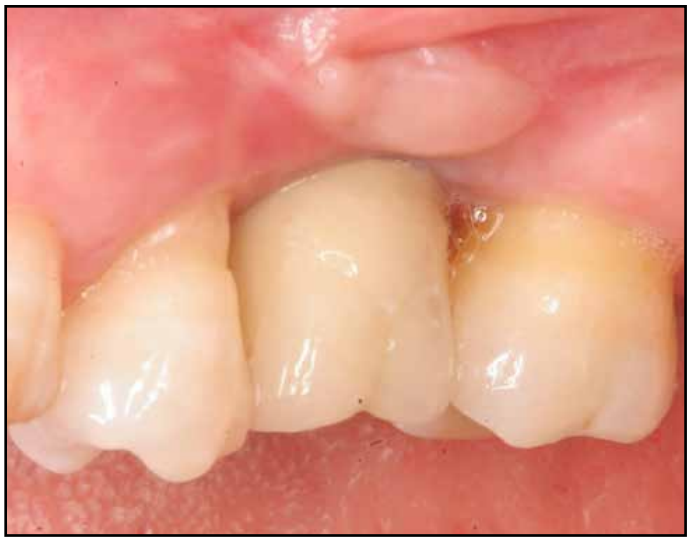

Figure 57: Note attached keratinized gingival zone after 3 years in function. No suppuration was shown.

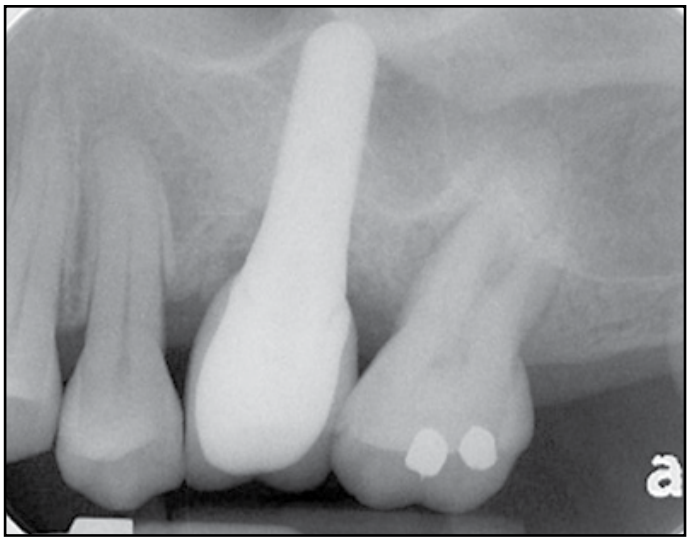

Figure 58: A radiogram reveals stable bone regeneration after 3 years in function.

nique sensitivity.[4,8] When performing a localized ridge augmentation, two-stage implant surgery is commonly recommended. Elevation of the full thickness flap and a sufficient periosteal releasing incision is required to achieve successful primary wound exposure. A primary wound closure is especially important in preventing bacterial contamination of the bone graft and barrier membrane. Soft tissue dehiscence and infection can lead to failure of bone augmentation and failure of implant osseointegration.[4,16] A periosteal releasing incision procedure can cause postoperative swelling, pain, hemorrhage, loss of attached keratinized gingiva, and delayed wound healing. Compared to two-stage implant surgery, one-stage implant surgery is more advantageous. One-stage implant surgery reduces the number of surgeries required, shortens healing time, minimizes the edentulous period and maintain attached keratinized gingival zone. In addition, it is reported that there is no significant difference, when performing a localized ridge augmentation, in marginal bone loss and the success rate of an implant between the two approaches.[17-20] Growth factor-enriched CGF membrane is a slowly biodegradable fibrin membrane that can last up to 4 weeks when it is exposed intraorally. It accelerates wound healing when placed on the bone graft as a barrier membrane, and contains the bone graft on the defect. CGF membrane contains platelets and leukocytes to release several growth factors which stimulate tissue regeneration.[11] CGF can be used as alternatives to the traditional barrier membrane covering a bone graft, therefore acceleration of tissue regeneration is acquired. According to Pinto et al.'s study comparing PRF using 4 different centrifuges**,** centrifuge characteristics can affect polymerization of the fibrin membrane and cell vitality entrapped in the fibrin membrane. The original Intraspin L-PRF clot showed stronger polymerization and higher vitality of cells compared to PRF made by other laboratory centri-

fuge.[21,22] The degree of polymerization of the fibrin membrane can affect its biodegradation speed. Thick and strong polymerization of the fibrin membrane allows for slow biodegradation. Unlike a PRF membrane using constant centrifugation speed, a CGF membrane utilizes altered centrifugation speed to produce much larger, denser and richer fibrin matrix containing growth factors.[11] Sohn's poncho technique utilizes the advantages of one-stage implant surgery and growth factors-enriched fibrin membrane with slow biodegradation. To our knowledge, the idea of Sohn's poncho technique in implant dentistry is first described by the author in 2008.[12] The word "poncho" comes from the name for a thick woolen cloth with an opening in the middle for the head used in the early 18th century in Middle and South America. This technique was introduced to minimize disadvantages related to elevation of the full thickness flap and periosteal releasing incision in localized ridge augmentation and the simple management of extraction socket. The CGF membrane is resorbed slowly for 4 weeks, and accelerates the formation of new soft tissue when exposed intraorally. Therefore, a primary wound closure is not necessary in most localized augmentation cases. Elevation of the full thickness flap can cause impaired blood supply to buccal bone in extraction socket and thin labial and buccal bone resorption is possible. Therefore, to remain the buccal flap attached to bony surface is more beneficial in extraction socket management as open membrane technique using CGF membrane.

Sohn's poncho technique has numerous advantages. Firstly, bone resorption is minimized because a full thickness flap related to primary wound closure is not elevated in extraction socket augmetnation. Therefore, healing is fast and the patient's postoperative discomfort including pain, swelling and bleeding is reduced. Secondly, the zone of keratinized gingiva is maintained because the coronally advanced flap prepared to achieve a primary wound closure is not needed. Thirdly, the number of surgeries is reduced because one-stage implant surgery is commonly performed on the bone defect. Fourthly, wound healing is accelerated because autologous concentrated growth factors are released during the healing period. Finally, surgical cost and time is reduced because the CGF membrane is utilized as an alternative to resorbable or non-resorbable barrier membrane. Sohn's poncho technique can be utilized in various clinical situations which require localized ridge augmentation with/without bone graft.

CONCLUSION

Sohn's poncho technique makes localized ridge augmentation and socket augmentation simple. It not only reduces postoperative discomfort but also accelerates wound healing. Therefore, its clinical applications provide several benefits to patient and clinicians.

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Disclosure
The authors claim to have no financial interest in any company or any of the products mentioned in this article.

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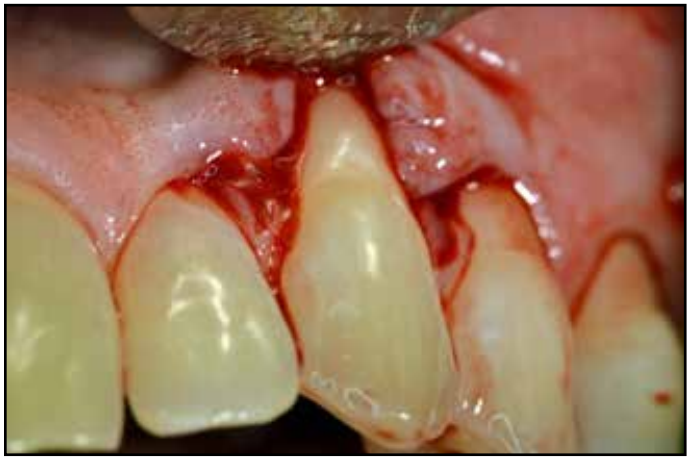
Amnio Cord in the Treatment of Gingival Recession: A Report of Two Cases

Mohamed Maksoud DMD[1]

Abstract



Background: Treatment of gingival recession has been one of the core areas of practice in periodontics for either increasing the zone of keratinized tissue to root coverage. Through the years, the treatment ranged from the use of gingival flaps, autografts, xenografts and acellular dermal allografts. The benefits of the procedures aim towards improving esthetics and eliminating exposed dentin hypersensitivity. The Amnio cord is the structure that encircles the blood vessels in the umbilical cord and been used in tissue engineering in the medical field.

Methods: The Amnio Cord used in this report was used to treat gingival recession. It is placed in between an elevated full thickness periodontal flap and the exposed root surface after scaling and detoxifying the root surface.

Results: The healing of the surgical area was uneventful and resulted in a visible increase in the keratinized gingival tissue.

Conclusion: This option of treatment modality could be added to other well documented treatment options of gingival recession.

KEY WORDS: Amnion, gingival recession, gingival grafting, Snoasis Medical

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BACKGROUND

Gingival Recession has been defined as apical migration of the gingival tissue resulting in exposure of the root surface which in turn could be responsible for root caries, root sensitivity and compromised esthetics.[1] Several procedures for the treatment have been introduced with reliable outcome and became an integral part of periodontal treatment.[2,3,4] Amnio Cord is a component of the umbilical cord, it surrounds and protects the blood vessels that carry nourishment and oxygenated blood to the fetus. It consists of amniotic epithelium and Wharton's jelly with extracellular matrix made of collagen and hyaluronic acid. Its processed through separation of the placental tissue followed by dehydration and preservation of the extracellular matrix. This matrix acts as a scaffold towards wound healing in addition to high content of collagen and other growth factors.[5]

CASE REPORTS

Two patients presented to the office with Miller class one recession on the buccal of upper left and upper right canines. This was attributed to trauma due to aggressive tooth brushing. The patients' chief complaint and concern was to improve esthetics. The periodontal examination revealed absence of microbial periodontal disease activity with no periodontal pockets and absence of bleeding upon probing. Moderate recession was detected on the buccal of the maxillary canines and with lack of keratinized tissue (Figures 1, 6). The diagnosis was Periodontal Disease with Miller Class one gingival recession. The radiographic exam revealed no significant bone loss around the dentition. Treatment options were discussed with the patients including subepithelial connective tissue graft, xenograft and acellular dermal graft in addition to the Amnio Cord. Each procedure was discussed with its advantages and disadvantages. A brief description of the recommended Amnio graft and its source was discussed with the patients and the need to evaluate the role in gingival coverage. The patients agreed to the procedure with a consideration of possible secondary grafting to establish complete root coverage. On the day of the procedure the surgical site was infiltrated with xylocaine 2% 1:100,000 epinephrine for anesthesia and hemostasis. An intrasulcular incision was made around the buccal of the canines followed by reflection of full thickness mucoperiosteal flap (Figures 2, 7). At that time, the exposed root surface was scaled using hand and ultrasonic scalers together with the use of citric acid to detoxify the root surface. This was followed by undermining the buccal flap using a blade to allow suturing without tension. The Amnio Cord graft (Snoasis Medical, Denver, Colorado, USA) was dehydrated in saline solution and sutured to the exposed root surface to the recipient site using non-resorbable sutures and completely cover the graft (Figures 3,8,9). Post-operative instruction given in addition to antibiotic and pain reduction prescriptions.

CLINICAL OUTCOMES

Patients were seen two weeks following the procedure for suture removal. Healing was observed with no complications. At six weeks, patients were seen for follow up that showed continuation of good healing (Figures 5, 10). Pre- and post-operative photographs were compared and showed evidence of gain of keratinized tissue in addition to root coverage.

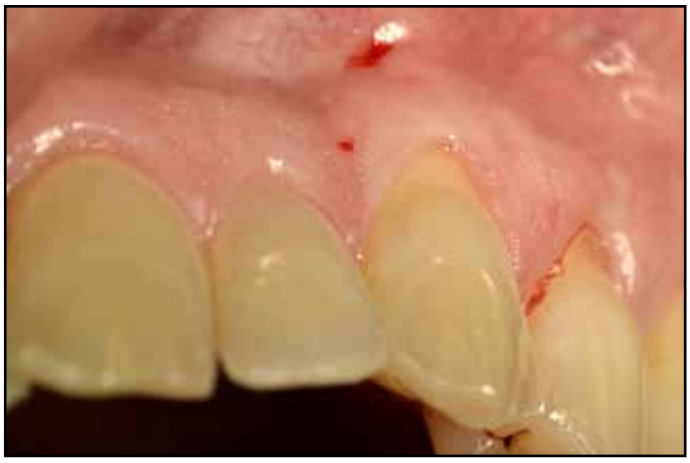

Figure 1: Case 1 Pre-operative photograph showing recession upper left canine.

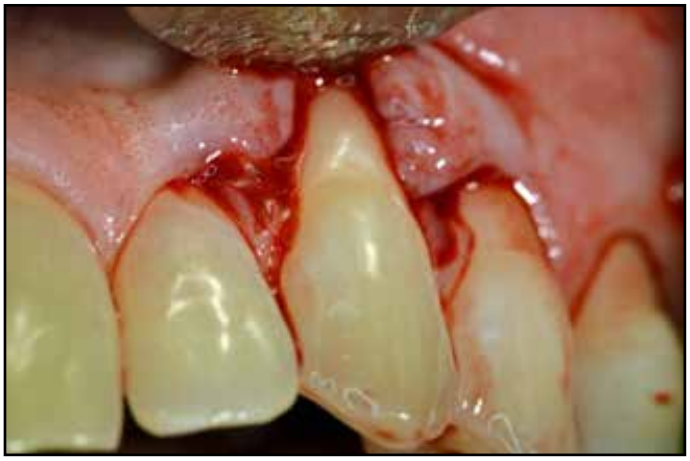

Figure 2: Case 1 flap elevation.

Figure 3: Case 1 implantation of the Amnio cord membrane.

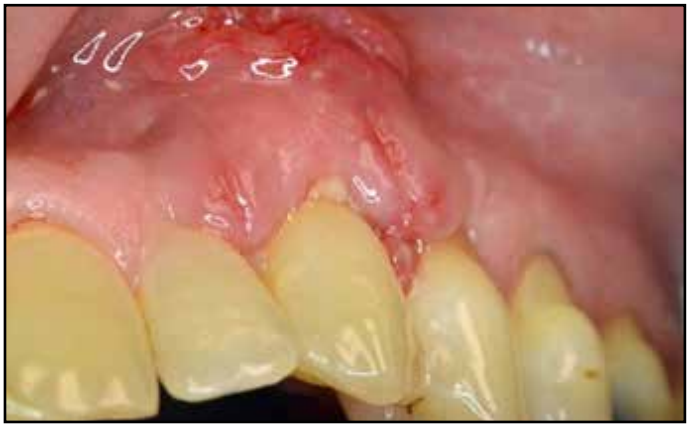

Figure 4: Case 1 two weeks post-surgery.

Figure 5: Case 1 six weeks post-surgery.

DISCUSSION

Amniotic membrane contains collagen types I, III, IV, V, and VII and is composed of structural extracellular matrix that also contains proteins including fibronectin, laminins, proteoglycans and glycosaminoglycans.[6] In addition, amniotic membrane contains essential, active, healing growth factors such as epidermal growth factor (EGF), transforming growth factor beta (TGF-b), fibroblast growth factor (FGF), and

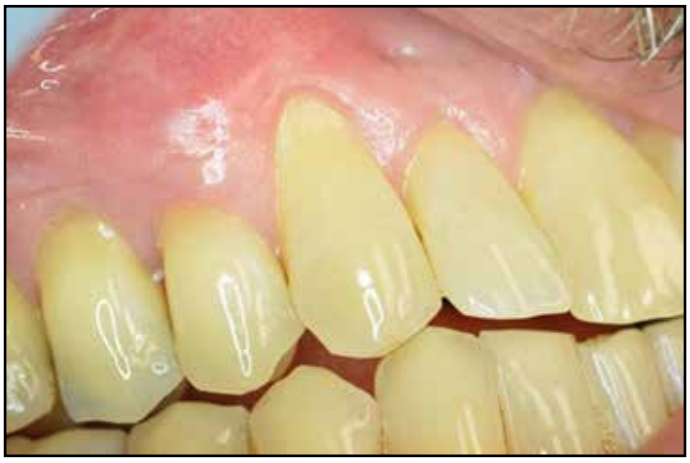

Figure 6: Case 2 Pre-operative photograph showing recession upper right canine.

Figure 7: Case 2 flap elevation.

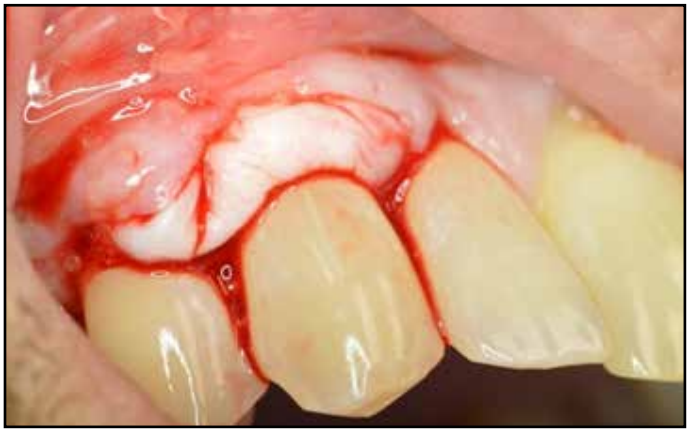

Figure 8: Case 2 implantation of the Amnio cord membrane.

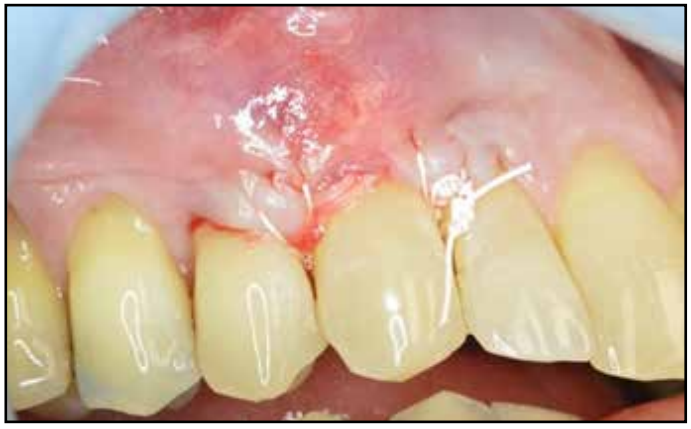

Figure 9: Case 2 two weeks post-surgery.

platelet derived growth factor (PDGF).[7] In dentistry Amnion membrane was successfully used in augmentation of extraction sockets and ridge augmentation.[8] The results indicated expedited wound healing with reduction of pain in a pilot study. The study suggests that the membrane provided accelerated epithelial adhesion and antimicrobial property. A randomized controlled trial the membrane used for guided tissue regeneration around periodontal defects

Figure 10: Case 2 six weeks post-surgery.

and showed antibacterial activity through samples taken for the gingival crevicular fluid when compared to controls.[9] A pilot study on the use of the Amnion membrane in the coverage of gingival recession in which the membrane was used in conjunction with coronally positioned flap.[10] It illustrated successful root coverage which was contributed to the characteristics of the membrane in enhancing wound healing. In a comparative study between the Amnion and Chorion membranes for the treatment of gingival recession there was statistical significance improvement in clinical parameters in both groups with 100% root coverage in most cases.[11] In This case in which umbilical cord tissue was used there was a clinical outcome of root coverage. The healing of the gingival graft observed had the same pattern as in other regularly performed procedures of gingival augmentation; the only difference was lack of postoperative edema which could be related to its anti-inflammatory effect.[9]

SUMMARY

The amnion membrane used to treat gingival recession has proven to be an alternative to commonly used surgical procedures. It was well received by the recipient site and resulted in coverage of the exposed root surface. Further studies are encouraged to compare it with acellular allografts within the same patient.

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Disclosure
The author reports no conflicts of interest with anything in this article.

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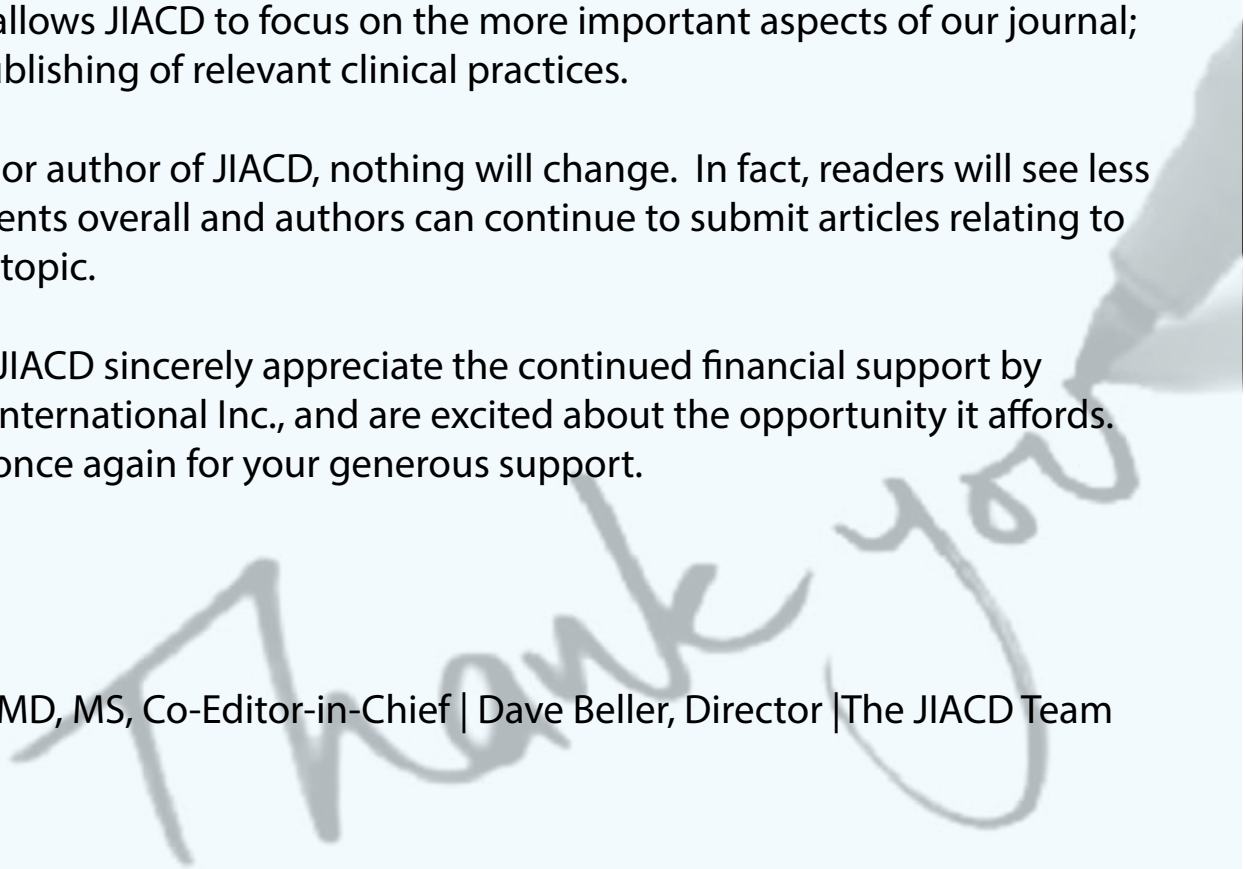
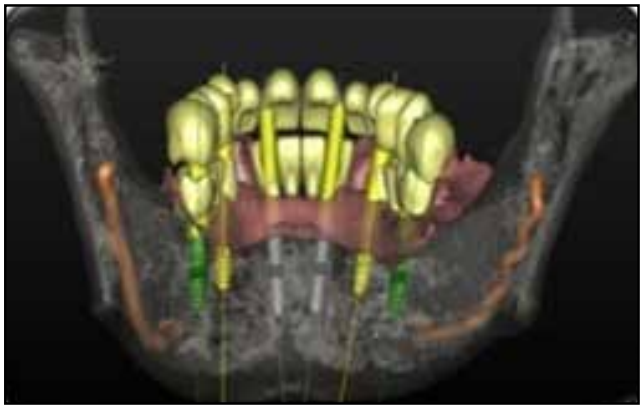


The Use of Steroeolithography in Dental Implant Placement: A Case Report

Zainab H Sulaimani, BDS, SSC-ARD, SF-DI[1] • Fadia Darwiche, BDS[1]

Abstract



Rapid prototyping is a method of producing solid physical copies of human anatomy from 3D computer data. Stereolithography is the most widely known and used rapid prototyping[1,2] and the one technique most often used to generate medical models and computer-generated surgical guides for osteotomy site preparation in dental implant surgery.[3,2] SurgiGuides are computer-designed and stereolithography generated surgical guides used during osteotomy site preparation. Stereolithography interfaces a patient's 3D CT study with the SimPlant plan. Made of acrylic resin, SurgiGuides contain one or more steel drilling sleeves, each of a defined diameter and with minimal tolerance, to control and ensure the accuracy of each osteotomy site preparation in two planes: buccolingually and mesiodistally. SurgiGuide design is based on the presurgical 3D positioning of implant icons using SimPlant (Materialise) interactive software, which transfers the prosthetically driven surgical treatment plan onto the CT. SurgiGuides can be supported by bone, teeth, teeth and mucosa, mucosa, or supragingival pre-existing dental implant components and mucosa. This article presents a case for teeth and mucosa supported implant placement for mandible, and bone supported for maxilla for the aim of complete oral rehabilitation with implants.

KEY WORDS: Computer-aided design, computer-assisted manufacture, surgical template, guided implant surgery

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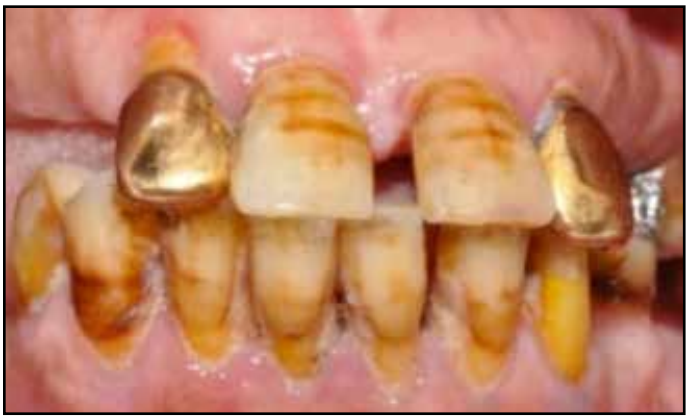

Figure 1a: Pre-surgical clinical photograph.

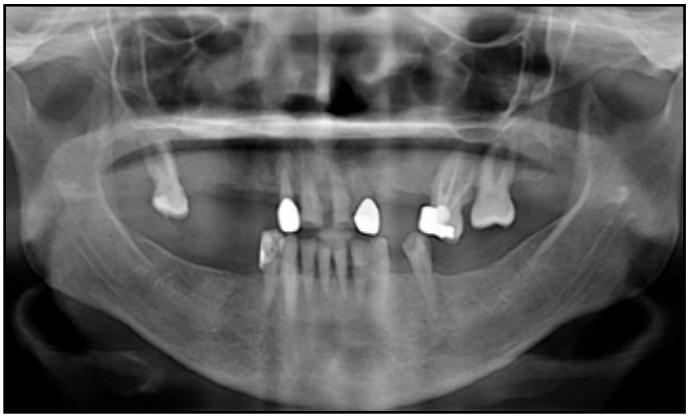

Figure 1b: Pre-surgical radiograph.

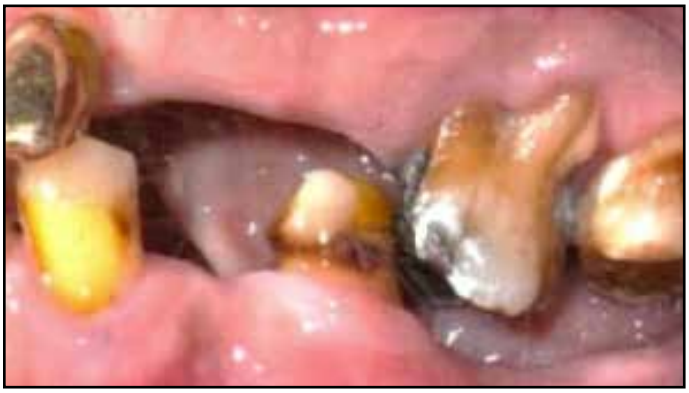

Figure 1C: Pre-surgical clinical photograph

INTRODUCTION

With the introduction of dental computed tomography (CT) in 1987, the method by which patients were evaluated for the placement of dental implants changed dramatically.[4,5] For the first time, the dental implant surgeon was able to understand regional anatomy and its influence on surgical decision-making preoperatively. This radiographic modality was superior to all other forms of dental radiographs in both accuracy and anatomic insight. However, two significant problems needed to be addressed. First, no prosthetic information was available in the CT study; second, there was no means to transfer the prosthetic information and treatment plan directly to the patient at the time of surgery, and this disconnect between diagnostics and treatment prevented broader professional acceptance. Nevertheless, as the demand for more esthetic and life like restorations increased, clinicians worldwide used surgical guides to facilitate more accurate placement of dental implants. The use of stereolithographic medical modeling coupled with three-dimensional (3D) patient-specific CT information makes it possible to fabricate bone, tooth, tooth/mucosa, and exclusively mucosa supported surgical guides (ie, SurgiGuides). SurgiGuides allow osteotomy site preparation to be performed in a more precise and efficient manner and, in certain instances, with less patient discomfort than conventional implant surgery.[6]

CASE REPORT

A 58-year-old Saudi female presented to the King Fahd General Hospital in Jeddah with a chief complaint of poor aesthetics from a prosthetic gold crown and mobility of her maxillary anterior teeth. Her medical history was good general health (ASA 1). Her dental history revealed missing maxillary and mandibular teeth due to progressive periodontitis (Figures 1a-c).

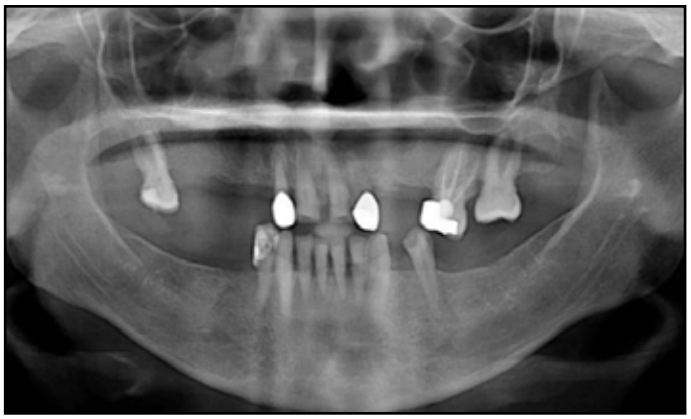

Figure 2a: Pre-surgical radiograph.

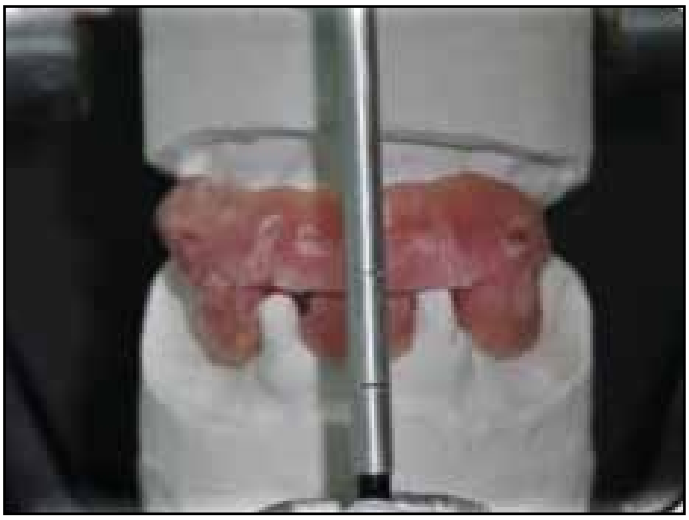

Figure 2C: Pre-surgical case planning models.

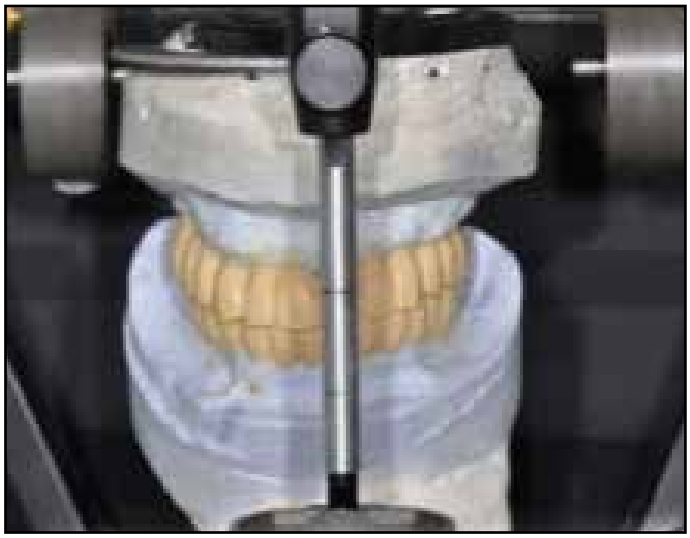

Figure 2b: Pre-surgical case planning models.

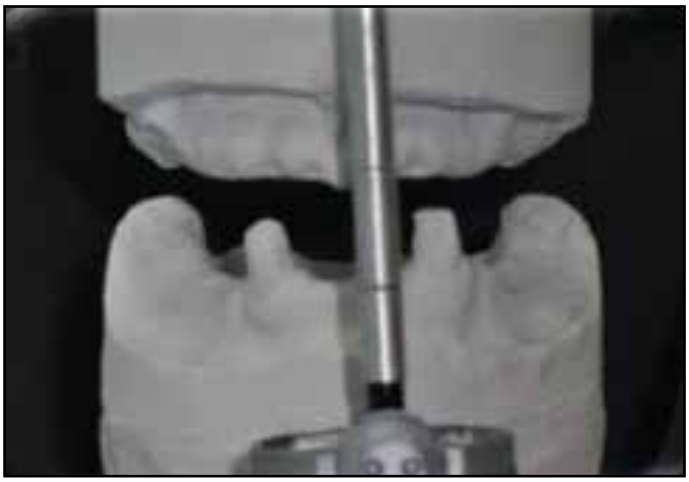

Figure 2D: Pre-surgical case planning models.

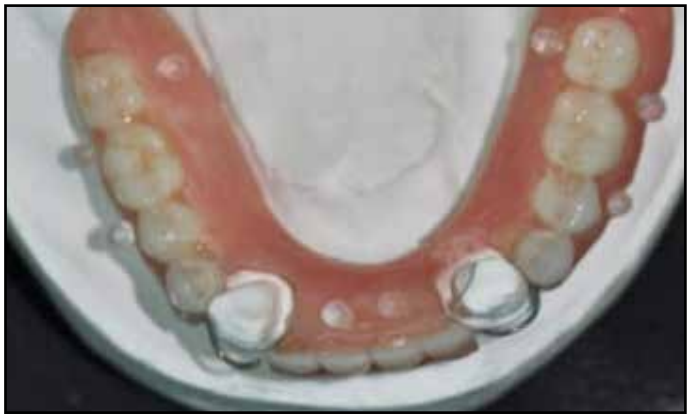

Figure 3a: Radiographic markers.

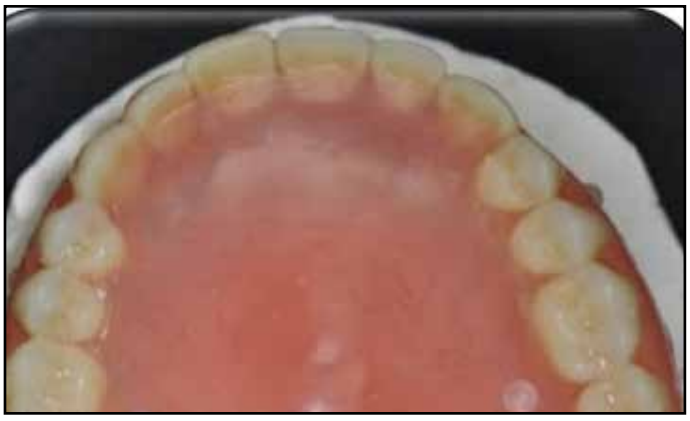

Figure 3B: Radiographic markers.

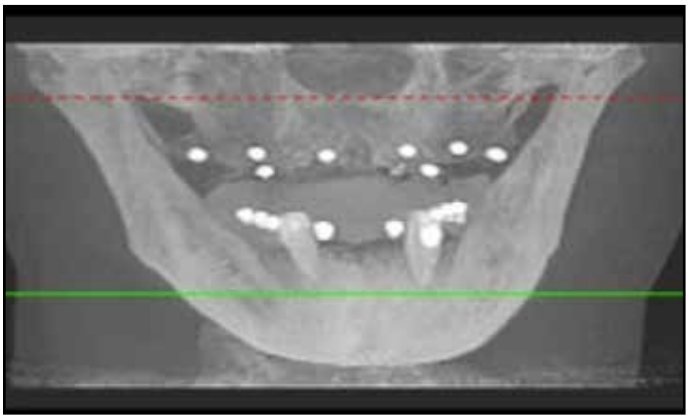

Figure 4a: CBCT scan with radiographic markers.

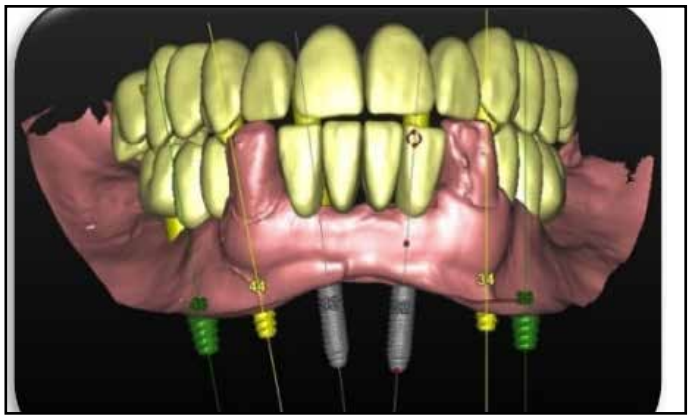

Figure 4b: CBCT planning scan.

After a careful evaluation of the case and the execution of diagnostic radiographic examinations (OPG and PA's) (Figures 2a-d), a proposed treatment plan of extraction of all maxillary and mandibular hopeless teeth except teeth #'s 33 and 43 (FDI tooth numbering system) and full mouth implant prosthetic rehabilitation of the maxillary and mandibular arches was offered utilizing BioHorizon® (BIOHORIZONS IMPLANT SYSTEMS, INC, Alabama, United States), tapered internal implant laser-lock; for both arches, followed by the relative prosthetic rehabilitation. The patient also needed to use a temporary prosthesis throughout the treatment period for professional reasons.[7,8]

After recording the vertical dimension of occlusion (VDO) and mounting in an articulator by means of face bow and its calibration, a complete removable denture for the maxillary arch and a partial removable denture for the mandibular arch was constructed.[9] These prostheses were planned in order to recover the masticatory function and aesthetics after extractions. By means of computed tomography, to evaluate the amount of bone remaining after the extraction of the compromised teeth, two surgical guides were planned (Figures 3a,b) in order to locate implant sites, to evaluate bone quality, and suitability for prosthetic rehabilitation choice for the patient. Radio-opaque markers were used in the denture for computerized tomography study of the dental arch for implant placement planning, ease of analysis in relation to the alveolar ridge crest, and relative to its applicability as a radiographic guide.[10] A CT Scan with scanning appliance in place is shown in Figures 4a,b. The resulting DICOM files were processed to be converted into SimPlant format, for both the maxilla and mandible (Figures 5a-f). A Surgical guide was fabricated and is shown in Figures 6a,b. The surgery was accomplished by placement of implants and abutments in the Maxilla with Bone-Supported SurgiGuide with 8 implants. Figures 7a-f shows the mandible with teeth and mucosa supported SurgiGuide with 6 implants for both arches. Provisional prosthesis are shown in Figures 8a,b.

In a "Five Year Prospective Study of Immediate/Early Loading of Fixed Prostheses in Completely Edentulous Jaws with a Bone qual-

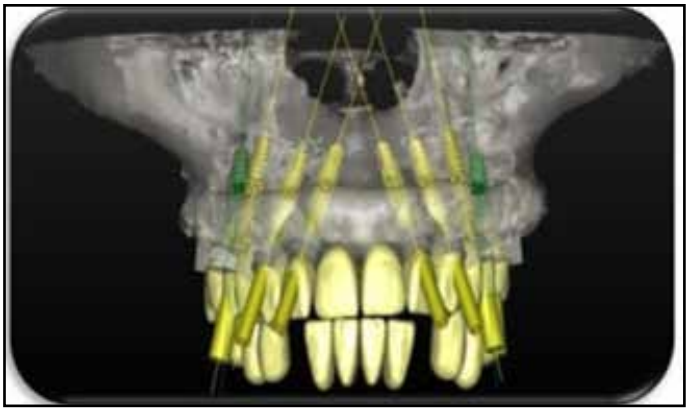

Figure 5a: DICOM files processed into SIMPLANT format.

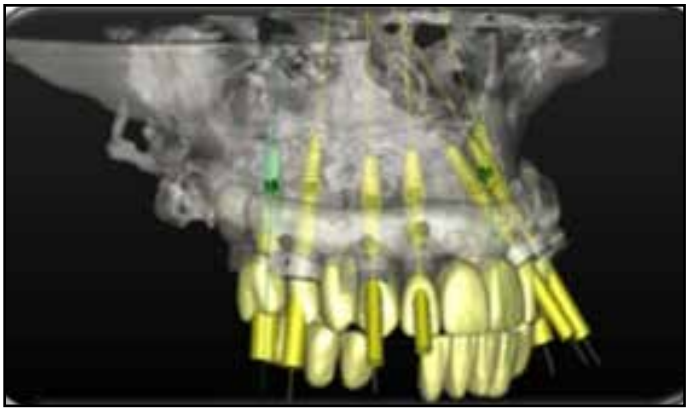

Figure 5b: DICOM files processed into SIMPLANT format.

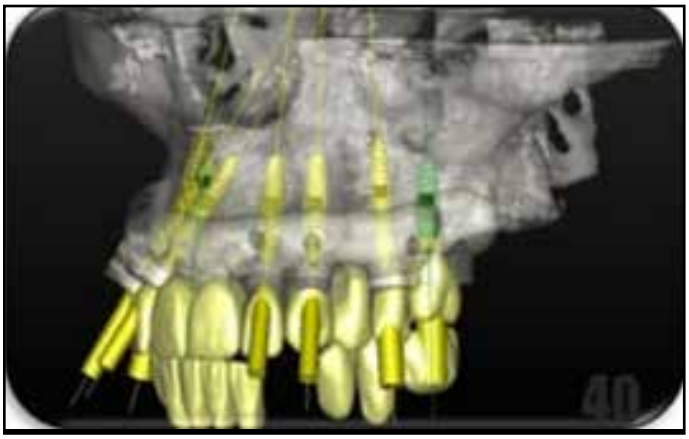

Figure 5c: DICOM files processed into SIMPLANT format.

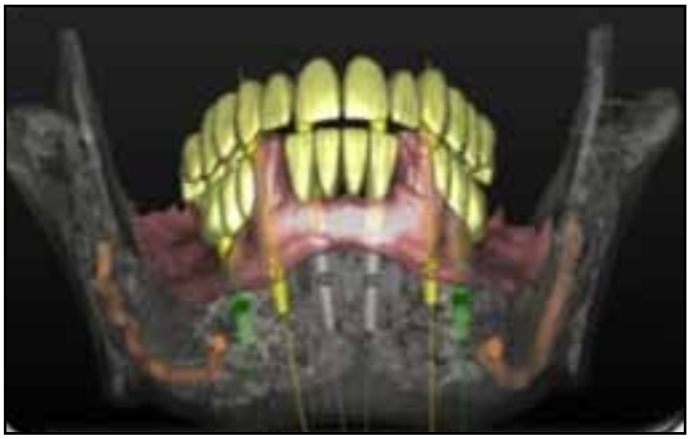

Figure 5d: DICOM files processed into SIMPLANT format.

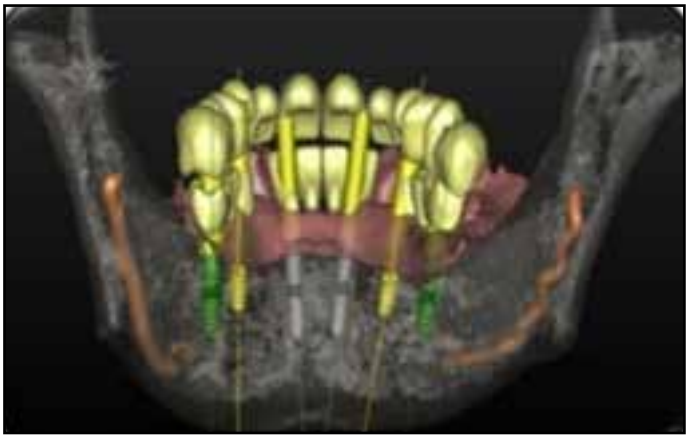

Figure 5e: DICOM files processed into SIMPLANT format.

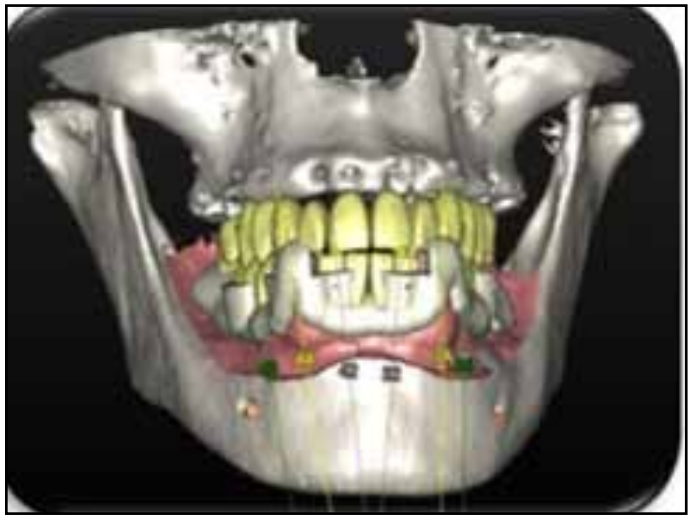

Figure 5f: DICOM files processed into SIMPLANT format.

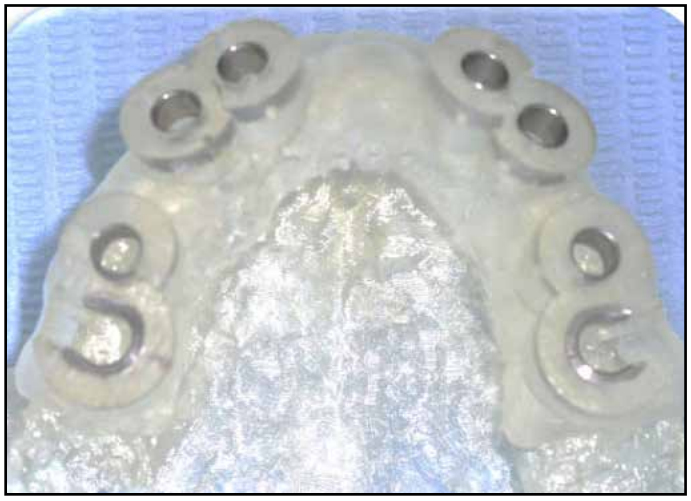

Figure 6a: Surgical guides.

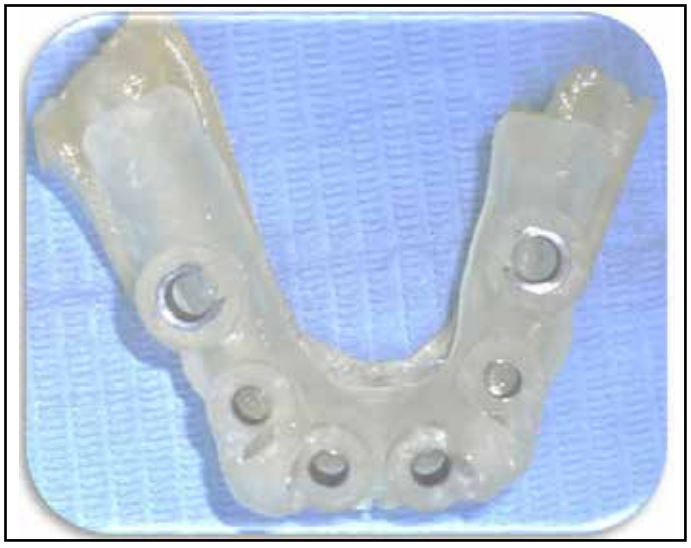

Figure 6b: Surgical guides.

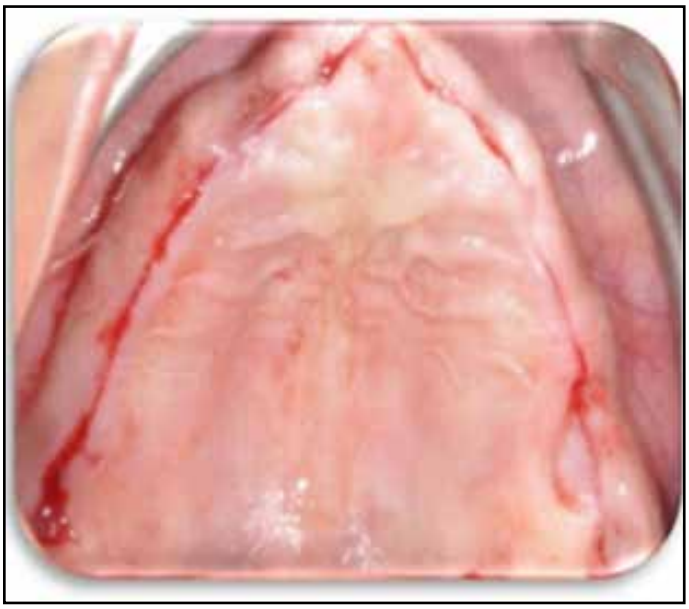

Figure 7a: Surgical procedure.

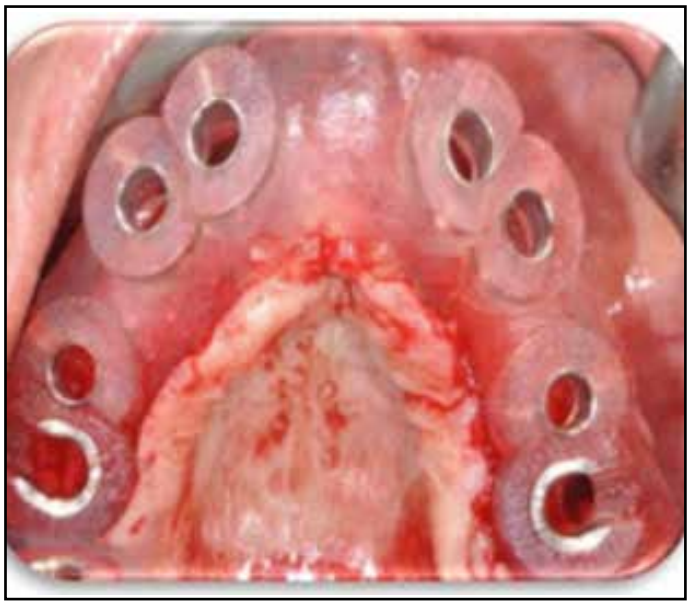

Figure 7b: Surgical procedure.

ity-based implant system", the author summarized the study using a bone quality-based implant system.[11] It was concluded that no implant failures occurred and crestal bone loss values were similar to or less than value reported with two stage approach. This may be related to the number of implants, implant design, and/or the surface condition of the implant loading.[11] Figures 9a,b shows upper and lower implant level impressions followed by placement of the definitive prosthesis after an appropriate healing period (Figures 10a,b).

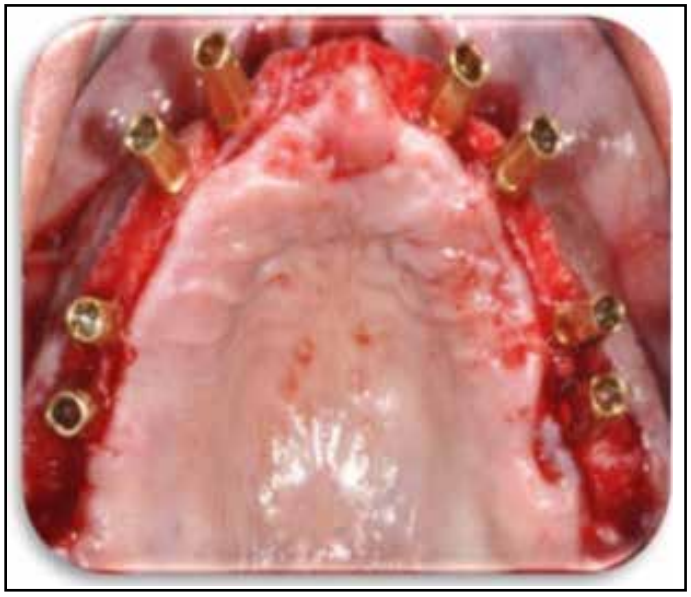

Figure 7c: Surgical procedure.

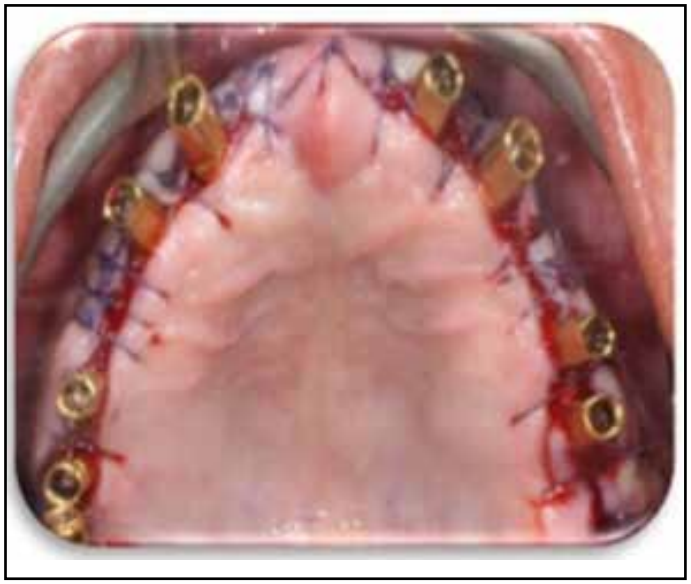

Figure 7d: Surgical procedure.

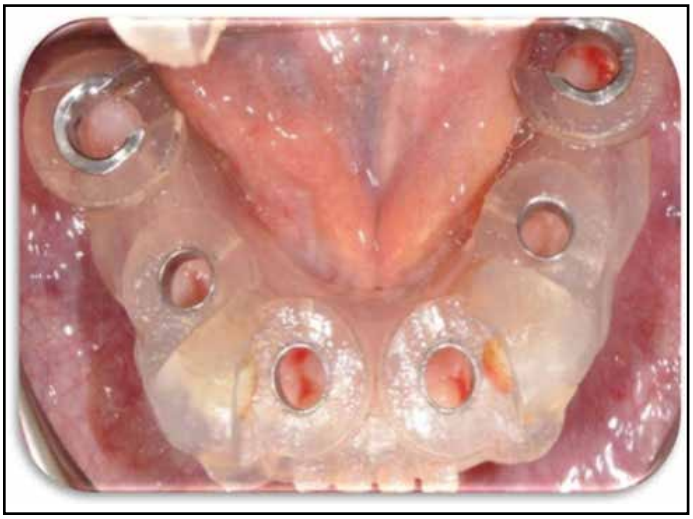

Figure 7e: Surgical procedure.

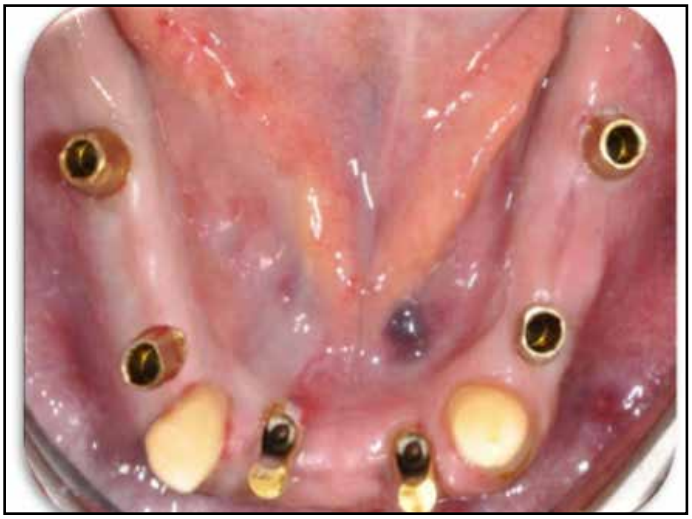

Figure 7f: Surgical procedure.

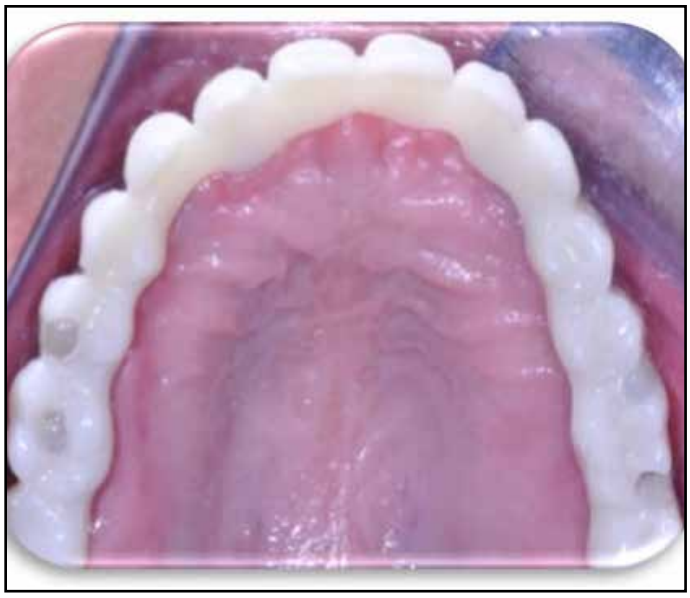

Figure 8a: Provisional prosthesis.

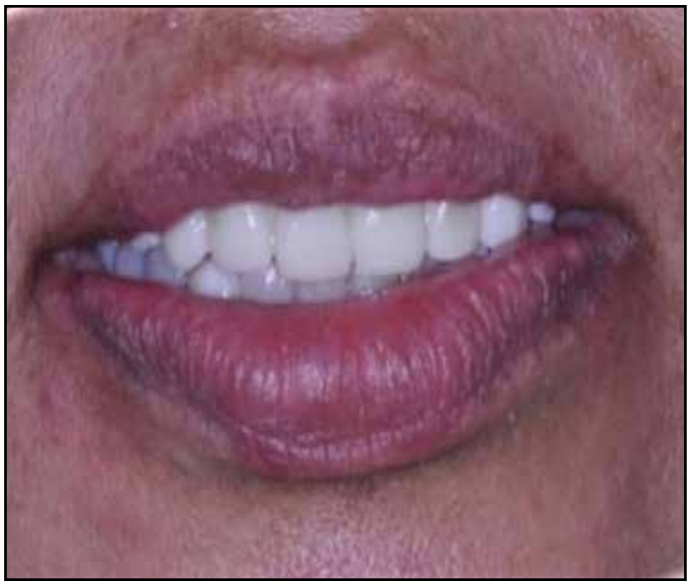

Figure 8b: Provisional prosthesis.

Figure 9a: Final impression.

Figure 9b: Final impression.

After a jaw relation record and teeth try-in, a metal substructure try-in was accomplished. Cement-Retained Implant Restorations were placed (as the study "Screw-Versus Cement-Retained Implant Restorations: Current Concepts" indicated that No differences were found between the two types of prosthesis in terms of implant survival or success rates. Prosthesis success rates (> 72 months), cement-retained prostheses demonstrated a 93.2% success,

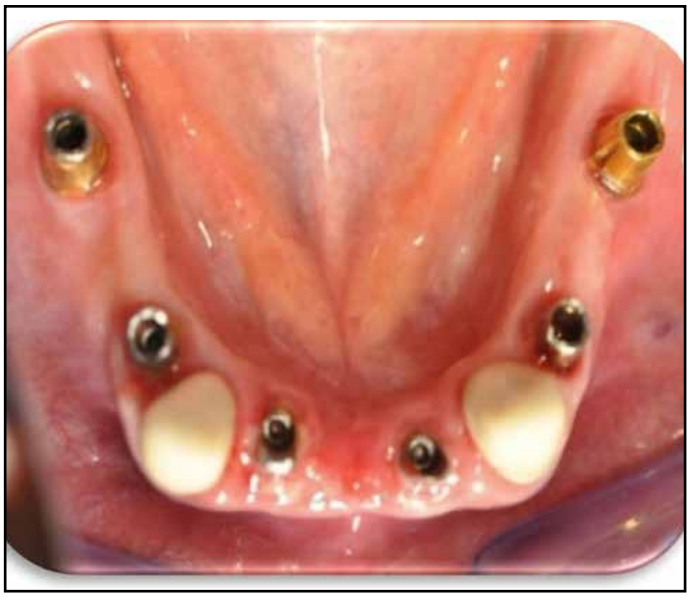

Figure 10a: Abutment placement.

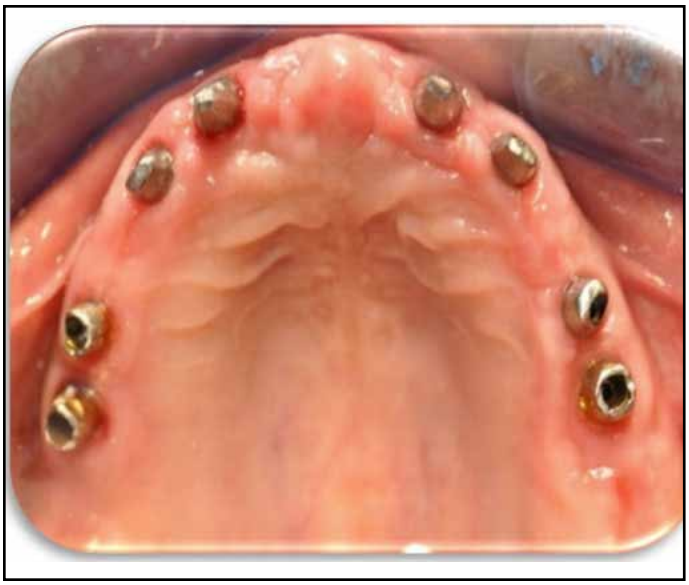

Figure 10b: Abutment placement.

Figure 11a: Maxilla before surgery.

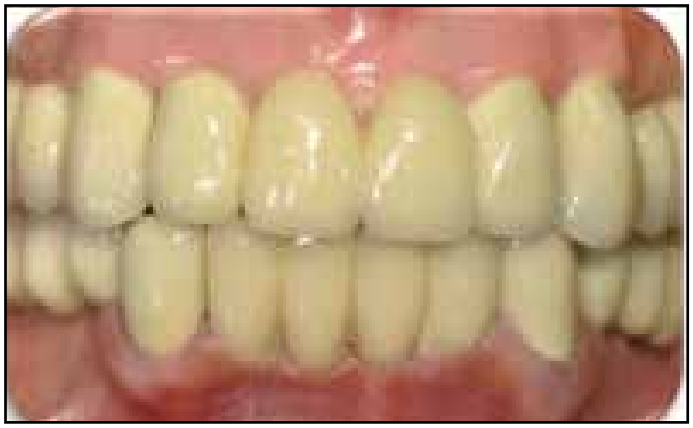

Figure 11b: Maxilla after surgery

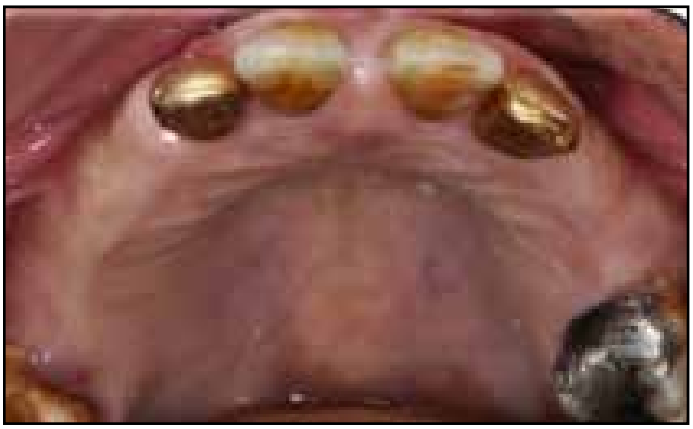

Figure 11c: Maxilla before surgery.

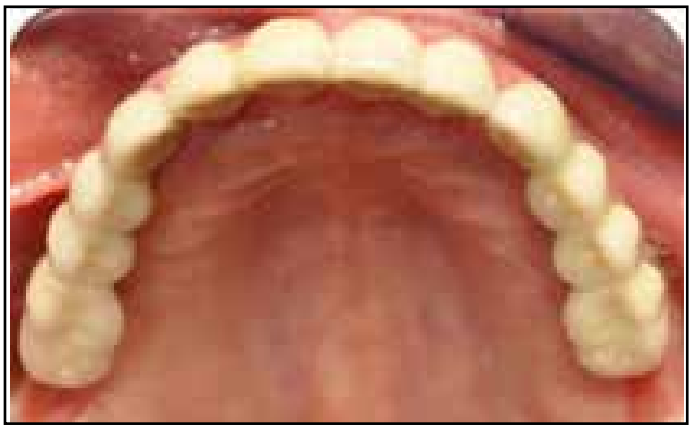

Figure 11d: Maxilla after surgery.

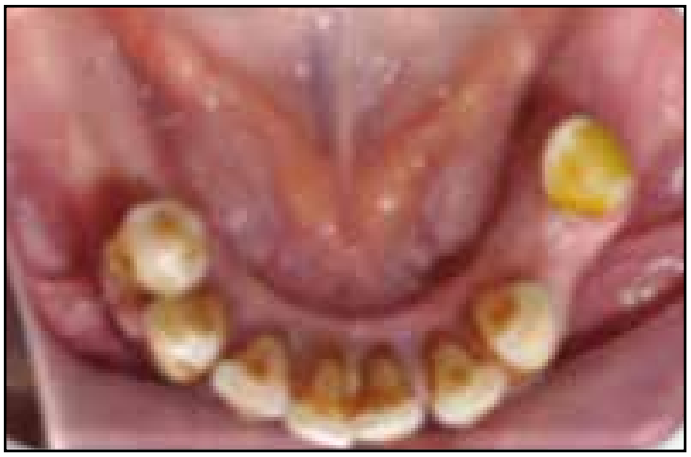

Figure 11e: Mandible before surgery.

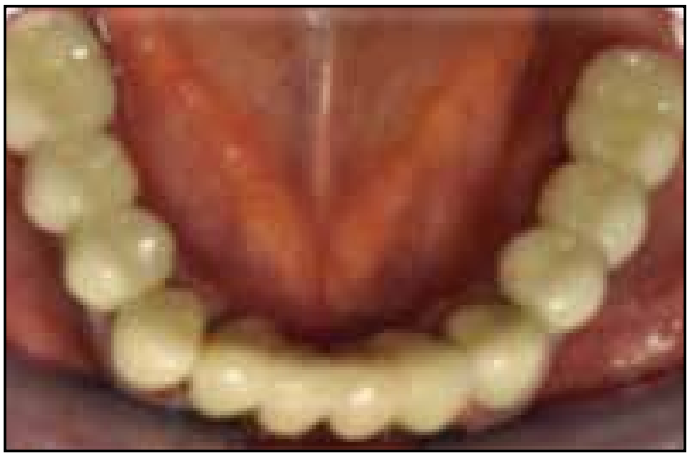

Figure 11f: Mandible after surgery.

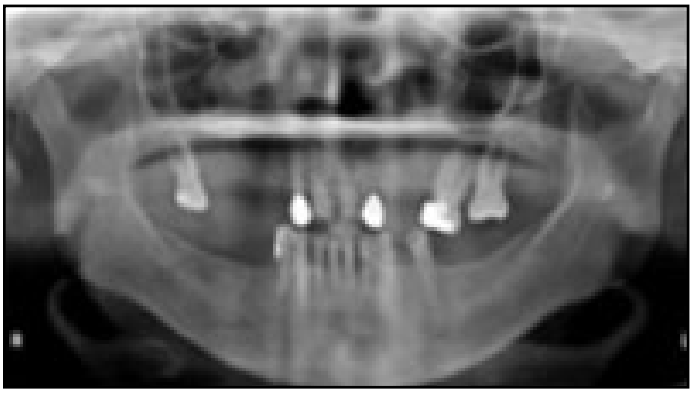

Figure 11g: Radiograph before surgery.

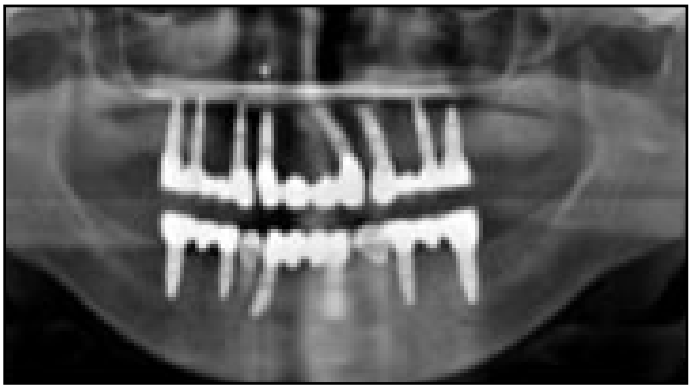

Figure 11h: Radiograph after surgery.

compared with 83.4% with screw-retained prostheses. It is generally agreed that the current trends to favor cement-retained implant restorations for their superior esthetics, occlusion, ease of fabrication, and reduced chairside time.[12] Final restoration photos are shown in Figures 11a-g. Finally, oral hygiene instructions and a night guard were given to the patient (Figure 12a-c).

CONCLUSION

The direct benefits of Stereolithography imaging to the dental implant patient include the following: 1) a better understanding of the treatment requirements and commitment needed for successful therapy; 2) a significant reduction in surgical time and a proportional decrease in postoperative pain, discomfort, and swelling;

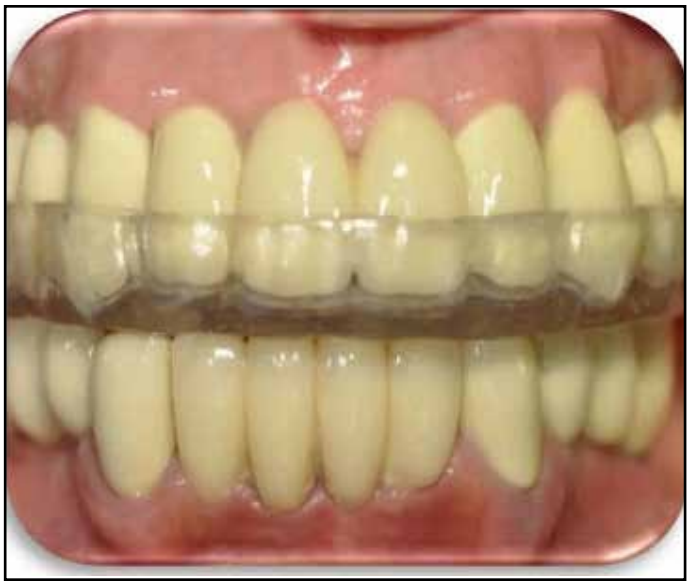

Figure 12a: Post-restoration night guard.

Figure 12b: Oral hygiene instructions.

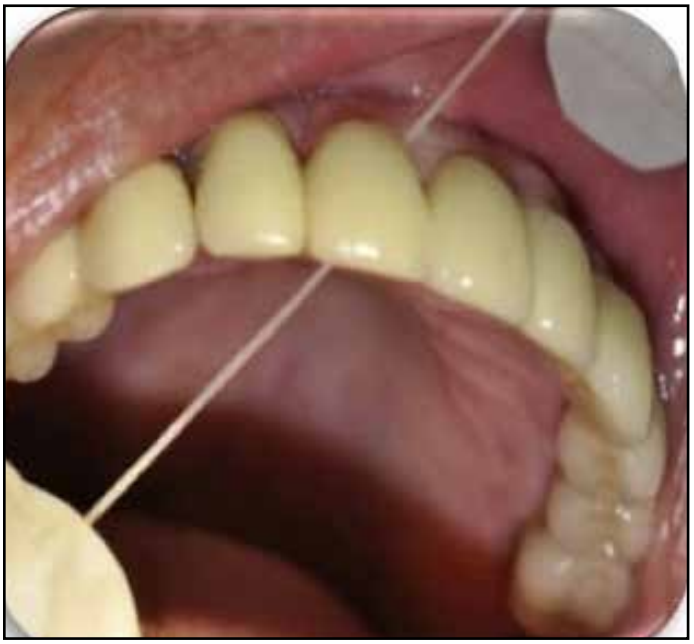

Figure 12c: Oral hygiene instructions.

3) a better understanding of anticipated outcomes and alternative types of treatment. Accuracy and reliability are two of the distinguishing characteristics of the stereolithographic process.

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Disclosure
The authors report no conflicts of interest with anything mentioned in this article.

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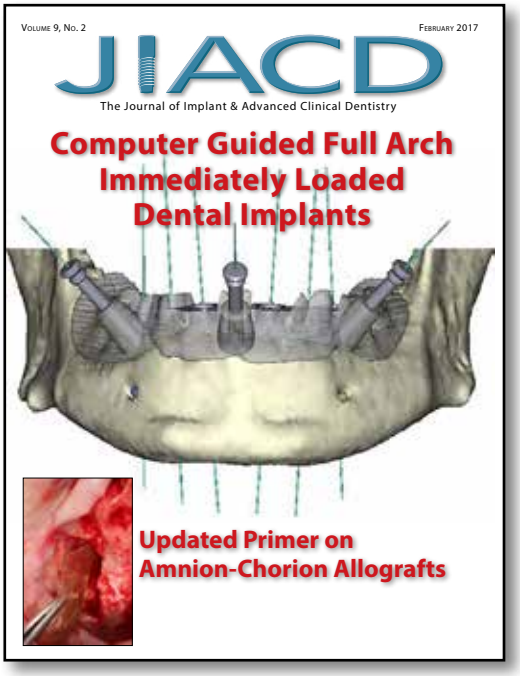

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