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Vertical Ridge Augmentation of Edentulous Posterior Inferior Jaw Using Xenogenic Graft Bone: A Clinical Case Report

Introduction

Installation of Osseointegrated implants for oral rehabilitation is undoubtedly the first treatment option, offering major benefits to patients whether in terms of comfort, when compared to a muco-supported prosthesis, or regarding to function, when assessing chewing forces and even when assessing the ease of proper cleaning [1]. Despite the advances found in studies in implant dentistry, such as greater reliability in short implants, changes in surfaces, etc., the need for peri-implant bone is still a sine qua non for longevity of the treatment.

Although it is currently possible to use short implants (4mm in length), reducing morbidity and the overall treatment time in severely atrophic ridges [2], there is a negative relationship between high crown- to-implant ratio, which can generate excessive occlusion forces in the cervical region, leading to marginal bone resorption and increased lever arm [1]. This stress transmitted to the peri-implant region is inevitable, but it can be reduced if we increase the depth of insertion of the implant [3]

Adequate bone volume is a pre-requisite for a favorable prognosis in implant dentistry. However, certain patients present low bone availability, both horizontally and vertically, thereby which limits an optimal implant- positioning. Guided bone regeneration (GBR) using different materials for maintaining proper space and cell exclusion has proven to be a predictable technique, with consistent results, for success in vertical and horizontal bone augmentation [4,5].

The predictability in GBR is largely due to the evolution in the science of bio-materials. Nonetheless, vertical augmentation of the bone ridge remains a potential challenge due to the complexity of soft tissue manipulation, especially in the posterior region of the lower jaw, due to the proximity of the inferior alveolar nerve. Therefore, the surgical procedure demands a great deal of skill on the part of the practitioner. Creating and maintaining space can be achieved with the use of rigid yet malleable membranes, associated with a bone substitute capable of maintaining the framework over a long period of time. The combination of inorganic bovine bone with autogenous bone has proven to be efficient for vertical augmentation in severely atrophic upper jaws, and the explanation behind this mixture is that autogenous bone supplies the graft with osteoinductive potential, while the hydroxyapatite particles act as a framework for creating and maintaining volume [5].

Objectives

This e-poster presents a clinical case based on the principles of tissue manipulation proposed in the literature, using a dense PTFE barrier (Cytoplast®, Osteogenics) and a mixture of 1:1 particles of autogenous bone removed from the mandibular ramus and Lumina Bone Porous® Large (Criteria Biomaterials) [5]

Case Report

Caucasian patient, 58 years old, non- smoker, referred for pain and mobility treatment in the region of tooth 35 (lower second premolar) [FDI notation, used throughout this article], base of a fixed bridge. Examination through imaging revealed an extensive periapical lesion with total loss of bone support and indication for removal of that tooth. Teeth 37 and 38 also produced in an unfavorable opinion, and were referred for extraction as well.

References

1. van Staden RC, Li X, Guan H, Johnson NW, Reher P, Loo YC. A finite element study of short dental implants in the posterior maxilla. Int J Oral Maxillofac Implants. 2014;29(2).
2. Urban IA, Monje A, Lozada J, Wang HL. Principles for Vertical Ridge Augmentation in the Atrophic Posterior Mandible: A Technical Review. Int J Periodontics Restorative Dent. 2017;37(5).
3. Ronda M, Stacchi C. Management of a coronally advanced lingual flap in regenerative osseous surgery: a case series introducing a novel technique. Int J Periodontics Restorative Dent. 2011;31(5):505.
4. Urban IA, Monje A, Lozada J, Wang HL. Principles for Vertical Ridge Augmentation in the Atrophic Posterior Mandible: A Technical Review. Int J Periodontics Restorative Dent. 2017;37(5).
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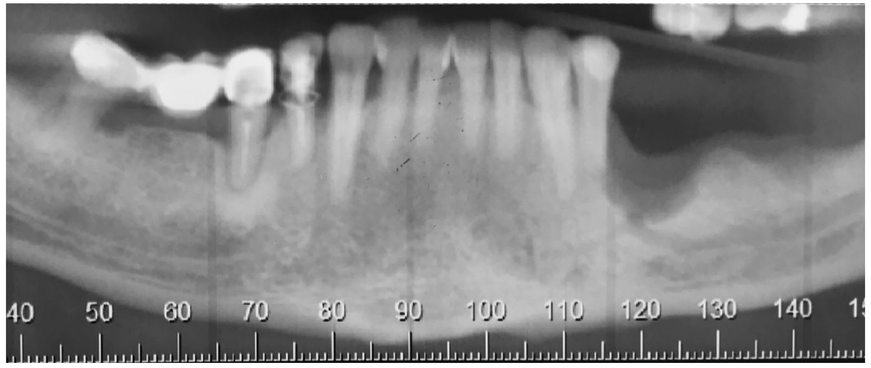
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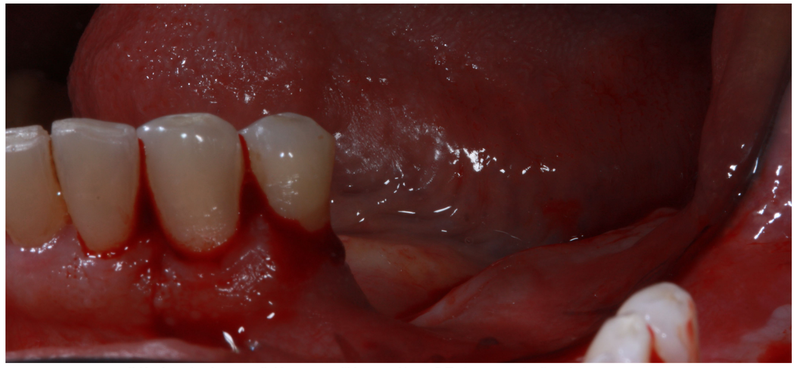
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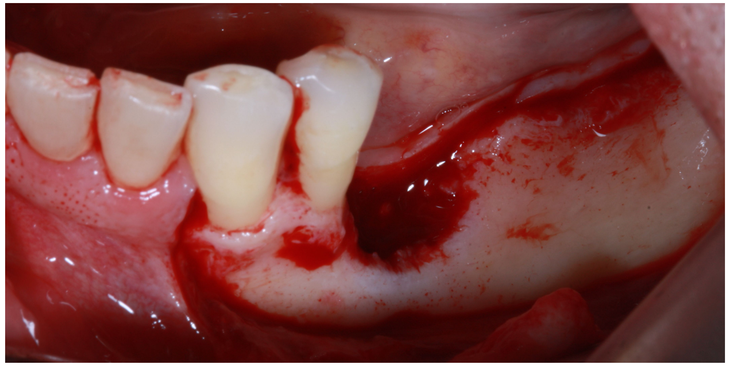
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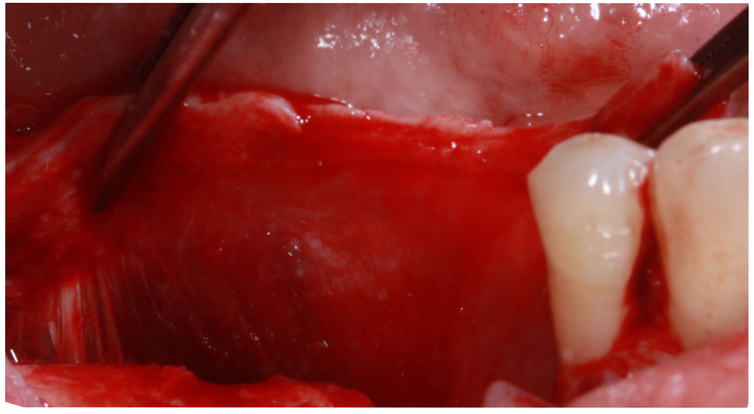
Clinical case

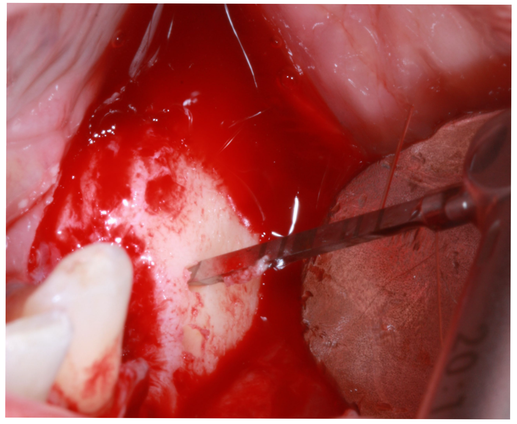


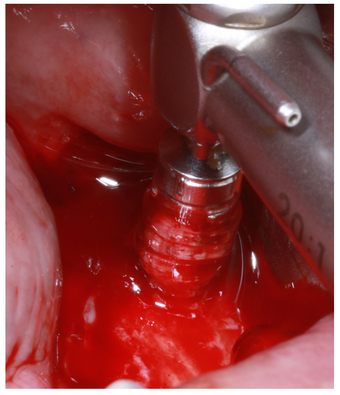
Pre-op panoramic X-ray: great bone deficiency associated with dental tooth loss


Clinical view of the grafting site: 3D bone defect.


Exposition of the bone defect during procedure

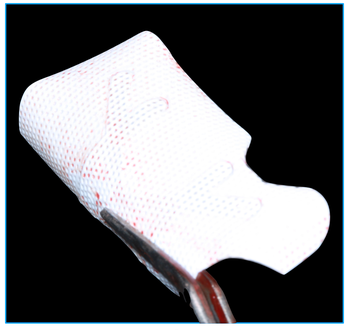

Detachment of milo-hyoid muscle from the mandible and flap releasing


Corticotomy of the graft site


Harvesting autologous bone with collector drill from the mandibular ramus


Autologous bone chips


Xenograft chips


Titanium reinforced barrier

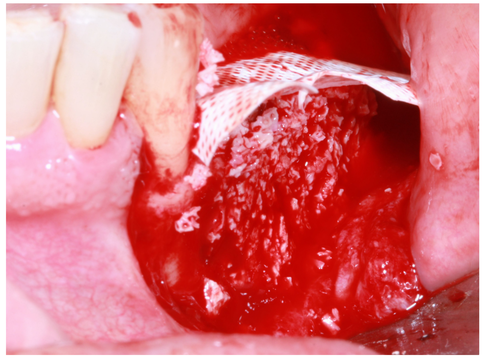
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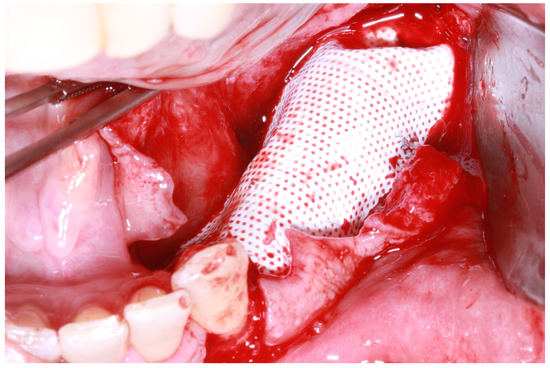
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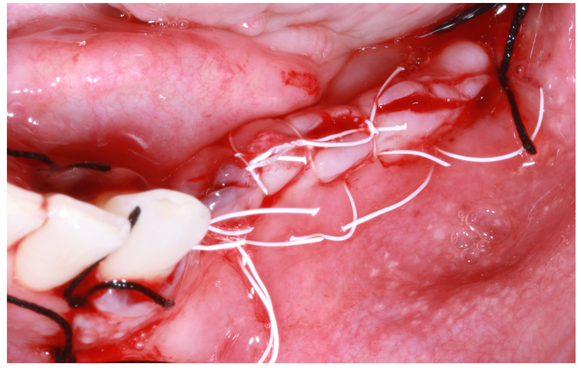
Clinical case



Grafting the site with a mix of 50/50 autologous bone chips and xenograft under a titanium reinforced barrier scaffold



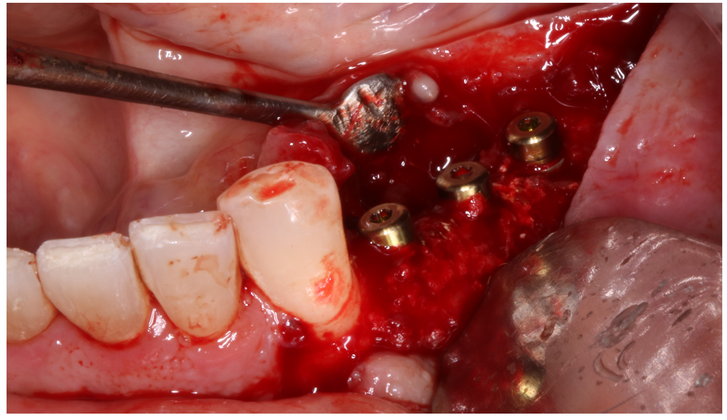
Titanium reinforced barrier fixed in mandible



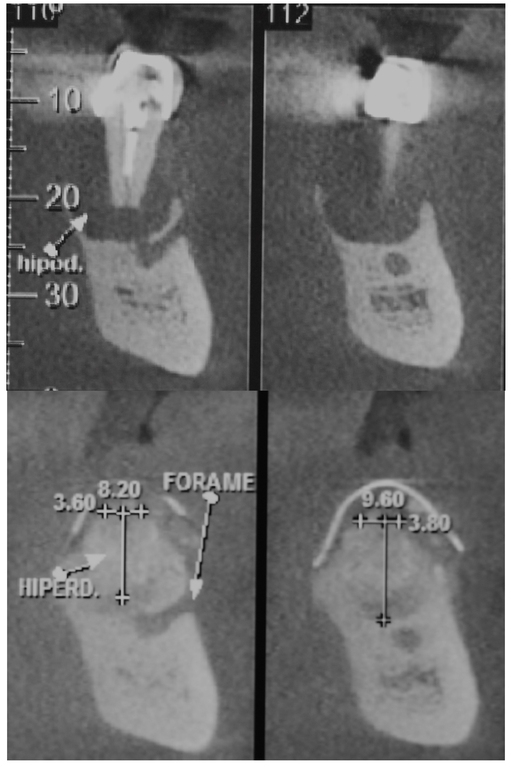
Primary closure of the flap - no tension in sutures, ptfe threads used over the graft site



9 months pos op follow up: implant surgery pre op



Implant instalation on neobone site



Comparison of the grafted area: more then 8mm high of bone gain

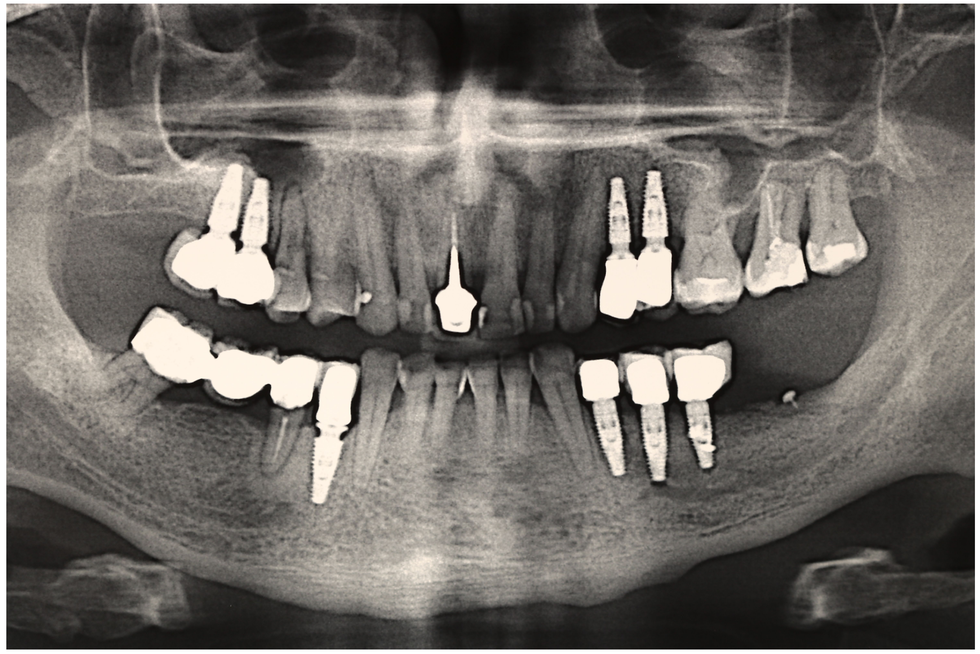
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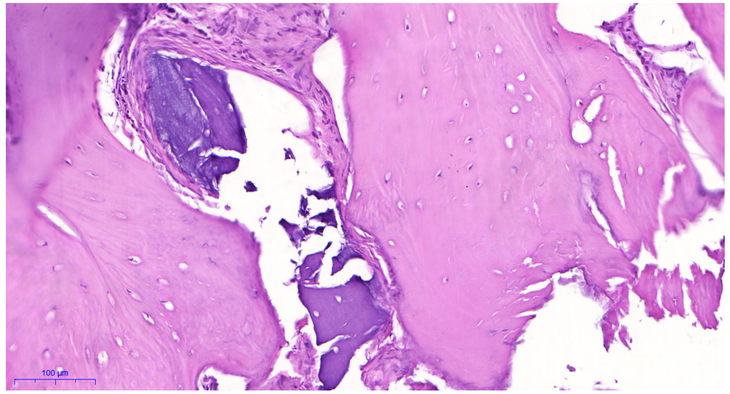
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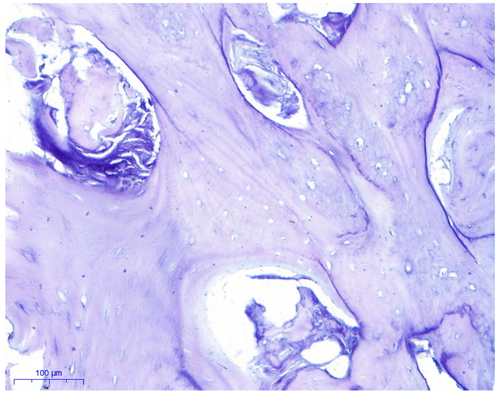
Follow up



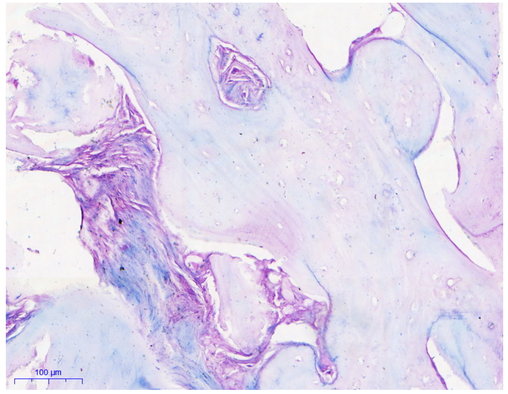
One year follow up Panoramic X - ray: crestal bone maintenance



Eosin-hematoxilin stain: biocompatibility of bone substitute



Methilen blue: vital Neo-bone formation surrounding biomaterial particle.



Methilen blue/fuccin: after 9 month pos-op, bone substitute particles still present on grafted area. Low resorption rate.

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Discussion

GBR is a classic bone augmentation technique [2], which is versatile and can be used in different types of defects, in different regions of the upper and lower jaw [2-4]. Despite being quite predictable and having several success reports in the literature, it is quite sensitive and has a high complication rate, particularly in relation to early exposure of the barrier used to maintain the framework [2]. This exposure often leads to partial or total loss of the graft. From a surgical standpoint, the insufficient release of soft tissue and the use of sutures under tension are crucial factors for the onset of complications [2-5]. Accordingly, some authors have developed or improved techniques for releasing the buccal and lingual flap, especially in the posterior mandibular region [3,4], one of the most usual areas for vertical bone augmentations. The patient had severe bone absorption in this region, caused by periapical pathology, and despite having a healthy tooth adjacent to the lesion, it was included in the graft to increase the height of the bone peak, and allows greater predictability in the augmentation procedure.

It is been a while since the titanium-reinforced e-PTFE membrane was the barrier of choice for creation and maintenance, in addition to promoting cell exclusion, providing an ideal environment for GBR [4]; currently, this membrane has been replaced by a new PTFE barrier, this time using dense PTFE. However, the GBR procedure is not limited to reinforced PTFE membranes, and we can find successful cases in the literature using titanium meshes, whether or not associated with collagen membranes [5]. Manipulation of the d-PTFE membrane is simpler than the titanium mesh, and it promotes total isolation of the graft on the inside [2-5].

Natural hydroxyapatite are described in the articles as highly porous, both microscopically and macroscopically, which facilitates osteoblastic adhesion and neovascularization of grafts [5]. In this presented case, the results observed after 9 months were encouraging, verifying great vertical gain, enabling the installation of three implants as established is the initial planning. The implants achieved a satisfactory initial stability (40 N.cm) and Osseointegrated with no complications. In addition to vertical gain, one of the concerns in grafting is maintenance of the bone over time, ensuring longevity to the proposed treatment; eight months after the implant-supported prostheses had been installed, no marginal bone loss was observed.

Conclusion

Vertical bone augmentation is a safe and predictable technique, but it relies on a learning curve for its performance; therefore, knowledge of the anatomical structures and correct manipulation of the soft tissues is essential in order to ensure optimal results of the treatment. Regarding the quality of biomaterials available, advances in biomaterials science are making it possible to rely more and more on products available to dental surgeons, such as Lumina Bone Porous®, which had already shown good results in maxillary sinus floor augmentation surgeries, and has now been proven to be interesting in more critical procedures as well.

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