Atrophic Maxilla Reconstruction With Fresh Frozen Allograft Bone, Titanium Mesh, and Platelet-Rich Fibrin: Case Report

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ABSTRACT

The purpose of this article was to report the clinical and radiographic findings about a case of a man affected by severely atrophic maxilla to demonstrate the clinical proceedings associated with alveolar reconstruction destined for dental implant rehabilitation. The 3-dimensional augmentation of the alveolar ridge with the use of fresh-frozen bone graft, platelet-rich fibrin membrane, and titanium mesh suggests potential benefits to the development of the bone formation physiology. The treatment combination may result in an optimal prognosis and represents an option for reconstruction of bone defects. At 8 months after surgery, no evidence of complications was observed; the clinical examination and computerized tomographic scan revealed bone formation and installed implant stability.

THE ANATOMIC limitations of residual alveolar bone can cause problems for the insertion of dental implants. In many cases the proposed treatment can be solved with the use of autogenous bone grafts or expensive biomaterials.

Furthermore, autologous bone grafts have the drawback of a secondary surgery site for autograft retrieval. Consequently, procedure and anesthesia time increases, as well as donor site morbidity. Since the quantity of bone volume required in severe atrophic maxilla is large, the use of homologue bone provides a reasonable alternative [1–7].

Bone homograft transplantation has been performed in humans for >100 years. Currently, the number of oral and maxillofacial reconstructions, with the use of fresh-frozen bone (FFB), exceeds the number of orthopedic surgeries in Brazil [1–6].

The concept of guided bone regeneration (GBR) involves the following assumptions: tissue integration, clinical manageability, biocompatibility, occlusivity, and the creation of a space for ingrowth with proper dimensional stability. Titanium mesh has been used extensively in numerous bone reconstructions for dental implant procedures, allowing these assumptions to be an excellent solution in lateral and vertical bone augmentation [8].

Recently, Choukroun et al developed a simple method to prepare fibrin gels without exogenous supplements. This fibrin gel was designated as platelet-rich fibrin (PRF) and is widely recognized as a new alternative to improve the tissue repair in GBR [9,10].

Therefore, the objective of the combination of advanced bone reconstruction techniques, FFB, and PRF for the treatment of severely atrophic maxilla is to promote bone repair and dental implant osteointegration [8,10].

CASE REPORT

A 73-year-old male patient visited a private dental clinic reporting a masticatory discomfort and esthetical problem related to his upper removable denture. During the preoperative evaluation we noted a total absence of the upper teeth that was associated with severe maxillary atrophy. In addition, the atrophy was confirmed by cone-beam computerized tomography (CT), which demonstrated volume bone loss level before the installation of the dental implants.

The treatment advised to the patient was bone reconstruction with the use of allograft material associated with titanium mesh and PRF. Surgery was performed under local anesthesia (4% articaine with 1:100,000 epinephrine). An incision was made in the alveolar ridge and another 2 relieving vertical incisions in the posterior region, which allowed for a complete view of the receptor bone site.

A sample from patient's peripheral blood was collected immediately after venous stasis, with the use of a needle (25 × 7 mm) and a tube holder (through 6 tubes [Vacuette 9 mL Serum Clot Activator]).

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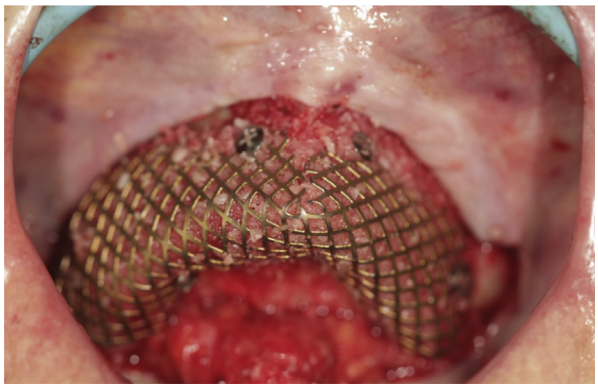

Fig 1. Titanium mesh with fresh-frozen bone in maxilla.

To prepare the PRF, the blood samples were centrifuged for 2 minutes after the blood was collected, then at a 45-degree angle and 2,700 rpm for 12 minutes, leading to fibrin clots, which were removed with the use of a surgical pincer and then separated from the red fraction from the blood cells with the use of scissors. The fibrin clots were deposited in a stainless steel box under a perforated platform, and then they were compressed with this device and converted into PRF membranes. Each membrane measured ~1 mm thick. Bone augmentation was promoted with the use of cortical particulate human FFB tissue donated from the musculoskeletal tissue bank at the University of Marilia in the state of São Paulo, Brazil. The bone volume, which was 25 cm^3, was included on the receptor bone site surface and mixed with 2 previously minced PRF membranes (Fig 1). The bone sample was then stabilized with the use of a titanium mesh (Neodent, Brazil) and fixed with bone screws (10 and 12 mm, Neodent). The other remaining membranes were prepared to cover the external part of the titanium mesh (Fig 2). The surgical flap was repositioned and sutured with the use of nylon 5-0.

After 8 months, cone-beam CT was applied to the region to evaluate the stability of the bone (Figs 3-5). The results of the cone-beam CT demonstrated the feasibility of a 2nd surgical phase where the titanium mesh was removed and 6 dental implants were installed (HE 4.1 mm platform by 10 and 8 mm height diameter by 3.75 mm [SIN/SW, Brazil]). The implants had torque values ranging from 35 to 40 $N \cdot cm^2$ (Fig 6).

Eight months after the implant placement, the patient was in the final stages of prosthetic rehabilitation (Fig 7) and had not demonstrated any bone exposure or comorbidities. A subsequent cone-beam CT was performed to monitor the evolution of the implant's survival.

DISCUSSION

The rehabilitation of the atrophic maxilla is challenging. The principal problem is severe bone mass loss. This prognosis of implant therapy in severely atrophic maxilla is one of the most complex cases in implantology [1,11–13].

Several surgical techniques that have been proposed in the past 5 years have solved this problem by using short and small-diameter dental implants, sinus lift procedures, and reconstructions with the use of bone grafts and/or biomaterials. Autologous bone is the criterion standard owing to its high degree of biocompatibility; however, the pain and complications associated with bone harvesting are not acceptable to many patients [11,12,14].

One of the alternatives for bone reconstruction, when the patient does not accept bone removal, is to use FFB, which has been widely used in dentistry, not only in particulate form but also as a block to fill in bone defects [5,6,11,12].

FFB has only osteoinductive properties, not osteogenic characteristics. Because of this, the biologic process to create new bone with the use of FFB is very extensive [11,12]. Although it was observed that FFB clinically presented the hardness similar to an osteoid tissue, allowing dental implants at the end of a 6-month period, some articles in the literature have shown variations from 6 to 9 months [5,12].

Although bone reconstruction with the use of FFB has been supported by the scientific literature, a consensus about a criterion standard has yet to be established. Furthermore, research is still required to create a standard protocol.

The various strategies adopted to replace bone volume loss in vertical or horizontal jaw defect have evolved over the years. Currently, different reconstructive surgical techniques improve the physical and chemical environment to maintain the correct cellular development near the receptor bone tissue.

Studies in the past 2 decades described that the growth factors in bone tissue were important to improve awareness of the peripheral blood in tissue repair, particularly with the creation of centrifugation processes that produce masses of platelet concentrates and fibrin [7,9,10].

There are endothelial growth vascular factors, basic fibroblast growth factor, platelet-derived growth factors, epithelial growth factors, integrins, and interleukins in PRF samples [15,16]. Therefore, its role, especially in

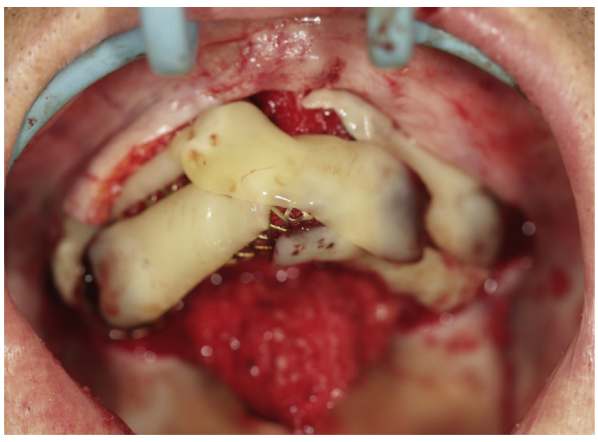

Fig 2. Platelet-rich fibrin on titanium mesh surface.