Atrophic maxilla reconstruction: case report

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ABSTRACT

Objective: To report and analyze the sequence of surgical and prosthetic events used in the rehabilitation of an edentulous patient, with severe atrophy of the alveolar bone of the maxilla. **Case report:** Patient submitted to multiple procedures aiming the rehabilitation of severely atrophic maxilla. Treatment plan included three surgical procedures: maxillary reconstruction with anterior iliac bone autograft; maxillary dental implants placement for the fixation of a decompensated upper prosthesis; maxillary advancement throughout Le Fort I osteotomy. Results: The planning and treatment were successfully performed and patient presents himself satisfied and without complaints. **Conclusion:** Implant-supported rehabilitation of edentulous patients, with large maxillo-mandibular skeletal discrepancies is a challenge for buco-maxillofacial surgeons and prosthetic dentist. The correct sequence of surgical-prosthetic procedures indicated in each case is related to the success of the treatment.

Keywords: Mouth rehabilitation. Orthognathic surgery. Alveolar bone loss.

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INTRODUCTION

The alveolar bone requires stimuli to maintain its shape and density. After tooth loss, there is a chronic and progressive process of bone resorption. This process of atrophy is influenced by some factors, including individual differences, age and anatomical region.[1,2]

The rehabilitation of patients with severe maxillary atrophy using implant-supported dentures usually requires previous procedures to increase the alveolar bone support. Bone grafts are widely employed for that purpose. Autogenous bone is the material with most characteristics of an ideal graft, and the iliac crest is considered a potential donor site, due to the bone quantity available.[2,3]

Even though reconstruction techniques are available for cases of moderate resorptions, in more severe cases the bone graft alone may be insufficient to recreate the correct intermaxillary relationship. In these cases, orthognathic surgery with interposition of autogenous bone grafts allows more adequate maxillary repositioning, favoring the maxillomandibular relationship in both vertical and anteroposterior directions.[3,4,5]

Thus, this paper repots the case of an edentulous patient, with severely atrophic maxilla, who was rehabilitated using autogenous graft from the anterior iliac crest, orthognathic surgery for maxillary advancement and implant-supported dentures. The paper also discusses the importance of the correct sequence of surgical and prosthetic procedures employed in such cases.

CASE REPORT

A female individual aged 58 years attended the Oral and Maxillofacial Surgery and Traumatology Service of HC-UFMG for evaluation concerning the possibility of dental rehabilitation by implant-supported dentures.

The systemic medical history of the patient was uneventful. She did not report harmful and/or parafunctional habits. During anamnesis, she reported having been edentulous for 30 years and the use of unstable removable partial dentures, which presented poor esthetics in her opinion.

Facial analysis revealed deficient projection of soft tissues of the midface, lack of upper lip support, inverted relationship between upper and lower lips and good anteroposterior positioning of the mandible (Fig 1A, C). Intraoral examination evidenced severely resorbed maxillary and mandibular alveolar ridges (Fig 1B), associated with unstable removable partial dentures.

The panoramic radiograph and lateral cephalogram, as well as cone-beam computed tomography (Fig 1D), confirmed the severe atrophy of maxillary and mandibular alveolar ridges. There were no other significant skeletal alterations.

The case was diagnosed as maxillary hypoplasia and bimaxillary edentulism with severely atrophic alveolar ridges.

The treatment planning approved by the patient included three surgeries. The first procedure, performed under general anesthesia, comprised reconstruction of the atrophic maxilla using autogenous graft from the anterior iliac crest. Corticomedullary blocks were fixated to the anterior maxilla using bicortical screws and titanium plates with two orifices, from the 1.5-mm diameter mini- and microfragments fixation system (Synthes®, Switzerland). Particulate bone graft was used for partial filling of maxillary sinuses, after sinus lift (Fig 2A, B).

After four-month clinical and imaging follow-up (Fig 2C), a second surgery was performed under local anesthesia for placement of six implants in the maxilla. The implants had external hex platform, being two implants measuring 4-mm diameter and 9-mm height, and the other four implants measured 4-mm diameter and 13-mm height (Neodent®, Brazil). A period of 35 days was allowed for osseointegration, during which one maxillary implant was lost, at the region of tooth #22 (Fig 3A). The Prosthodontics team was contacted to discuss the possibility of implant-supported denture without replacement of the missing implant.

Five implants were placed in the mandible (Fig 3A), also with external hex platform, between the mandibular foramina, both measuring 4-mm diameter and 9-mm height (Neodent®, Brazil). The initial torque in mandibular implants was greater than 45 N.cm, allowing immediate load in the mandible. The implants were opened on the same session and a provisional complete mandibular denture was used, which had been fabricated at treatment onset.

Six months after placement and osteointegration of maxillary implants, a provisional complete denture was fabricated to allow the orthognathic surgery. The

procedure was performed under general anesthesia, eight months after implant placement. The single-jaw surgery comprised advancement of 8 mm with 2 mm of inferior maxillary positioning, by a Le Fort I osteotomy. Rigid internal fixation was achieved in the maxilla using four L-shaped plates and sixteen titanium screws from the 1.5-mm diameter mini- and microfragments fixation system (Synthes, Switzerland).

Except for the loss of one maxillary implant, all surgeries were uneventful, either trans- or postoperatively. Definitive dentures were placed six months after Le Fort I osteotomy (Fig. 3B).

Three-year postoperative follow-up evidenced normal aspect associated with the implants and stability of correction of the dentoskeletal and facial alteration (Fig. 3C, D).

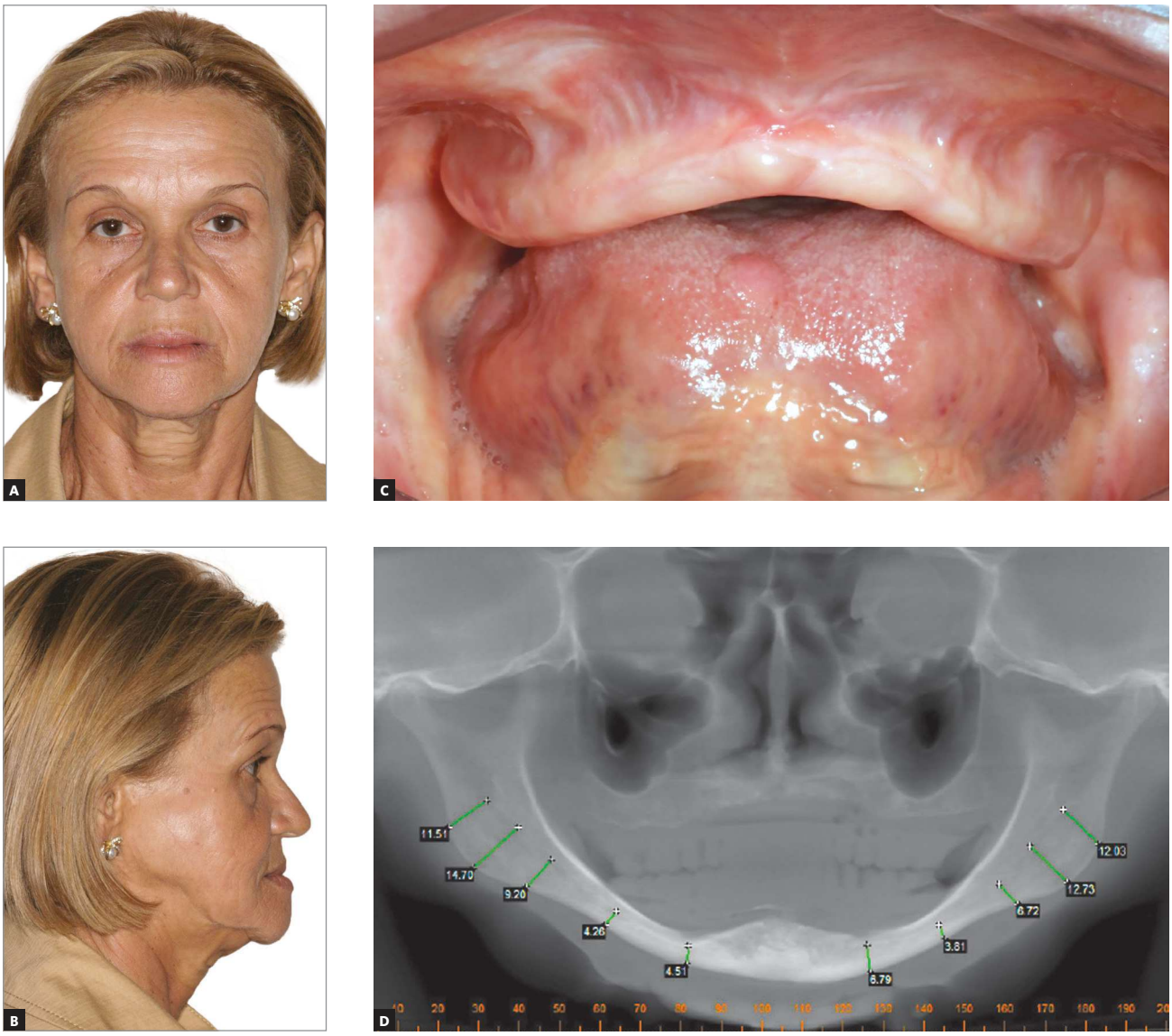

Figure 1: Preoperative images: **A**) frontal view at rest; **B**) lateral view at rest; **C**) alveolar ridge preoperatively; **D**) cone-beam computed tomography evidencing the atrophic alveolar ridges.

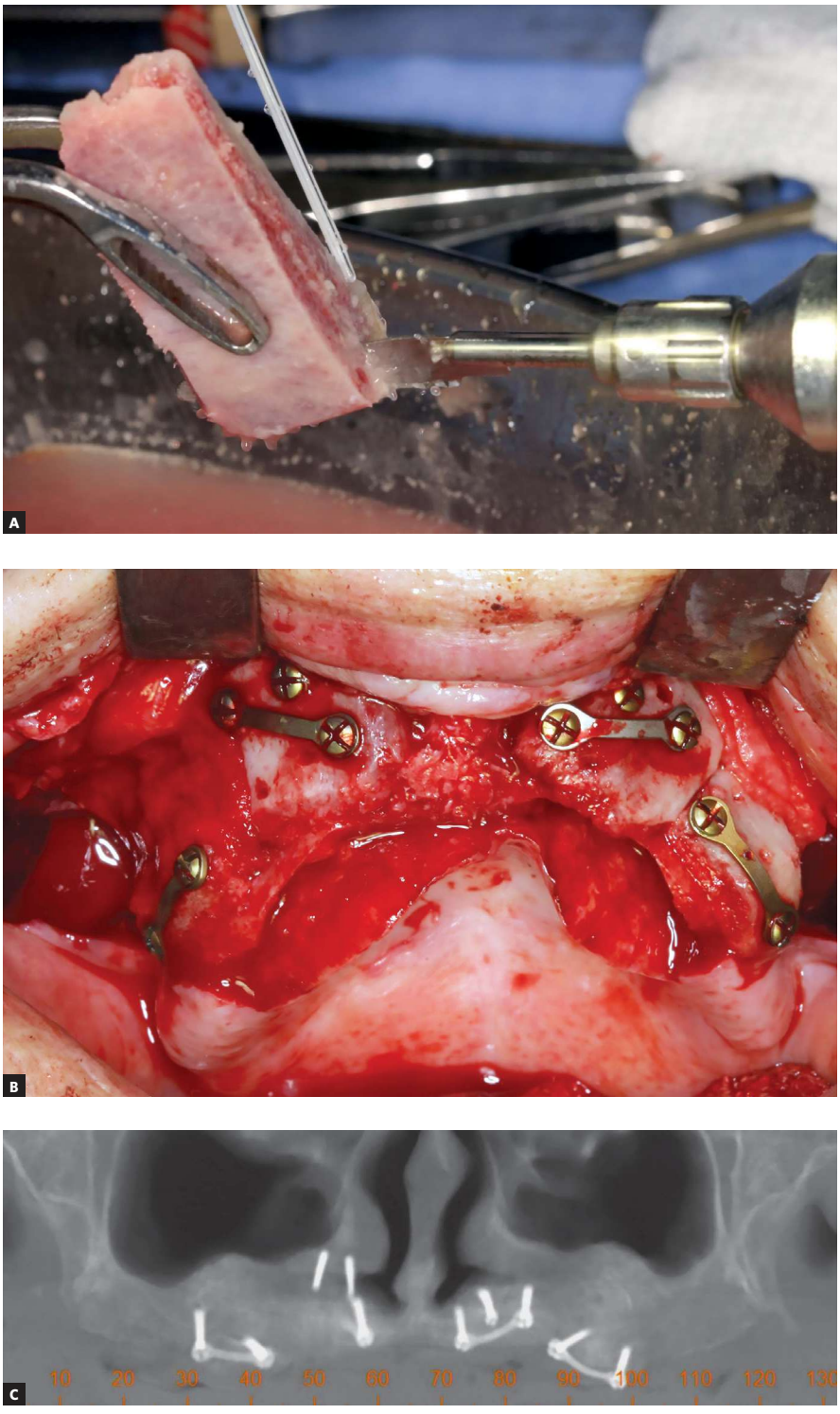

Figure 2: A) Preparation of corticomedullary blocks transoperatively. **B**) Fixation of blocks using bicortical screws and titanium plates with two orifices. **C**) Cone-beam computed tomography obtained four months after reconstruction with bone graft from the iliac crest.

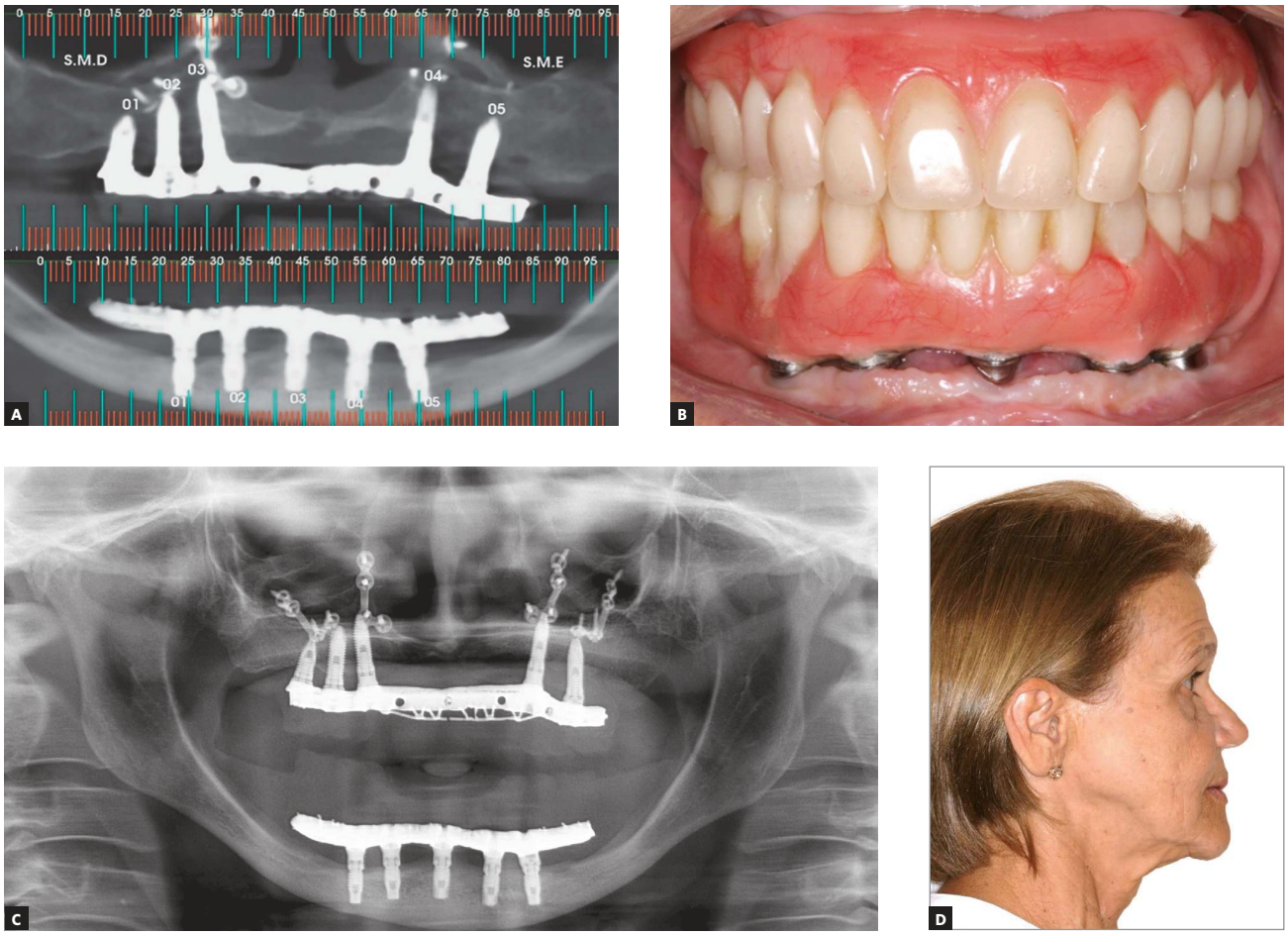

Figure 3: Postoperative images: **A**) cone-beam computed tomography after rehabilitation on five implants in the maxilla and five implants in the mandible; **B**) definitive dentures in place; **C**) panoramic radiograph at three-year follow-up; **D**) lateral view three years after implant-supported rehabilitation.

DISCUSSION

Individuals with atrophic maxillae are still a challenge in implant-supported reconstructions, due to the proximity with the maxillary sinus and nasal floor. It is often necessary to use bone grafts, and unfavorable maxillomandibular relationship is often observed in these patients.[3]

As demonstrated in the present case, the patient presented characteristics of maxillomandibular atrophy class VI according to the classification of Cawood and Howell,[1] presenting functional and esthetic complaints. As described by Li et al.[3], reconstructive procedures in isolation are often unable to solve all complaints of patients, which may impair the success and longevity of prosthetic rehabilitation.

To address the patient's complaints, it was decided to perform grafting in the atrophic maxilla, placement of implants and uncompensated provisional dentures, combined to orthognathic surgery (Le Fort I) for maxillary advancement. This planning was considered necessary, since the patient presented negative overjet of 14 mm between the dental arches, with actual possibility of postoperative instability if only one technique was employed.

If correction of the intermaxillary relationship is not planned, the result of implant-supported rehabilitation in these cases may cause unfavorable load of occlusal forces on the compensated dentures, reducing the predictability of cases in the long term, besides providing unsatisfactory esthetic and speech outcomes.[5,6]

It was decided to perform these procedures individually to allow more predictable results, despite the greater morbidity associated with multiple surgical procedures. This was also reported by Nystron et al.[6], who stated that techniques of maxillary reconstruction and Le Fort I osteotomy, when performed separately from implant placement, in different surgical moments, may provide greater predictability and higher success rate.

According to Gil et al.[5], accomplishment of dental fixed rehabilitation before Le Fort I osteotomy aids the maxillary repositioning, enhancing the predictability of teeth positioning, as well as of their relationship with the upper lip. The authors further highlighted the importance of the maxillary central incisor as reference, which is fixated to the maxilla in the three-stage technique, aiding the treatment planning.

The study of Kahnberg et al.[7] compared the implant loss after Le Fort I osteotomy associated with iliac crest graft with implant placement in the same procedure (study group) and Le Fort I osteotomy with iliac crest graft and implant placement after three to four months (control group). In a five-year follow-up, the authors observed lower rates of implant maintenance in the study group (60%) compared to the control group (85.6%). Thus, the authors concluded that accomplishment of two surgical steps is more adequate in this procedure.

Besides the success rate of implants, it is important to consider the rate of bone resorption after iliac crest grafting. According to Dreiseidler et al.[8], most studies analyzing changes in the iliac crest volume demonstrated results with 23% to 59% of reduction, yet using different surgical approaches and follow-up periods. A tomographic study evaluating the bone volume loss after four months revealed 15% of bone loss, being the lowest value reported in the literature.[8] Considering the maxillomandibular discrepancy of the patient and the volume loss expected due to bone remodeling, it was necessary to perform maxillary advancement by Le Fort I osteotomy, providing better anteroposterior maxillomandibular relationship at treatment completion.

Castagna et al.[9] conducted a study comparing the bone gain and resorption in patients who received four provisional implants simultaneously to autogenous bone grafting, compared to a control group submitted only to grafting from the same donor site. The authors did not observe significant differences in the evaluation of bone gain and resorption after a mean follow-up period of five months, by cone-beam computed tomography analysis. Thus, it may be assumed that implant placement in the same surgical step is not an important aspect for maintenance of the grafted bone volume.

Gil et al.[5] mention advantages of implant placement in a second surgical step, including reduced risk of ischemic necrosis of the graft, lower probability of implant loss and possibility of achievement of a perforation guide based on previous planning of the best position for implant placement. Treatment indication, planning and accomplishment of the present case was based on these facts.

Le Fort I osteotomies are indicated for individuals with skeletal Class III dental malocclusion due to anteroposterior maxillary deficiency, providing optimal outcomes with long-term stability. For achievement of success after surgical movements of the maxilla, it is necessary to restore the masticatory function, promote pleasant esthetics and provide long-term stability.[4] According to Carlotti et al.[10], the stability of the surgical outcome achieved is related to factors as appropriate wound healing, absence of vascular involvement, adequate maxillary mobilization and fixation, and quality of occlusion of the patient.

During bone consolidation, the fixation and stability of the complex should be sufficiently rigid to withstand the anteroposterior forces, in order to avoid relapse[10]. As reported by Gil et al.[5], we believe that the accomplishment of bone grafting, implants and Le Fort I osteotomy in different surgical steps increases the predictability and stability of outcomes, since the patient will have an implant-supported provisional fixed denture in place during orthognathic surgery, with satisfactory tooth contacts.

CONCLUDING REMARKS

Implant-supported dentures, bone grafts and Le Fort I osteotomy may be indicated for the treatment of patients with severe atrophy causing significant dentoskeletal and facial alterations. This requires careful planning of treatment stages, involving professionals of oral and maxillofacial surgery and prosthodontics. The technique in three surgical stages, despite the greater morbidity, seems to provide more predictable results, which may lead to greater treatment stability.

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