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Sinus lift and dental implant treatment as an option for enhancing the quality of life of our patients

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Abstract

The loss of teeth in the posterior maxillary area is a real handicap for patients, which significantly affects their quality of life. This study aims to perform an exhaustive multidisciplinary analysis of bone reconstruction at this level using alloplastic osteoinductive material, followed by dental implant treatment. The results of the study show a 92.7% rate of implant integration and a 35% rate of replacement of the augmentation material with new bone after six months. The recovery of the lost functions is complete, and after a maximum length of time of 18 days, with a mean of 4.36 days, patients no longer perceive the reconstruction as a foreign body, which means a real improvement in their quality of life.

Keywords: sinus lift, dental implants, quality of life.

Introduction

The loss of teeth in the posterior maxillary area has severe repercussions on the functions of the maxillo-dental system. Thus, masticatory and self-maintenance functions are lost, followed by a marked alteration of the aesthetic function. This results in a major impact on the patient, including the development of gastrointestinal disorders, a negative influence on the mental state and a reduction in the quality of life of the patient. There are multiple modalities for the recovery of the lost functions, consisting of various, generally fixed prosthetic reconstruction methods. Over the past years, the reconstruction of edentulous areas with dental implants has been increasingly used because this is the most biological method, with the best results [1]. However, the use of dental implants is limited at this level by the subantral bone reserve, which tends to diminish with the loss of teeth. A number of bone augmentation methods have been developed, which use various bone graft types. Of these, the most biological materials with the highest rate of success are autologous grafts, but many patients tend to refuse this treatment because of the need for opening a secondary operative field [2]. Alloplastic sinus grafts are an alternative solution and are much more easily accepted by the patient [3].

This research aims to evaluate the integration of alloplastic grafts placed in the sinus floor, as well as the integration of dental implants positioned in alloplastic material grafts, as a therapeutic alternative intended for the improvement of the quality of life of patients.

Patients and Methods

This research included 30 patients in whom the sinus floor was elevated, unilaterally in 19 patients and bilaterally in the rest, with a total number of 41 augmented maxillary sinuses. Augmentation was performed with alloplastic material (PerioGlas) by lateral sinus approach. The stability of implants was tested using Periotest, at the time of their placement and subsequently, at the time of the prosthetic restoration. When the implants were placed, bone tissue was taken for histological examination. This was performed by both optical microscopic analysis and electron microscopic analysis. In the 41 sinus lift cases, 96 MIS, Oraltronics and Biomicron implants were placed six months after bone augmentation. Subsequently, the implants were exposed intraorally and their stability was tested using the Periotest Medizintechnik Gulden device, having a value scale between -8 and +50. If values range between -8 and 0, the implants are considered to be osseointegrated and the prosthesis can be placed; if values range between +1 and +9, it is recommended to delay the placement of the prosthesis, and if values are higher than +10, the prosthesis cannot be placed [4]. Six months after the prosthetic restoration,

all patients were asked to come for a control examination and they filled in a questionnaire evaluating the presence of subjective complaints, the mean time of adjustment to the prosthesis and the degree of perception of the prosthesis as a foreign body.

The Microsoft Excel program was used for contingency tables and Student *t*-test was used for the statistical validation of the results.

Results

Clinical results

In all the patients included in the study, the augmentation of the sinus floor was performed without the intraoperative perforation of the sinus mucosa or other complications. In one patient, complications were reported 18 days after bone augmentation and consisted of inflammatory manifestations followed by the appearance of a fistula at the level of the mucosal flap. In this case, the augmentation material was removed and the inflamed tissues were curetted. At six months postoperatively, the case was radiologically evaluated (by OPT), after which 1–6 implants were placed in each patient, with a mean of 2.93 implants. The degree of stability was assessed immediately postoperatively and the presence of primary stability was found for all the implants. During the osseointegration period, two implants (Biomicron and MIS) were lost. At six months, the implants were exposed surgically and the prosthesis was placed depending on the stability of the implants (Figure 1).

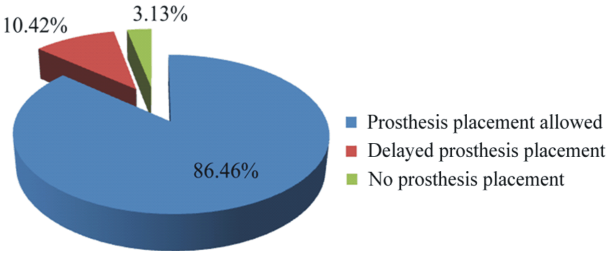

Figure 1 – ***Percent distribution of the stability of implants six months after their placement.***

Of the 10 implants that were not stable enough to support a prosthesis, six could be used three months after the first evaluation and four were lost (two MIS, one Biomicron, one Oraltronics). The final osseo-integration rate of the implants was 92.7%, and the prosthetic restoration rate of patients after subantral augmentation was 90.24%. The causes of failure were: in one case of augmentation, the augmentation material was rejected and in the case of three augmentations, the implants were not integrated.

At the periodic postoperative follow-up, in three sinus lift cases, the patients complained of mild painful discomfort on increased pressure on the prosthetic dental arch. The mean time for adjustment to the prosthesis was 4.36 days, with a minimum of one day and a maximum of 18 days, at the end of which patients did no longer perceive the prosthesis as a foreign body, and six months after the placement of the implants all patients perceived the prosthesis similarly to their natural teeth.

Histological results

Electron microscopy

In the first stage of microscopic research, the alloplastic material used for sinus augmentation was examined in order to be evidenced in the harvested grafts.

The examination of PerioGlas revealed the presence of bioglass particles with sizes ranging between 90 and 710 μm (Figure 2). After the identification of the bioglass structure, the next stage consisted of the analysis of the harvested grafts at the time of the implant placement.

Scanning Electron Microscopy (SEM) examination of the bone tissue harvested after the elevation of the sinus floor using PerioGlas as an augmentation material showed the presence of bioglass residues six months after grafting (Figure 3).

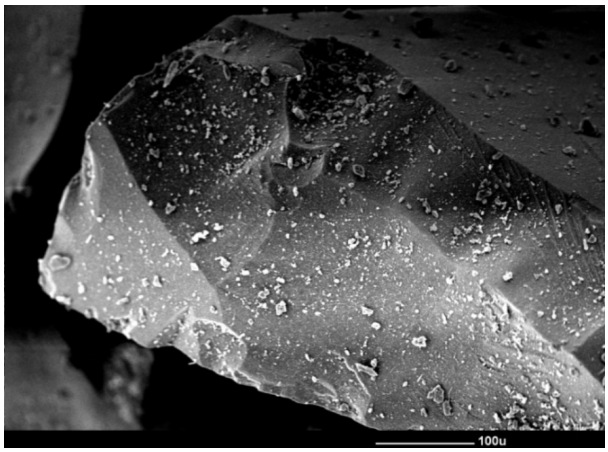

Figure 2 – ***PerioGlas (SEM, 200×).***

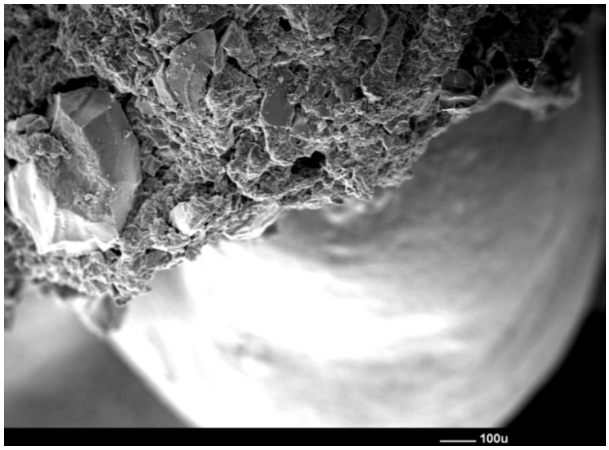

Figure 3 – ***SEM (70×) showing the presence of bioglass six months after grafting and the bone tissue–graft interface.***

Optical microscopy

For optical microscopic examination, the material was embedded in paraffin after previous decalcification and sectioned at 5-μm thickness. The slides resulting from the stretching of these sections were deparaffinized, hydrated and stained with HE and Masson's trichrome (MT).

The slides were examined and photographed using an Olympus BX40 microscope with a 4-MP Olympus Camedia C4040 camera.

The resulting images were histopathologically described and morphometrically analyzed with the dedicated software Cell® produced by the Olympus Company.

Masson's trichrome staining allows to identify in the viable bone the mineralized areas (green) compared to non-mineralized protein osteoid areas (pink) (Figure 4). Optical microscopic images evidence the adhesion of osteoblasts to the amorphous material (PerioGlas) (Figure 5).

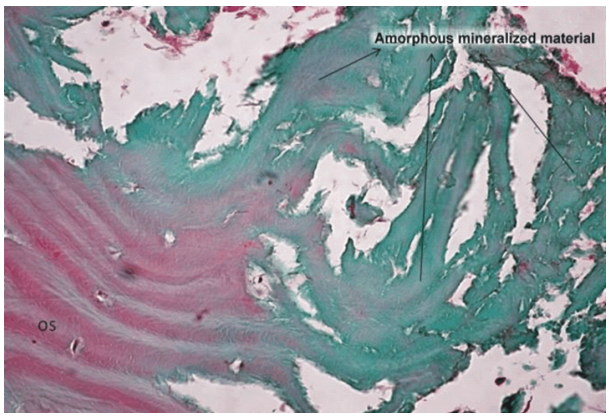

Figure 4 – ***Alloplastic material graft, MT stain, 400×. OS: Osteocyte.***

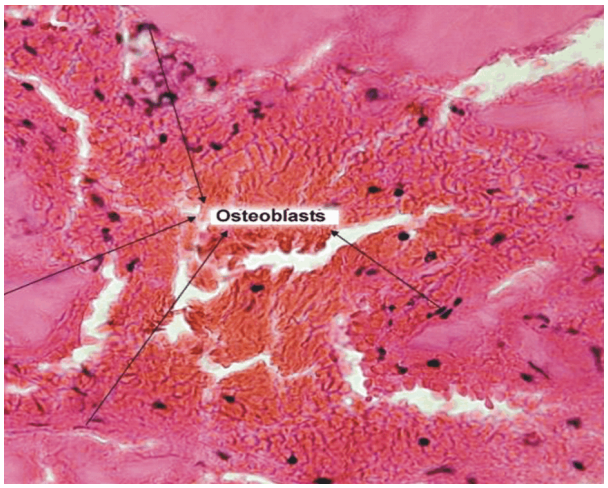

Figure 5 – ***Alloplastic graft, HE stain, 400×.***

The amorphous material is highly fragmented. TM staining shows that these fragments are mineralized (green color), similarly to bone, but they are not populated with cells. However, the material has the property to attract osteoblasts that will begin to deposit osteoid and will thus convert the material into living bone. The analysis of the formed bone indicates 35% trabecular bone present at the receptor site [5].

Discussion

The prosthetic restoration of the posterior maxillary area, whether by fixed prosthesis or dental implants, can raise problems. Fixed prosthetic restoration is the most frequently used, but it can pose serious problems from the point of view of both the clinician and the patient. The maxillary area is submitted to increased bone resorption phenomena, which makes the construction of a stable and functional prosthetic structure difficult [6]. The same resorption phenomena may hinder dental implant prosthetic reconstruction because of the limited subantral bone reserve. For these reasons, various subantral bone augmentation techniques have been developed, which have become the standard for operative technique. Current debates in the literature are most frequently related to the augmentation material type.

Autografts are considered in daily practice the "gold standard" for bone reconstruction, but they also have disadvantages such as: deficient vascularization, complications at the donor site, prolongation of the operative time, intraoperative hemorrhage and frequently an insufficient size of the bone graft [3, 7]. In addition, these types of grafts require the opening of a secondary operative field from which the augmentation material is taken. The majority of the patients are reluctant to this intervention, which frequently leads to the rejection of dental implants by the patients [8].

Recent research has focused on the discovery of augmentation materials that can successfully replace autologous bone grafts. Multiple types of grafts have been proposed, from lyophilized human bone, bovine bone to alloplastic grafts. The latter remain among the most accessible augmentation materials [9–11]. The histopathological analysis of the augmentation material applied to the maxillary sinus has shown a newly formed bone content between 36–42%, which is comparable to the results of this study. The amount of newly formed bone proved to be sufficient for the placement of dental implants, of which more than 90% were sufficiently stable to allow the placement of a prosthesis. The explanation of this outcome can also be provided by the conclusions of other studies revealing that one year after the application of the augmentation material; this is replaced by trabecular bone in a 75% proportion, this length of time being necessary for both the integration of the graft and the subsequent integration of the implant [12].

Dental implants were perceived by the majority of the patients as being a natural component of their body after a relatively short time period, which supports the literature studies that evidence the major disadvantages of other types of prosthetic restoration [13]. In this way, a segment of the human body is replaced with a structure that completely restores the functions of the body. Although bone resorption is present around the implant, in time the method proves to be more biological than the other methods because it provides a stable long-term solution for patients [14].

Data presented at the *Sinus Consensus Conference* confirm the high predictability of this procedure. Thirty-eight clinicians provided data on 1007 sinus grafts that had 3354 implants in function for at least three years. Long-term survival rates were in 90% to 97% range [1].

Autogenous bone or combinations of allografts, alloplasts, xenografts and autogenous bone all yielded similar results [15, 16].

Zygomatic implants have been shown to cause minimal complications and have demonstrated a high success rate.

The development of this new alternative to sinus grafting could shorten the surgical procedure, reduce cost, diminish the length of rehabilitation with the

possibility of immediate function, and improve comfort and oral function [17, 18].

Conclusions

This study achieved its aim of demonstrating that sinus lift with alloplastic materials followed by the placement of endosseous implants in the grafted site and subsequent prosthetic restoration is an alternative for the improvement of the quality of life of patients with edentulous maxillary areas.

The sinus augmentation method with alloplastic materials proves to be reliable and clinically applicable, with similar results to those obtained by augmentation with autologous material. Unlike in augmentation with autologous material, postoperative risks and possible postoperative complications are minimal, while the functionality of the grafted area is similar.

Contribution Note

All the authors have equal contribution to the paper.

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