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USE OF RH BMP-2 IN MAXILLARY SINUS FLOOR ELEVATION, CASE REPORT

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ABSTRACT

The rescue of ancestral knowledge on the use of medicinal plants, through local ethnobotanical studies, is emerging as an alternative in its rescue. The objectives of this study are: i) to identify the medicinal plant species that are part of the cultural heritage of some families; ii) to determine the uses and applications of medicinal species; iii) to propagate the species of greatest medicinal use and importance, to strengthen ancestral knowledge in the community. To this end, information was collected from 25 families in the area. For the ethnobotanical tables, part of the plant used, route of administration, preparation, categories of use, among others, were established. Twenty-two species of medicinal plants were identified, the most used plant organ is the leaf, the form of preparation is infusion (64%) and the most used route of administration is the beverage. Based on the use value indexes and the level of significant use TRAMIL, two plant species were identified. The species used in propagation were Ginger (*Zingiber officinale*); Escancel (*Aerva sanguinolenta L.*); Lemon verbena (*Cymbopogon citratus*); Aloe (*Aloe vera L.*).

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INTRODUCTION

The rehabilitation of jaws with dental implants is undoubtedly one of the adversities that dentistry faces with the use of several techniques that help in the search for increasingly predictable and safe results. The pneumatization of the maxillary sinuses and their increasing approximation with the bone crests, reducing the amount of alveolar bone, makes the possibilities for rehabilitation with implants even more difficult (Gowd *et al*., 2017). In this context, procedures for increasing bone volume with the elevation of the floor of the maxillary sinus and bone grafting from these areas using different types of materials have been studied for many years in order to find the most appropriate materials, or that better regenerative results can present (Song *et al*., 2020). For many years, autogenous bone grafts have been recommended as the first options, due to their osteogenic, osteoinductive and osteoconductive characteristics. However, the discomfort to the patient in performing these procedures and the amount of materials for bone substitutes with characteristics, sometimes osteoinductive, sometimes osteoconductive, makes a greater range of options available for bone grafts in maxillary sinuses. In addition to all the available materials, several authors are researching the filling of the maxillary sinus only with blood clot (Sakkas *et al*., 2017). In a practical way, maxillary rehabilitation with dental implants, when it requires an increase in bone volume, through bone grafts, will involve a 2-stage treatment, one for the performance of bone grafts and the other, after its healing, for the performance of dental implants (Mittal; JIndal; Garg, 2016). Some studies evaluate the regenerative properties of bone morphogenetic proteins, known as BMP's. BMP's are excellent inducers in bone formation, due to the presence of transforming growth factor - TGF-β. BMPs are multifunctional polypeptides that play an important role in a range of cellular functions and processes such as embryogenesis, cell growth and differentiation, and bone healing and fracture repair (Loozen *et al*., 2019). It was previously observed that the differentiation of pluripotent cells into osteoblasts is possible, opening the way for the study of substances with osteoinductive potential. This observation triggered a series of investigations with the aim of identifying, in demineralized bone, the possible substances responsible for the phenomenon (Wang; Yeung, 2017). Thus, a low molecular weight glycoprotein was identified, at the time already called bone morphogenetic polypeptide, which promoted ectopic bone formation. The next big breakthrough was the purification of three BMPs from bovine bone, which were later called BMP (May *et al*., 2019). Recombinant DNA technology was used to generate complementary DNA clones of human BMP molecules, which were inserted into mammalian and other animal cells for the production of human recombinant BMP, currently known as rh BMP. Since then, about 20 BMP's have been isolated and reported in the literature (Park *et al*., 2019). This paper aims to present a clinical case of bilateral maxillary sinus floor elevation using rh-BMP2 associated with xenogenous

biomaterial and fibrin-rich plasma, L-PRF, in order to prepare the maxilla for oral rehabilitation with dental implants.

CASE REPORT

The following case to be reported comes from a private clinic in the city of Jaraguá do Sul, Santa Catarina, with prior consent. The female patient, 58 years old, reporting good systemic health at anamnesis, non-smoker, sought dental care in order to install implants in her jaw. Her biggest complaint was suffering from the premature loss of teeth and feeling unmotivated with her self-esteem and with the use of dentures that no longer fixed. After clinical evaluations and complementary images (Figura 1A-B).

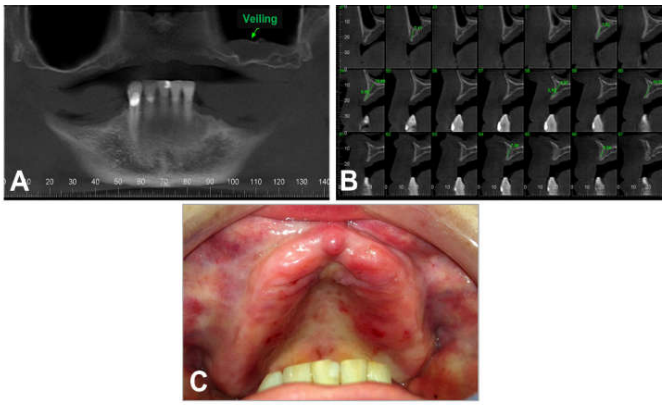

Figure 1. A - Overview of the tomography; B - Tomographic section, anterior region; C – Image of the palate and trauma caused by the complete denture

The tomographic image showed extensive pneumatization of the maxillary sinuses with anterior projection, minimum bone height between the ridge and floor of the maxillary sinus in the posterior regions of the maxillae. Clinically, his prosthesis showed marked wear and his alveolar mucosa with mild irritations, accentuated volume and tuberosities and anterior bone depression, suggesting Kelly syndrome (Figura 1C).

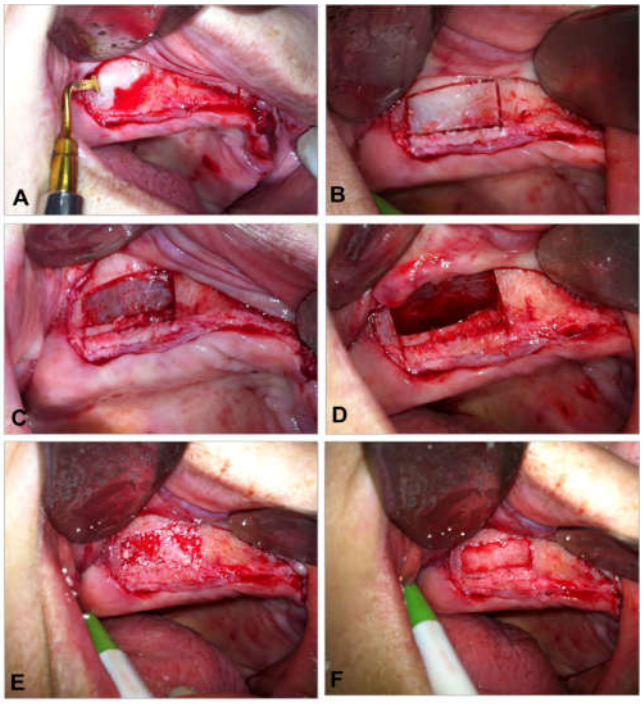

Figure 2. Surgical procedure. A - Osteotomy with piezosurgery; B - Cuts performed, delimiting the access area to the maxillary sinus; C - Vestibular wall of the maxillary sinus removed and sinus membrane exposed; D - Unglued and elevated sinus membrane, prepared for filling; E - Adapted graft; F - bone window repositioning

The planning for the patient's rehabilitation involved for the maxilla: Bone graft using the association of rh BMP-2 (INFUSE® Bone Graft) with Geistlich Bio-Oss® e Fibrin rich plasma, L-PRF, the healing period will be 6 to 8 months and after this period 6 implants will be installed which will have another 6 months of healing for making a fixed total denture over implants, during this period the patient will remain with a provisional total denture. In the mandibular arch, it was decided to extract the remaining teeth (43, 42, 42, 31, 32) and install 5 implants to create a protocol with immediate loading. The patient was previously medicated with antibiotics in a prophylactic dose (1 g), dexamethasone 4 gm and sodium dipyrone. Truncular and infiltrative anesthesia were performed using the anesthetic Mepiadre (DFL) Mepivacaine with 1:100,000 epinephrine. The supracrestal total flap incision and the appropriate displacement allowed access to the maxillary sinuses. The osteotomy for accessing the sinuses was performed with a piezoelectric motor, PiezoSurgery III from Mectron (figure 3). At this moment, the membranes of the sinuses are detached, elevating them, placing the space prepared to receive the bone graft. At this stage, blood collection from the patient was performed using a vacuteiner for processing in a centrifuge, in order to separate the fibrin-rich plasma, processing it to obtain the L-PRF. After collection, it is immediately centrifuged with a precise protocol, 12 minutes at 2,700 rpm, in a centrifuge indicated for L-PRF process.

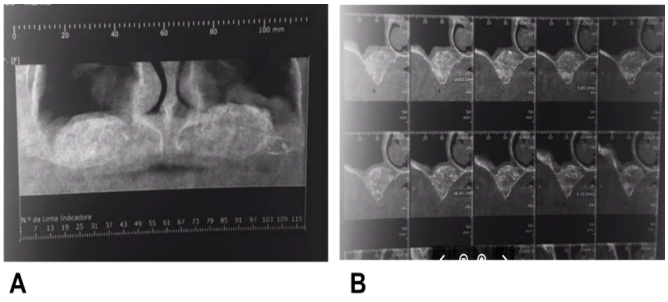

Figure 3. Tomography image. A - Panoramic image; B - Tomographic sections of the grafted areas and their mineralization after 6 months

In this process, there is less risk of contamination, with no pipetting, tube exchange and use of a Petri dish. Its centrifugation process is crucial to determine the three-dimensional organization of fibrin, as well as its resistance, containing practically the highest concentration of platelets in the tube and a large amount of leukocytes. The processed L-PRF membrane, chopped into small pieces, was associated with the grafting biomaterial Geistlich Bio-Oss®. Associated with these materials, rh BMP-2 (Infuse Bone Graft – Medtronic) was added. Handled following the manufacturer's instructions, it was soaked in its stabilizer (collagen sponge) and added to the Bio-Oss® bone already prepared with L-PRF. Forming a set between the three biomaterials now ready and prepared to be implanted in the patient's maxillary sinuses. The bone graft must be prepared at the time of surgery. The preparation must always be started 3 minutes before the application of the material to the patient, outside the sterile field. At the time of surgery, the original device packaging must be opened and the absorbable sponge placed in a sterile field. Then, the other syringe provided with the system must be opened and placed within the same sterile field. With the syringe, 2.8 ml must be removed in a sterile field from the ampoule with the reconstituted bone graft. Bone graft in the amount of 1.4 ml must be distributed evenly in each of the sponges. The damp sponges should rest for 15 minutes and be used within two hours. The material is taken with care to the maxillary sinus and is gradually compacted in the spaces of the maxillary sinus floor until its filling is adequate for the needs of the implants that will be installed in the future. Soon after its complete adaptation, the vestibular window of the maxillary sinus wall is repositioned and a collagen membrane is installed over it to protect this grafted region (figura 3). The flap was then repositioned and sutured with mononylon thread (Ethicon®, São Paulo, Brazil) and the patient was released, with postoperative guidelines and properly prescribed medications. Immediately after the surgery, the patient can adapt her prosthesis to use it as a temporary one, until a new one is subsequently made. The waiting period was 6 months to perform a new tomographic exam using a Cone Bean

tomograph, so that the result could be evaluated. In the tomography images, it is possible to observe the great expansion of the maxillary sinus and the almost non-existent quantity of alveolar processes of the maxilla (Figure 4).

DISCUSSION

The treatment of implants in the posterior region of the maxilla is still a great challenge for professionals. This is because the placement of an implant in this area can be limited by the anatomical conditions of the maxillary sinus, due to the small amount of alveolar ridge in height. Therefore, grafting procedures become necessary to correct this deficiency (An *et al*., 2017). Currently, there are several materials used as bone substitutes for the treatment of the maxillary sinus. As an alternative to autogenous grafting, due to numerous disadvantages and several options, recombinant human bone morphogenetic proteins, more specifically type 2 (rhBMP-2) have the property of inducing bone neoformation (Luiz; Padovan; Claudino, 2014). Nevins *et al*. (1996) studied the efficacy, safety and feasibility, in an animal model, of rhBMP-2 in a resorbable collagen sponge for grafting in the maxillary sinus lift. The results over 4, 8 and 12 weeks revealed an advanced remodeling process compared to the control group, suggesting that placement of rhBMP-2 successfully induced bone neoformation in the floor of the maxillary sinus. The use of rhBMP-2 is directly related to the amount, concentration and type of carrier, or also known as scaffold. However, in the literature, clinical reports are still not clear about the best concentration of rhBMP-2 to be used for bone augmentation (El Bialy; Jiskoot; Reza Nejadnik, 2017). The clinical case reported in this study starts from the patient's complaint about the early loss of teeth, low self-esteem due to the use of dentures that no longer fixed, and in addition to the unfavorable clinical situation for the installation of osseointegrated implants. Thus, even with little post-surgical time, it is possible to suggest a gradual restoration of bone architecture through the use of this complex of grafting material, rhBMP-2 + Bio-Oss® + L-PRF, in a sufficient way for the installation of implants, with CT scans of the quality of the newly formed bone.

Considering the patient's postoperative period, side effects were reported within the normal range described in the literature, such as little discomfort and facial edema (Boyne *et al*., 2005; Fiorellini *et al*., 2005; Herford, Boyne, 2008). With the intraoral use of rhBMP-2, no systemic adverse reactions have been observed or reported so far in the literature. Another point to be considered is the need to use a space maintainer due to the unfavorable mechanical characteristics of rhBMP-2. Thus, in this study, the space maintainer used was the association of particulate biomaterial of xenogeneic origin and L-PRF. These are materials that have little systemic interaction, enhancing the protein's mechanism of action and increasing the half-life of the material (Hwang *et al*., 2009). In recent years, rhBMP-2 has been widely analyzed with other materials for bone grafting and concomitantly used in clinical conditions by several professionals in the medical and dental fields. However, the amount, concentration, scaffold of this protein, clinical use and possible complications are also debatable factors in the literature and objects of scientific investigation (Li *et al*., 2019). Thus, the equipment, techniques and advanced materials available to dentistry provide extraordinary gains in regenerative quality. The use of rhBMP-2 is a clinically and scientifically proven, viable alternative for bone augmentation for maxillary sinus floor elevation and other uses in dentistry. However, the use of rhBMP-2 requires caution and clinical and scientific knowledge on the part of the surgeon, since it is a material whose scientific proof for other types of bone defects in the craniofacial region is still in an evolving state.

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