

CASE REPORT

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Utilization of nano-hydroxyapatite mixed with platelet rich fibrin for reconstruction of severe atrophied over pneumatized maxilla: A case report

Gustavo Helder Vinholi, Igor da Silva Brum, Renan Lana Devita, João Carlos Lopes Amorim, Marco Antônio Alencar de Carvalho, Jorge José de Carvalho

ABSTRACT

Introduction: With the current need for large bone reconstructions due to very robust losses in skeletal architecture, not only of the maxillary and mandibular regions but also in other regions of the body, this guided bone regeneration has been increasingly used.

Case Report: A leukoderma patient at 52 years of age sought the implantology clinic of the Brazilian Dental Association (ABO) to solve his case of tooth loss. The patient presented overly aggressive bone loss in the total maxilla, and, because of this, it was planned to reconstruct the lost area with a synthetic particulate nano-biomaterial (Blue Bone, Curitiba, Brazil), with the help of the platelet aggregate (PRF). For the surgery, 6 grams of this biomaterial were used, in the anterior region of the maxilla, tent screws were placed to stabilize the grafted bilateral and maxillary

sinus lifting surgeries were performed in the posterior regions. The entire regenerated area was covered with L-PRF membrane for better stability and healing. An incredibly significant gain in bone volume was observed six months after surgery throughout the regenerated region, enabling the placement of dental implants (Systhex, Curitiba, Brazil) and later the placement of the supported prosthesis.

Conclusion: The nano graft presented a very favorable result in the gain of bone volume, proving to be an excellent indication for more severe cases of bone loss.

Keywords: Biomaterial, Graft, Nano-hydroxyapatite, PRF

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INTRODUCTION

The use of biomaterials for the reconstruction of areas with large bone losses can be considered the best current alternative in order to achieve a more favorable result in bone gain [1]. This advance is due to the constantly changing biomaterials and evolving molecular and

structural of the morphological engineering in addition to clinical, immuno-histochemical, and histological results that present more interesting responses than the presented with other biomaterials in the past [2]. This evolution is due to the discovery of nanotechnology, which allowed the development of biomaterials more appropriate to cellular response, allowing us to have a higher index of newly formed matrix and a greater amount of osteocytes than in micrometric biomaterials [3].

Among the most used biomaterials are biphasic ceramics, where we can mention hydroxyapatite and tri-calcium phosphate. These two compounds can be used in their commercial form individually or in conjunction with different concentrations [4].

After much scientific evidence we can affirm that the highest concentration should be hydroxyapatite because it serves as a framework, preventing cellular invagination in the grafted site, against starting the tri-calcium phosphate presents a faster resorption, making room for tissue regeneration in the site [5]. This is the crucial point, because if the percentage of tri-calcium phosphate is much higher than hydroxyapatite, there may be a much higher resorption than hydroxyapatite can prevent tissue formation at the site. Thus, the evidence indicates that it is necessary for a hydroxyapatite concentration greater than 70% in relation to tri-calcium phosphate for adequate regeneration [6, 7].

Different types of techniques can be associated together so that you have a more favorable guided bone regeneration process. For the maxillary sinus, the technique of lateral opening of the window is the most used and has a lot of literature showing its efficacy and predictable results [8]. In very severe cases of bone loss in the maxilla the tent technique provides the head a more elongated barrier for invagination of connective tissue in the grafted site through the installation of screws, being very well cataloged in the literature. We can mention the platelet aggregate as a facilitator for bone regeneration techniques, promoting greater connectivity of biomaterial granules and facilitating their handling and application to the surgical bed [9].

The aim of this study was to show that it is possible to reconstruct severely reabsorbed maxilla using particulate nano-biomaterial associated with bone reconstruction techniques in conjunction with (platelet rich fibrin—PRF) on a case the close long monitoring follow-up.

CASE REPORT

Patient

The 54-year-old leukoderma woman sought the Brazilian Dental Association (ABO) of Campo Grande, MS, Brazil, complaining that she had sought numerous oral rehabilitation centers without success, all of which retreated due to the great complexity of the case that

presented severe maxillary resorption. In the initial consultation we were able to check on tomography regions of anterior premaxilla and maxillary sinus, where large regions of bone resorption were recorded (Figure 1).

Particulate biomaterial with the aid of platelet aggregate was planned for this case to regenerate the areas of the bilateral maxillary sinus and the entire anterior pre-maxillary region.

Biomaterial and dental implant

To reconstruct the area of bone loss found in this case, a biomaterial of alloplastic origin called Blue Bone (Curitiba, Brazil) was used. For the oral rehabilitation, dental implants, Cone Morse Avantt (CM), Systhex (Curitiba, Brazil) were selected.

Surgery and prosthetic stage

In order to collect a significant amount of blood for the preparation of the platelet aggregate, the patient was instructed to drink 3–4 liters of water per day, not to eat fried food or fats and to give preference to white meat for seven days. On the day of surgery, 28 tubes of the patient’s blood (using the Shokrum Dohan Ehrenfest DM) were collected to make the platelet aggregate and make the L-PRF membranes (Figure 2). The patient received antibiotics: 2 g amoxicillin (4 × 500 mg capsules) 1 hour after surgery and Clavulin 875 mg every 12 hours for 14 days and dipyrone (1 g tablet) for six days. A wash of 0.12% chlorhexidine solution for 1 minute was

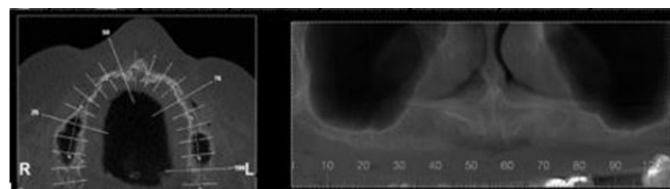


Figure 1: Initial CT scan of the case showing severe bone resorption.



Figure 2: Sequence of protocol to obtain platelet aggregate.



Figure 3: Surgical sequence showing the initial aspect, the placed tent screws and the lifted maxillary sinus membrane ready to receive the graft.



Figure 4: Sequence of PRF membrane acquisition, nano-graft placement in the area to be regenerated, and finally the suture.

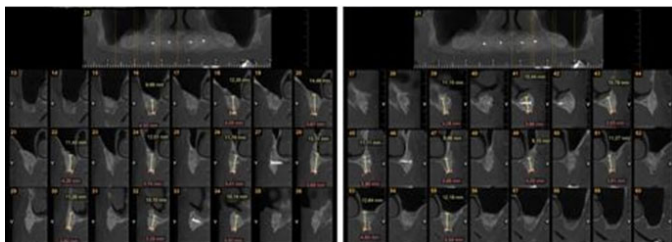


Figure 5: CT scan of the regenerated area, demonstrating the excellent bone gain on both sides.



Figure 6: The area after six months of regeneration and the panoramic radiograph showing the six placed dental implants.



Figure 7: Placement of the mini pillars and the fixed resin proteases placement over the dental implants.

performed before the operation. Local anesthesia (2% lidocaine mepivacaine with adrenaline 1:100,000) was administered. Initially, a supra crystal incision was made from tuber to tuber with total displacement. Then, the left and right maxillary sinus were lifted, and tent screws were installed in the premaxilla region to better support the forces of the tissues on top of the graft (Figure 3). The right and left maxillary sinus and premaxilla were filled with 6 grams of nano-biomaterial (Blue Bone, Curitiba, Brazil) and, finally, the entire grafted area was covered with the L-PRF membranes (1300 rpm), and the sutures were performed (Figure 4). The patient was not using the total prosthesis for the first two months. Six months after surgery, a new tomography was performed, where we were able to analyze the extraordinary bone regeneration achieved in all grafted regions, achieving bone gain over tent screws (Figure 5). Six Cone morse Avantt model dental implants, 3.5×11 mm, from (Systhex, Curitiba, Brazil) (Figure 6) were planned. A six-month period was

given for the osseointegration, then the mini pillars were placed, and the case was rehabilitated with a Branemark resin protocol prosthesis (Figure 7).

DISCUSSION

Maximiano et al. [10], in a prospective randomized clinical study in humans, a total of 49 maxillary sinus floor lifts that were performed in 49 different patients were analyzed and divided into two groups: a control group (without graft, 25 patients) and a test group (with graft, 24 patients). The conclusion was that maxillary sinus elevation and implant placement without grafting is a successful treatment with few complications. But these statements oppose what the vast literature states, that the elevation and grafting of the maxillary sinus is a favorable and predictable procedure [11–13], based on the results presented in this study.

Bone augmentation techniques are not fully predictable and are not always able to guarantee the expected result, especially in the anterior region of the atrophic maxilla. Complications and failures can often occur, and this possibility should always be explained clearly to those patients with high demands and aesthetics [14]. However, other authors [15, 16] claim that proper selection of the implant to avoid oversized implants; careful handling and low soft tissue trauma and placement of the implant in an appropriate position using a periodontal probe or a prefabricated surgical guide; use of the appropriate surgical technique, such as guided bone regeneration with barrier membranes and appropriate bone grafts and or bone substitutes; and the precise closure of the wound establishes a favorable condition for a positive outcome of the case, just as the clinical case in this study presented was performed.

In addition, a meta-analysis that gathered a collection of randomized studies, where survival rate, bone neo-formation, contact between neo-formed bone and bone substitute with use and without the use of PRF were analyzed, showed that there was no statistically significant difference between the groups studied and the rate of implant loss was also not relevant, concluding that the current evidence supports the need to add PRF to the bone graft in the increase of the maxillary sinus and other areas are Limited's [17]. One of the limitations of this study was not presenting a histological analysis, but in clinical and radiographic analyses they showed results that were extremely satisfactory and did not present loss of dental implants.

Oral rehabilitation in patients with protocol-style prostheses has been consolidated in the literature due to its positive clinical response in the short and long term, leading to quality of life for several patients [18, 19], but the available literature proves that a large percentage of these patients require rehabilitation with dental implants and need to associate the use of biomaterials for total resolution of the case [20–22]. In the study presented

we can consolidate these statements by showing fantastic bone regeneration with a fixed prosthesis on implant in the Branemark protocol model.

CONCLUSION

Through the presented case report it is possible to conclude that cases of maxilla with large bone resorptions can be solved using surgical techniques with particulate nano-biomaterials associated with platelet aggregates, achieving predictable results in the short and long term.

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Author Contributions

Gustavo Helder Vinholi – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Igor da Silva Brum – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Written informed consent was obtained from the patient for publication of this article.

Conflict of Interest

Authors declare no conflict of interest.

Data Availability

All relevant data are within the paper and its Supporting Information files.

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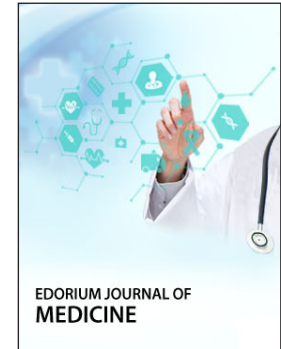
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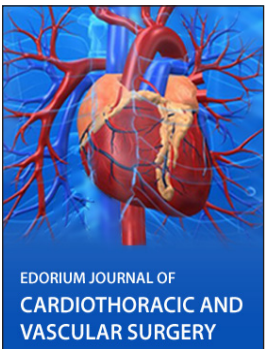
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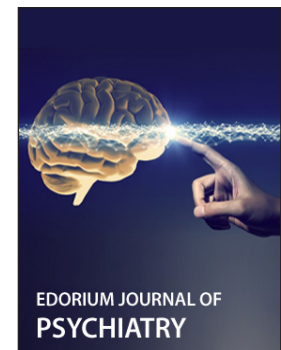
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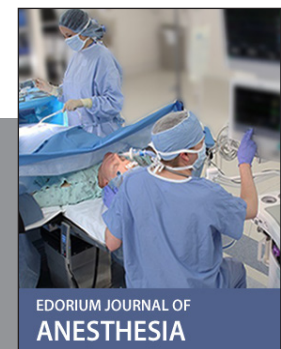
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