

## Surgical restoration of interocclusal space and maxillary sinus floor elevation for prosthetic purposes: a case report

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**Aim:** To report on a surgical procedure with osteotomy in the posterior region of the maxilla and lifting of the maxillary sinus floor for the installation of implants and rehabilitation with implant-supported crowns.

**Case report:** A 54-year-old female patient was admitted to the dental clinic, complaining that she was dissatisfied with her smile and the missing teeth. After the clinical, radiographic, and tomographic examinations, as well as a case study of a semi-adjustable articulator, multidisciplinary planning was carried out using surgical, endodontic, periodontic, orthodontic, and prosthetic approaches. A lack of interocclusal space was observed in the posterior region of the maxilla. After osteotomy in tuberosity, maxillary sinus lift using an autogenous bone graft was performed, and three implants were installed. After the osseointegration period, provisional crowns were placed, followed by definitive metal-ceramic crowns.

**Conclusion:** The surgical techniques used in this clinical case made it possible to install implants in a single clinical session for prosthetic rehabilitation.

**Uniterms:** Dental implants. Dental prosthesis. Maxillary sinus. Osteotomy. Surgery, oral.

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### INTRODUCTION

The loss of teeth results in changes of soft and hard lining tissues<sup>1,2</sup>. In the posterior region of the maxilla, it also favors the pneumatization of the maxillary sinuses<sup>3</sup>. This physiological condition can result in smaller bone volume, insufficient for prosthetic rehabilitation of the region with implants. Currently, the maxillary sinus lifting technique is performed in a predictable manner and with high success rates with or without several biomaterials, including autogenous, synthetic, xenogeneic, or a combination of these<sup>4</sup>.

Tooth loss can also result in the extrusion of the opposite arc segment, resulting in an inadequate intermaxillary space for the installation

of dental prostheses<sup>5</sup>. In the posterior regions of the maxilla, a third physiological factor facing tooth loss is the increase in tuberosity, a rounded structure with type III or IV bone support, thin cortical layer, and abundant bone marrow<sup>6</sup>. Studies have shown that the osteoblastic activity of maxillary tuberosity showed proliferation, the expression of cell activity markers, and the production of the mineralized bone matrix, which has an osteogenic potential<sup>7,8</sup>.

Autogenous bone grafts taken from maxillary tuberosity have been proposed for guided bone regeneration and dental implant placement<sup>9,10</sup>. One cohort study, in an animal model, compared tibial bone repair after osteotomy and filling with autogenous or xenogeneic graft. Radiographically, the results

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showed an equivalence among the groups, but clinically, site osteotomy was improved when the autogenous bone was used<sup>11</sup>.

Osteotomy is an alternative for interocclusal space gain; however, when combined with the pneumatization of the maxillary sinus and dental extrusion, it presents significant challenges<sup>12</sup>. The objective of this clinical case is to report a tuberosity osteotomy surgery followed by a maxillary sinus lift using autogenous bone, enabling the immediate installation of implants for later prosthetic rehabilitation.

## CASE REPORT

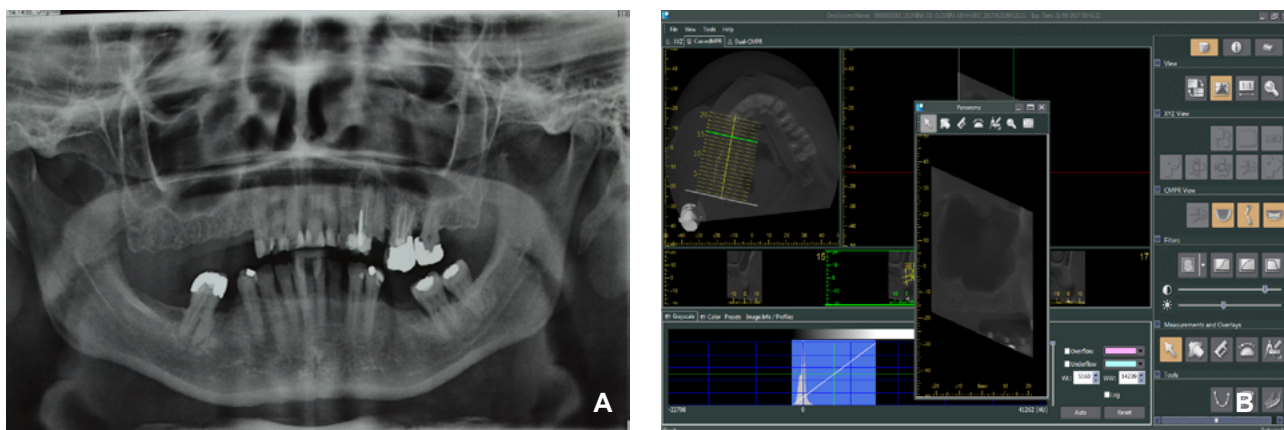
A 54-year-old female patient visited the Postgraduate Clinic in Oral Prosthetic Rehabilitation at the Bauru School of Dentistry, University of São Paulo, due to dissatisfaction with her smile even after several dental treatments. The maxillary arch on the left side showed all

dental elements with extensive restorations (except tooth 25 with coronary destruction) and tooth 24 with a periapical lesion. Absence of teeth 14, 15, 16, 17, and 18 was noted on the right side of the upper arch (Figure 1A). The mandibular arch was devoid of teeth 35, 45, 47, and 48, resulting in diastemas in the lower anterior region and mesialization of tooth 46 (Figure 1B). The patient had a Class II intermaxillary relationship and a marked overjet. The posterior region of the edentulous maxilla on the right side resulted in the extrusion of the antagonistic dentoalveolar segment, which led to a reduction in the restorative space in the upper arch (Figure 1C). Images from computed tomography, as well as periapical and panoramic radiographs, displayed a pneumatization of the maxillary sinus (Figures 2A and 2B). Diagnostic models were also studied, and a meticulous planning of the case was established by several specialists to promote the patient's oral rehabilitation.

**Figure 1.** Initial condition of A) upper arch, B) mandibular arch, C) restorative space on the right side.



**Figure 2.** Initial exams. A) Panoramic radiograph. B) Computed tomography.



In the maxillary edentulous region, under local anesthesia, surgery was performed to adapt the intermaxillary space and install the implants in the correct apical-coronal positioning in the same clinical session. A flap was raised, and horizontal osteotomy was performed following the previously manufactured surgical guide, with

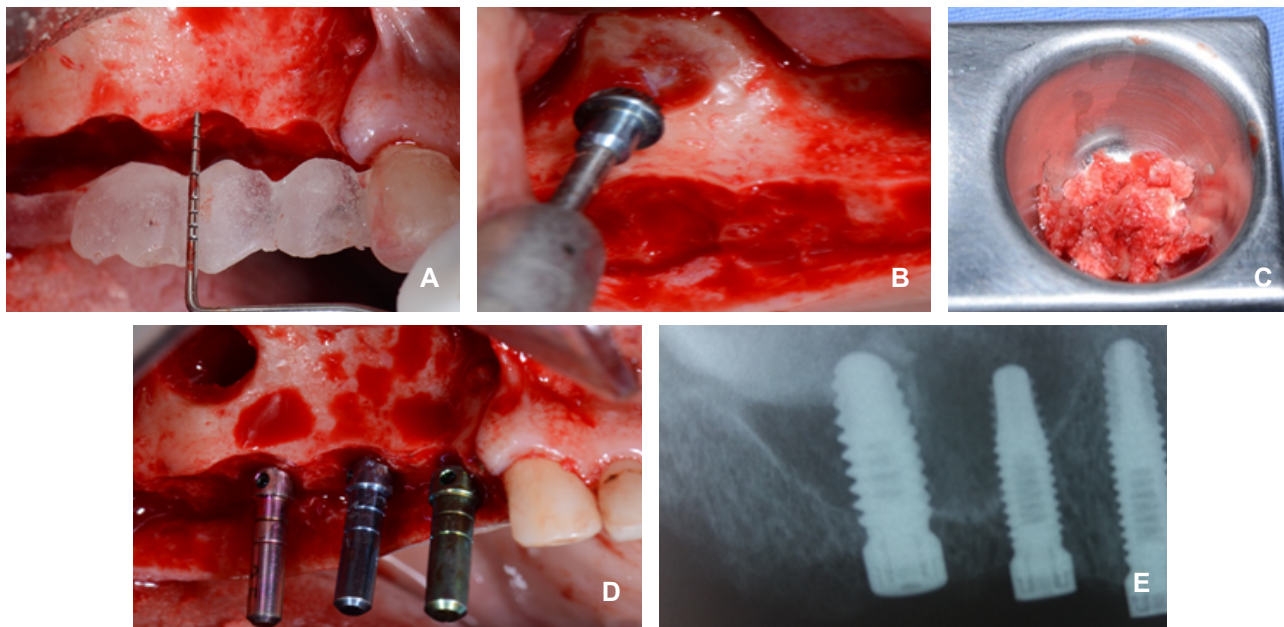
a 5-mm gain (Figure 3A). The dimensions of the side window for the elevation of the maxillary sinus were then determined, using a circular tip to gain vertical bone volume (Figure 3B). After elevating the sinus membrane and inserting the autogenous bone graft obtained from tuberosity (Figure 3C), three external hexagon implants

Surgical restoration for prosthetic purposes

(Neodent®, Curitiba, Brazil) were installed in the region of teeth 14, 15, and 16 (Figure 3D and 3E). Six months after the surgery, the functional

load of the implants was begun using temporary crowns. During follow-up, gradual bone formation around the implants was observed (Figure 4A).

**Figure 3.** Surgery. A) Horizontal osteotomy. B) Window for elevation of the maxillary sinus. C) Autogenous bone graft obtained from the tuberosity. D) Three external hexagon implants installed. E) Immediate radiography after implant placement.



**Figure 4.** After 6 months. A) Bone formation around implants. B) Orthodontic treatment on lower arch and interocclusal space gain for superior arch.



The patient used an orthodontic appliance on the lower arch to close the anterior diastemas and gain space in the mesiodistal direction of the posterior teeth (Figure 4B). The prosthetic preparations of the remaining teeth

were performed and received temporary crowns. All of the steps for conventional rehabilitation with definitive metal-ceramic crowns were performed (Figures 5A, 5B, 5C, and 5D). The case has been undergoing follow-up for 3 years.

**Figures 5.** Finalized case. A) Upper arch. B) Mandibular arch. C) Frontal view. D) Right side.



## DISCUSSION

Prosthetic rehabilitation with osseointegrated implants has become commonplace in dental offices, with a predictability of survival and conservation of adjacent structures and teeth close to the implants. However, implant planning must involve several requirements, such as available bone, periodontal biotype, biological distances, and occlusal aspects. This evaluation is essential, since the loss of dental elements causes several changes to the soft and hard tissues of the alveolar lining, such as the movement of the teeth neighboring the edentulous space, extrusion of antagonistic teeth, and vertical and horizontal bone resorption<sup>1,2</sup>. Another consequent tooth extraction occurs without replacing the teeth lost in the posterior region of the maxilla, as it favors the pneumatization of the maxillary sinuses<sup>3</sup>, an anatomical obstacle that makes it difficult to install implants for later prosthetic rehabilitation.

Excessive fibrous tuberosity is the most frequent cause of the lack of space in the posterior

region of the maxilla and requires surgical correction of soft tissues. However, there may also be a need for bone correction, especially after the loss of occlusal support and extrusions. Although segmental surgery is performed on toothed segments<sup>5</sup>, it can also be indicated on edentulous edges<sup>12</sup>. Nevertheless, this technique becomes more invasive, since it is performed under general anesthesia and presents a risk of complications, such as oronasal communication, infections, hemorrhages, unfavorable segmentation (unwanted fracture), and pseudoarthrosis<sup>13</sup>. In this situation, the vertical alveolar reduction must be considered. While it seems to be a simple procedure, it presents some challenges, such as the loss of cortical bone during the reduction, the presence of keratinized mucosa, and the enlarged edentulous ridge. In addition, the condition of pneumatization of the sinuses may be present due to the loss of upper posterior teeth<sup>3</sup>. Such limitations were present in the clinical case described and result in difficulties for the subsequent installation of implants in the correct apico-coronal placement for prosthetic rehabilitation.

Bone grafts can be performed simultaneously or before implant placement. The combined approach is preferred, as it results in decreased patient morbidity, treatment time, and costs<sup>14</sup>. Still, placing the implant at the ideal time and applying the appropriate occlusal force are important to promote the corticalization and maturation of the newly formed bone<sup>15</sup>. This suggests that the simultaneous placement of dental implants and bone grafts may reduce the rate of bone resorption grafted in the postoperative period. One study carried out on an animal model compared the use of blood clots, autogenous or xenogeneic bovine-derived material for a single-stage maxillary sinus lift and simultaneous implant placement<sup>16</sup>. As a result, there was no difference between groups for the total area of the mineral component and the bone-to-implant contact<sup>16</sup>.

Regarding bone graft techniques, autogenous bone graft is considered the gold standard for the reconstruction of bone defects and offers several advantages, when compared to xenogenic, allogeneic, or synthetic bone grafts, such as reduced immune and inflammatory reactions, faster bone consolidation, and higher regenerated bone quality<sup>17</sup>. Autogenous bone is considered the only osteogenic, osteoinductive, and osteoconductive biomaterial, and is considered to be the best option to obtain better new bone formation after maxillary sinus augmentation<sup>17-19</sup>. By contrast, as a disadvantage, autogenous grafts result in greater post-surgical morbidity due to the need for a donor site<sup>18</sup>. In the present clinical case, this disadvantage was eliminated, as the autogenous bone used in the maxillary sinus lifting was obtained through the osteotomy necessary to obtain the space for restoration.

The excessive eruption of opposing teeth that affects the prosthetic space presents several treatment options to create sufficient space for restoration, such as enamel wear, orthodontic intrusion, dental realignment, endodontic treatment, and the preparation of the crown and osteotomy<sup>20</sup>, procedures applied in this clinical case. These complex clinical situations require a meticulous treatment plan, as the main objective of treatment is to provide the patient with esthetic and functional rehabilitation. Therefore, all clinical procedures must be conducted through reverse planning, with a diagnostic wax-up for the preparation of a surgical guide, which is essential to identify the best treatment plan and achieve a satisfactory result. Likewise, a multidisciplinary approach is considered when planning treatment with dental implants, which

involves orthodontic, surgical, prosthesis, and restoration procedures<sup>20</sup>.

In the present clinical case, favorable results were observed for both the survival of the implant and the stability of bone levels in a year and a half of follow-up. Patient compliance and motivation for proper oral hygiene led to an excellent postoperative course. The clinical and radiographic monitoring, together with the excellent integration of the implant system in the osteomucosal context, made possible by the proper management of soft tissues, consolidated the success of the surgical technique, among others, which has been widely confirmed in the literature.


## CONCLUSION


The proposed multidisciplinary planning resulted in a simple, fast, and cost-effective technique that allowed for the use of autogenous bone to elevate the maxillary sinus and install implants in a single clinical session, thus providing a satisfactory outcome from the esthetic and functional points of view, in addition to meeting the patient's expectations. The surgical technique also proved to be effective, as favorable results were observed for both the survival of the implant and the stability of bone levels.


## CONFLICTS OF INTEREST


None.

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## Reestabelecimento cirúrgico do espaço interoclusal e levantamento do assoalho do seio maxilar para fins protéticos: relato de caso

**Introdução:** A reabilitação oral envolve um tratamento integrado, que inclui diversas especialidades odontológicas para restabelecer os aspectos estéticos e funcionais, resultando também na satisfação do paciente.

**Objetivo:** O objetivo foi relatar um procedimento cirúrgico com osteotomia na região posterior da maxila e levantamento do assoalho do seio maxilar para instalação de implantes e reabilitação com coroas implantossuportadas.

**Relato de caso:** Paciente do sexo feminino, 54 anos, apresentou-se ao ambulatório queixando-se de insatisfação com o sorriso e com a falta de dentes. Após os exames clínicos, radiográficos, tomográficos e estudo de caso em articulador semi-ajustável, foi realizado o planejamento multidisciplinar com abordagens cirúrgica, endodôntica, periodontal, ortodôntica e protética. Observou-se falta de espaço interoclusal na região posterior da maxila. Após a osteotomia na tuberosidade, foi realizada a elevação do seio maxilar com enxerto ósseo autógeno e foram instalados três implantes. Posteriormente, no período de osseointegração, foram colocadas coroas provisórias e, posteriormente, coroas metalocerâmicas definitivas.

**Conclusão:** As técnicas cirúrgicas utilizadas neste caso clínico possibilitaram a instalação de implantes em uma única sessão clínica para a reabilitação protética.

**Palavras-chave:** Implantes Dentários. Prótese Dentária. Seio Maxilar. Osteotomia. Cirurgia Oral.