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SEGMENTARY MANDIBULAR RECONSTRUCTION: A NARRATIVE REVIEW

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Abstract: Osteolytic lesions of traumatic, infectious, tumor origin or bone defects of genetic origin represent a challenge for aesthetic and functional rehabilitation. Bone biomechanics, important for mastication, swallowing, speech, breathing and self-esteem, require efforts to satisfactorily return the patient to his vital and social functions. Procedures for bone and tissue grafting have always been used for this purpose, but they require a long time and that medical teams from different specialties work together to achieve satisfactory results. These techniques are available in large centers, making access in remote areas difficult. Technological advances and material and tissue engineering have allowed new techniques to make it possible to reproduce segments of the human body for the rehabilitation of mutilated patients or those with genetic defects with reduced morbidity. In addition, these new techniques allow patients to recover their social life in a dignified and fast way, with reduced impacts on their daily lives.

Keywords: Mandibular reconstruction, customized prosthesis, vascuarized graft.

INTRODUCTION

Osteolytic lesions of the mandible can represent a challenge for aesthetic-functional rehabilitation depending on the extent and need for bone resection depending on the particularities of the bone and its characteristics (AWAD, 2019). Free grafts, vascularized or not, have been the main form of functional and aesthetic rehabilitation of patients affected by trauma, tumors, congenital or acquired deformities or infections (WAD, 2019; KAKARALA, 2018). Even so, the morbidities of patients undergoing this treatment associated with the risk of contamination offered by the oral microbiota and the total time for final rehabilitation makes new techniques to be developed (BARR et al., 2020; KNITSCHKE et al., 2022). The state of the art in mandibular reconstructions concerns the use of titanium metallic prostheses (MOIDUDDIN et al., 2019; LEE et al., 2018; MOVAHED et al., 2015). In addition to reducing surgical time and morbidity for the patient, prostheses designed by specific software and machined from metal blocks allow the association of functional and aesthetic rehabilitation and restore the patient's vital functions, such as chewing and swallowing, in an extremely reduced time., making this form of treatment extremely safe and effective (SERRANO, 2019). A description of the characteristics of individualized mandibular prostheses for bone reconstruction was performed. Manufacturers were not compared, but the method used for such rehabilitations, their advantages and disadvantages.

FIBULA VASCULARIZED BONE GRAFT

Since its introduction in 1989 by Hidalgo, the fibula has been considered one of the best donor sites for this type of reconstruction, both due to bone characteristics and availability, reaching 25 cm in adults (KOKOSIS et al., 2016). The way of obtaining, with the possibility of blood supply, increases the predictability of success and allows the reconstruction of more extensive defects (HIDALGO, 1989). They may or may not be associated with soft tissue, depending on the type of defect to be treated (KOKOSIS et al., 2016). When obtaining the graft, it is possible to use cutting guides, designed by software (Figs 1 and 2), to facilitate the modeling of the graft according to the recipient region, especially in the anterior regions of the mandible, for proper curvature (LIM et al. al., 2016; SCHEPERS et al., 2016, LIU et al., 2014).

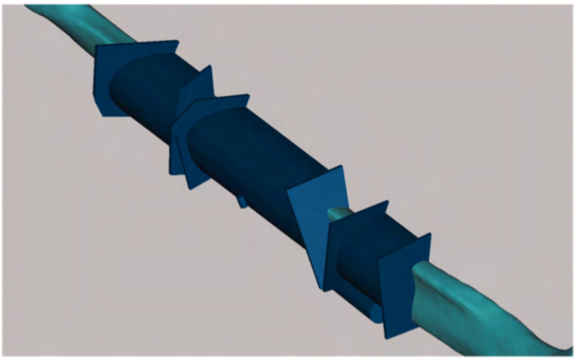

Figure 1 - Guide planning.

Source: LIM et al., 2016.

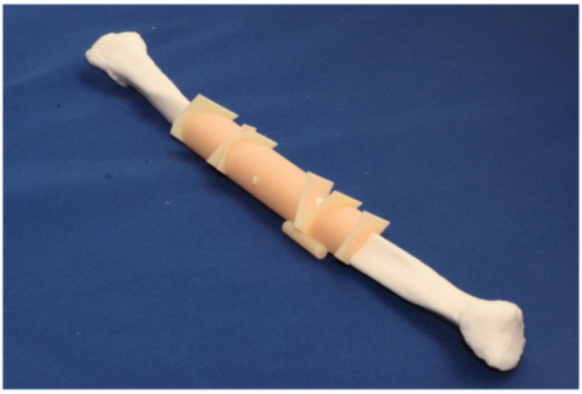

Figure 2 - Printed cutting guide.

Source: LIM et al., 2016

This technique reduces surgical time and consequently improves success rates. Infection and lack of nutrition compromise the graft and can doom the reconstruction. In addition, bone mobility can lead to pseudarthrosis, requiring a new surgery (LANDAU et al., 2018). A thorough evaluation of the patient must be performed to identify a history of radiation therapy, hypothyroidism, protein deficiency, uncontrolled diabetes, smoking, or other conditions that may increase the risk due to vascular and tissue health (HOUDEK et al., 2017; ROSSON; NAVIN). et al., 2005). Despite all the particularities of this type of graft, the success rates reach 95%, and the lack of nutrition of the transported bone is the main cause of failure, occurring from the first 72 hours to 3 weeks after surgery (VINCENT; MARC, 2021). Another important aspect in relation to free grafts is the health of the temporomandibular joint. It is known that the bad positioning of the condyles can lead to problems with mouth opening and degenerative processes in the medium and long term. Greater risk occurs when the joint is reconstructed with bone graft (SPORNIAK-TUTAK et al., 2011; KHADKA; HU, 2012).

INDIVIDUALIZED TITANIUM PROSTHESIS

Initially conceived for reconstructions of the temporomandibular joint, and made in a prefabricated way, that is, in pre-defined sizes, the use of this material was widely spread due to its advantages over traditional graft techniques for bone recovery of the mandible (RACHMIEl et al., 2017; DE SOUSA; PAREDES et al., 2022; GIL, 2019). Technological advances made possible the computational planning of the bone segment to be repaired, and quickly other regions of the mandible, in addition to the temporomandibular joint. This range of possibilities is due to the fact that the prostheses can be individualized, that is, they are machined especially for each patient, allowing to return the exact anatomy of the bone segment to be reconstructed (WOLFORD et al., 2015; VALERO et al., 2014). Currently, the possibilities go beyond the mandible, being able to be used in practically all the bones of the face (Figures 3a, b,c,de 4). They are developed by software that allows duplicating the area that will be resected, or even mirroring the contralateral segment when it is not possible to faithfully copy the affected area. They can be subjected to resistance tests, simulating forces applied to the jaw (CHEN et al., 2018). They allow the installation of specific devices to receive dental prosthesis. They offer the possibility of reconstructing the temporomandibular joint when disarticulation is necessary and can be associated with bone or soft tissue graft.

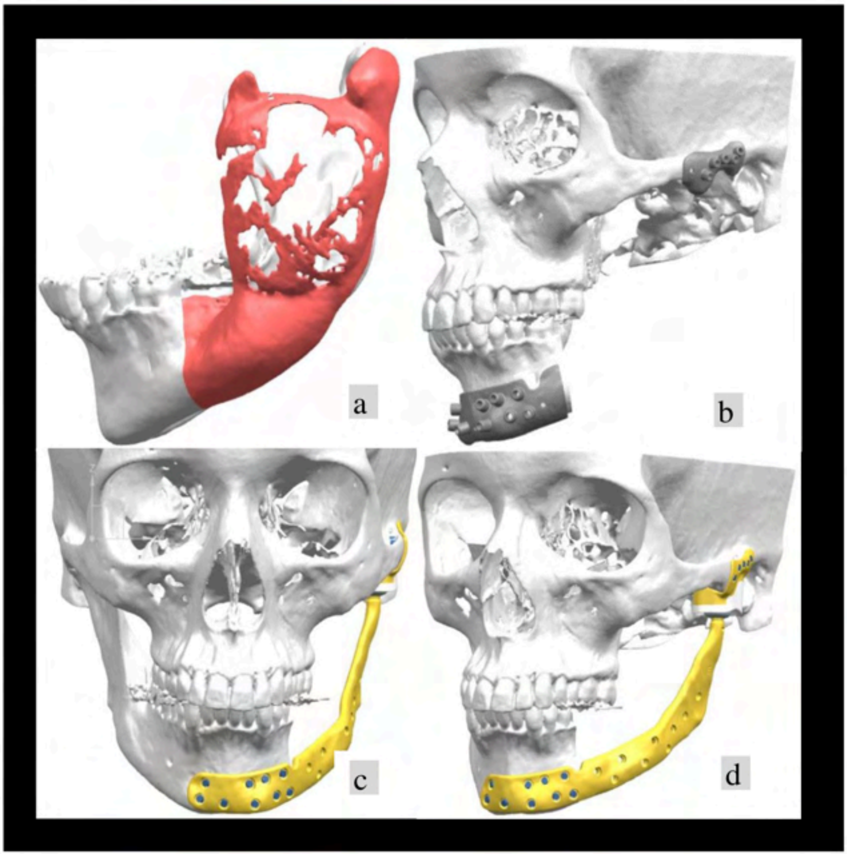

Figure 3 - a) simulation of mandibular tumor b) simulation of tumor resection. c) simulation of reconstruction with mandibular prosthesis, frontal view. d) Simulation of reconstruction with mandibular prosthesis, side view.

Source: Author's collection.

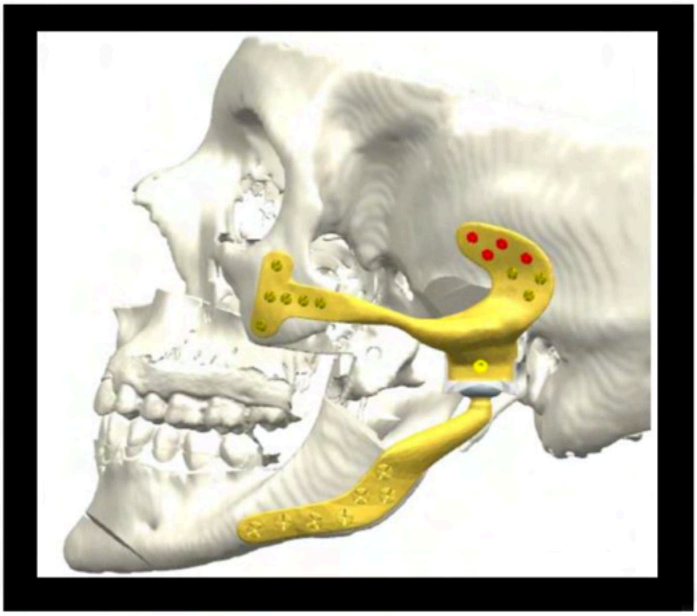

Figure 4 - Simulation of zygomatic arch prosthesis, temporomandibular joint and mandible ramus.

Source: Author's collection.

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The medical team receives relatively short training to perform the procedure and the patient is returned to their daily activities in an extremely short time compared to other treatment methods.

DISCUSSION

With the technological advance and expansion of the technique, several manufacturers offer metallic prostheses for bone reconstruction purposes. Initially, the materials used were prefabricated, that is, titanium plates that were molded by surgeons during surgical procedures. These procedures are still widely used, but they can present failures such as bone fracture, infection, graft nutrition failure, material displacement or skin exposure depending on the extent of the bone defect (AWAD, 2019; KAKARALA, 2018;KNITSCHKE et al., 2022; HIDALGO, 1989; KOKOSIS et al., 2016;LANDAU et al., 2018; HOUDEK et al., 2017; ROSSON; NAVIN et al., 2005;VINCENT; MARC, 2021). The thickness of the material does not allow adequate bone contouring and may leave aesthetic sequelae. In addition, it does not allow masticatory rehabilitation of the mandible, as it does not rebuild the alveolar ridge so that dental prostheses can be adapted or implants installed (KNITSCHKE et al., 2022; RACHMIEL et al., 2017; KOKOSIS et al., 2016). An alternative used to solve these problems is the association of bone grafts to plates, usually from the iliac crest, tibia, fibula, scapula or skullcap, and, depending on the extent of the grafts, it is necessary to obtain them in a vascularized form to maintain the nutrition of transported tissue (AWAD, 2019; HIDALGO, 1989;VINCENT; MARC, 2021). Currently, the vascularized grafts of the tibia are the most performed due to the volume and similarity with the body of the mandible, facilitating, in a way, the modeling of the graft and adaptation to the recipient bone, as well as the installation of dental implants for future masticatory rehabilitation (AWAD)., 2019; KAKARALA, 2018;KNITSCHKE et al., 2022; HIDALGO, 1989; KOKOSIS et al., 2016;LANDAU et al., 2018; HOUDEK et al., 2017; ROSSON; NAVIN et al., 2005;VINCENT; MARC, 2021). Even so, the technique depends on a specialized medical team and specific equipment to perform the procedure, often available only in large centers.

Developed decades ago, but widespread in recent years, individual titanium prostheses for facial bone reconstruction offer a great advantage when compared to other methods due to the ease of technical execution, obtaining the material and reducing patient morbidity (SERRANO, 2019; SPORNIAK-TUTAK et al., 2011; KHADKA; HU, 2012; RACHMIEl et al., 2017; DE SOUSA; PAREDES et al., 2022; WOLFORD et al., 2015; VALERO et al., 2014). When compared to autogenous grafts, the individualized prosthesis reduces surgical time as it does not have a donor area. In addition, its rigid fixation system allows the mobility of the mandible in the immediate postoperative period, without the need to perform a maxillomandibular block, which offers risks of bronchoaspiration when there is nausea or vomiting in the immediate postoperative period, a routine fact in surgeries. of this nature. Titanium also offers the advantage of bone and tissue biocompatibility, being osseointegrated over the months, further increasing the stability of the treatment by returning function to the remaining bone. The dentures can be made with devices for fixing dental prostheses, allowing the return of masticatory function in a few weeks. Grafts, on the other hand, need to receive dental implants, which can be installed in the transported bone at the time of grafting, but require up to 6 months of time for osseointegration and subsequent installation of dental prostheses (RACHMIEl et al., 2017). In addition to time, some authors cite the failure of implants as one of the problems when using bone from the fibula or any very dense bone, since the installed pins need vascularization for osseointegration to occur, a characteristic of cancellous bones, such as the In the case of the iliac crest, however, it may not have other characteristics such as resistance to receive traction and torsion forces from the mandible.

On the other hand, the final cost of using titanium prostheses can make their wide use unfeasible, since, as it is a material that requires advanced technological means, it is considered extremely expensive. Even so, the length of stay and possible complications from other techniques must be taken into account when comparing the final costs for operators and managers.

CONCLUSION

Bone defects caused by large resections of the mandible represent a challenge for medical teams not only for facial aesthetics but also for the masticatory, phonetic and respiratory function of patients. Grafting methods using autogenous bone have been widely used for these purposes, with a high success rate, but with high morbidity for patients. With technological advances, the development of new techniques for facial skeleton reconstructions, allowed new treatment modalities through individualized materials, substantially reducing treatment morbidity and restoring function and aesthetics to mutilated patients.

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