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Case Report

Horizontal Mandibular Augmentation with Split Bone Block Technique: A Case Report

Joao Carlos Vicente de Barros Junior[1], Bruno Costa Martins de Sá[1], Claudio Ferreira Nóia[1], Rodrigo Cunha[1], Sergio Charifker Ribeiro Martins[2], Leandro Lécio de Lima Sousa[2] and Tarcio Hiroshi Ishimine Skiba[1*]

[1]Department of Implantology- (Sistema Odontológico de Estudos e Pesquisa)

[2]Department of Implantology and Periodontology RIDGE (Research Implant Dentistry and Graft Expetise)/ICS Funorte

[*]**Corresponding Author:** Tarcio Hiroshi Ishimine Skiba, SOEP-Rua Elias Gorayeb 920, Nossa Sra. Das Graças, Porto Velho, RO-Brasil.

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Abstract

The purpose of this paper is to report a clinical case which a split bone block (SBB) technique has been used to graft a horizontal mandibular defect for latter dental implant-supported prosthesis rehabilitation. The surgical procedure was described in this article as well as a discussion.

Case Report: A 50-year-old female was referred for an implant-supported prosthetics rehabilitation in the right inferior premolar area. Due to the bone defect, a horizontal bone augmentation was performed previously to implantation using Split bone block Technique.

Conclusion: The Split bone block technique has been proven to be a suitable and predictable technique for osseous augmentation due the use of the gold standard grafting material.

Keywords: Ostheosynthesis; Bone; Anesthesia; Mandibular augmentation.

Introduction

When Branemark first described the connection between the osseous tissue and the implant surface, under the name of osseointegration in 1977, it has been hailed as a milestone in dentistry, since that moment an implant based dental re-habilitation could be offered to the patients by the practitioners as an alternative to the traditional bridges and dentures with the purpose of reestablishing aesthetics and stomatognathic function [1]. Consequently, to the teeth loss the resorption of the alveolus take place resulting in either horizontal, vertical, or both defects which may demand surgical intervention for ridge augmentation whereas a proper osseous tridimensional situation is mandatory for the placement of implants as well as pink aesthetic [2]. Three considerable factors may turn the lower jaw into a difficult venue

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for implant-based rehabilitation: bone morphology-its frequently irregular surface jeopardizes the stabilization of grafting material; bone composition-the mandible may pre-sent poor marrow content and hence a bad blood supply; and anatomical boundaries, which may restrain the soft tissue grafting coverage, such as shallow vestibule or mouth floor muscle attachments [3]. A myriad of graft materials, membranes and barriers can be used to augment the alveolar ridge [4]. There are four groups of bone grafts that can be used for reconstruction, named: autogenous grafts, which are harvested form the same individual; allogenous grafts, which are harvested from a different individual of the same specimen; xenogeneic graft, from another specimen; and alloplastic graft, which origin is synthetic [5]. They can be found in different modalities, such as blocks, granules, moldable, in-situ hardening, or injectable materials [5]. The autogenous graft has been appraised as the gold standard grafting material whereas it possesses osteoinductive, osteogenic and osteoconductive properties [5]. There are distinct augmentation surgical techniques to be applied in the edentu-lous mandible, such as guided bone regeneration, bone block grafts and titanium mashes [6]. As far as the augmentation of the posterior mandible for implant installation is concerned, the elected technique has been the onlay intraoral autogenous grafting [7]. Classically, the bone block is adapted juxtaposed against the residual ridge with the aid of osteosynthesis screws [8].

A novel technique was developed by Dr Khoury which has been named as split bone technique. It differs from the former technique due the fact that the bone block is split and fixed to the ridge with ostheosynthesis screws so that a void is created between them and filled with particulated autogenous bone [8]. Such technique has become the most prominent one among most of the surgeons [8]. There is no need to use extra-oral bone even in large reconstructions. Despite its increasingly popularity, so far there has not been an extensive literature regarding the subject in the literature [8]. The purpose of this paper is to report a clinical case which a split bone block (SBB) technique has been used to graft a horizontal mandibular defect for latter dental implant-supported prosthesis rehabilitation.

Case report

A 50-year-old female was referred for an implant supported prosthetics rehab-ilitation of the right inferior first premolar area. A CT scan was prescribed in order to evaluate the amount of the tridimensional remaining bone (Figure 1). The radiographic exam revealed a paper-cut ridge while an osseous reconstruction was mandatory prior to implant insertion.

Her medical background was checked, and no comorbidity nor allergy conditions were found. The patient was on orthodontic therapy (Figure 2) in order to establish an optimal occlusion while some teeth were missing and a proper prosthetic space was required for an adequate oral rehabilitation. There were no abnormal intraoral clinical findings but a narrow crest with no vertical deficiency in the inferior right first premolar area (Figure 3). It was also noticed an edentulous inferior area comprising the first and second premolar teeth which was not treated before due to economic reasons. No abnormal findings were noticeable in the extraoral examination.

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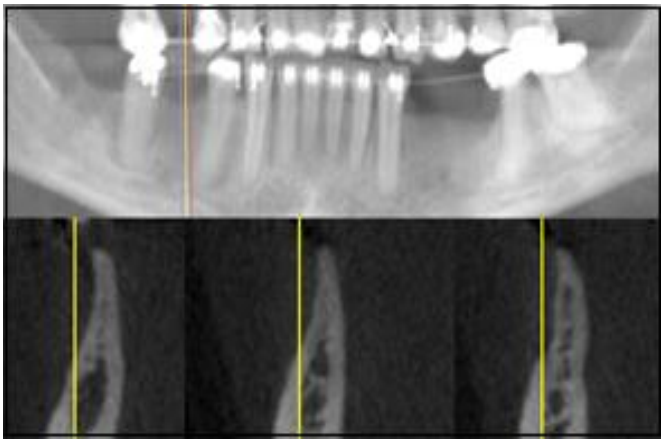

Figure 1: Cone beam computed tomography.

Figure 2: Initial appearance

Figure 3: Incision and detachment of mucoperiosteal tissue.

An autogenous split bone block graft was planned for horizontal bone gain and the ipsilateral ramus as the donor site. The surgery was performed under local anesthesia with Arthicaine 4% and 1:100.000 epinephrine. The patient was prescribed to rinse 0,12% Chlorexidine pre operatively as well as to take 1mg Amoxicilyn and 8mg Dexamethasone P.O. 1 hour before surgery.

A mucoperiosteal incision was conducted with a 15C scalpel blade from the mandibular ramus to the mesiobuccal edge of the first premolar together with a vertical incision obliquely into the mandibular vestibulum (Figure 4). After the detachment of the vestibular mucosa, the lingual mucosa also was detached.

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Figure 4: Decorticalization.

Two vertical and one horizontal osteotomy had been performed on the mandibular ramus with a 701 bur in order to harvest a bone block (Figure 5). After removing this block with the aid of a root elevator, it was cut into two thin pieces with a disc and the cancellous bone was scraped, so that it could be used as a particular bone (Figure 6).

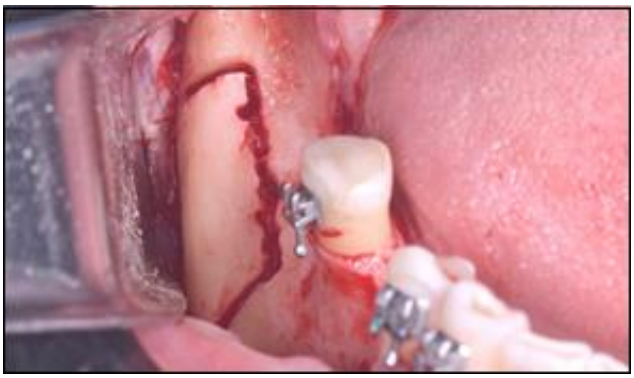

Figure 5: Collection of autogenous bone graft from the external oblique line region.

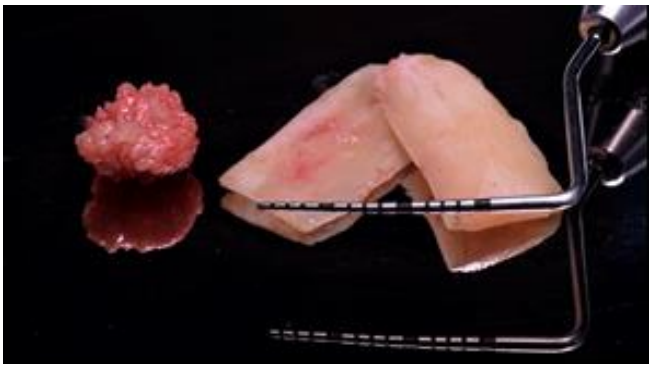

Figure 6: Splited and scraped autogenous bone.

A first block was loosely fixed from the vestibular second premolar area with two 1.5 mm ostheosynthesis screws (Figure 7) (Orth® screws, Implacil De Bortoli, São Paulo, SP-Brazil) and the particulated bone was inserted into the gap in between (Figure 8), whereas a minor bone block was inserted and fixed with one 1,5 mm ostheosynthesis screw atop the crestal area-like a ilidi-in order to reinforce the mechanical protection for the particulate bone (Figure 9).

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Figure 7: Fixation of the buccal bone plate.

Figure 8: Tunnel filling with heavy be chips.

Figure 9: Fixation of the occlusal bone plate.

The wound was closed with a 5-0 polypropilene suture (Micropoly 5-0, Microsu-ture, São Paulo-SP, Brazil), which was removed after 15 days (Figure 10). The surgery healed uneventfully, and the patient was prescribed with amoxycillin 500 mg P.O. every 8 hours for seven days and Ibuprofen 600 mg every 6 hours for 5 days. Three months later it was noticed, by means of a CT scan, a horizontal osseous augmentation and a conical implant (Maestro® from Implacil de Bortoli, São Paulo-SP, Brazil) was installed (Figure 11) in the grafted area.

Figure 10: Closure with polypropylene suture.

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Figure 11: Cone beam computed tomography.

After, a xenogeneic bone substitute (Lumina Bone® porous small from Criteria Biomaterials, São Carlos-SP, Brazil), (Figure 12) was placed and covered by a Collagen Membrane (Lumina Coat Double Time® from Criteria Biomaterials, São Paulo- SP, Brazil), (Figure 13) and closed with a PTFE 5-0 suture (MicroPTFE 5-0, Microsuture, São Paulo-SP, Brazil), (Figure 14). A provisional crown was placed 6 months post operatively (Figure 15). The definitive prosthetic rehabilitation took place 8 months postoperatively, which has been followed ever since, functioning successfully so far (Figure 16).

Figure 12: Implant installation after three months.

Figure 13: Slow-absorbing bone substitute for volume maintenance.

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Figure 14: Collagen membrane.

Figure 15: Closure with PTFE suture.

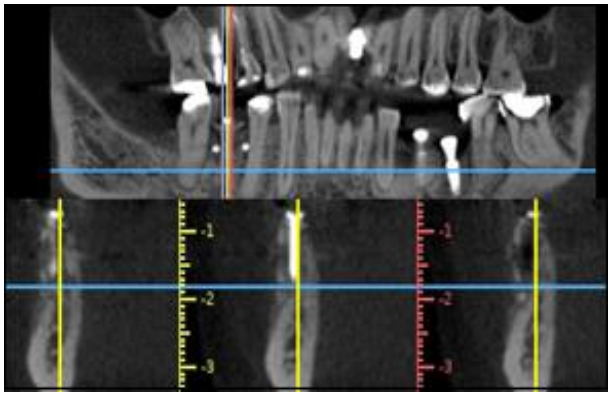

Figure 16: Final restoration.

Discussion

According to the alveolar crest atrophy classification by Cawood-Howell (1988), the class IV atrophy, also named "knife-edge" atrophy offers difficulty for dental implants placement [9].

All the bone grafts can only incorporate to the host through three processes: osteoconduction, osteoinduction an osteogenesis. Such mechanisms may take place separately or altogether, in many levels [10]. Autogenous grafts are deemed to be the gold standard for large tridimensional defects because are both osteoinductive, osteoconductive and osteogenic, with superior regenerative performance as to other biomaterials [11]. Although xenogeneic and allogenic grafts are sensitive to the host bed characteristics, autogenous grafts are more efficient to unite with the host bone, regardless of how adverse the physiologic conditions may pose [12].

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The split bone technique provides a long-term stable bone on the grounds that the amount of cancellous bone and mesenchymal cells within the graft turn into host bone predictably under local osseous stimuli [12]. The quality of revascularization and regeneration of the graft is enhahced by the stable scaffold provided by the technique, in which is full of particulate autoge-nous bone containing living osteocytes [13]. Kalchthaler, et al. compared two different on-lay autograft designs: full block and split bone block design. It was concluded that a greater bone volume could be generated using a split-bone block design compared with a full-block design [13]. Not only the volume gain was significantly greater, but the horizontal dimension of the grafted areas was also larger [14]. This technique may bring a larger amount of edema and postoperative morbidity due to the fact that it is a lengthy surgical procedure [12]. Furthermore, the harvesting of autogenous bone may cause morbidity, bone resorption and injury to important anatomical structures such as nerves and arteries [15]. The classic association of particulate autogenous bone with freeze-dried deproteinized bovine bone is described in several studies, and is based on the principles of Osseo in-duction and Osseo conduction in addition to the low rate of reabsorption provided by hydroxyapatite11, [14]. Natural hydroxyapatite are described in the articles as highly porous, both microscopically and macroscopically, which facilitates osteoblastic adhesion and neovascularization of graft, according to Martins, et al. 2021 [16].

Conclusion

The Split bone block technique has been proven to be a suitable and predictable technique for osseous augmentation due the use of the gold standard grafting material.

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