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Oral prosthetic-surgical rehabilitation using guided surgery in the posterior region of the mandible with bone atresia

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***Keywords*— Computer guided, Inferior alveolar nerve, Lateralization.**

***Abstract*— The placement of dental implants in the posterior mandibular alveolar ridges can become a challenging procedure in case of severe bone atresia, where the bone height is limited between the crest and the lower alveolar canal. The aim of this case study was to introduce an innovative, less invasive, highly accurate and easy surgical technique for lateralization of the lower alveolar nerve in the mandible using a special printed three-dimensional surgical guide for the placement of the implant. This report is about a patient with edentulous mandibular alveolar crests in elements 36 and 37. Customized surgical guides were manufactured using modeling technology to precisely position a rectangular window, discover the canal and subsequently place dental implants. It was concluded that it was possible to perform procedures in regions with a restricted amount of bone and important anatomical accidents, achieving a satisfactory degree of predictability, and success in treatment, in addition to allowing minimally invasive surgical access and with significantly safer and more comfortable postoperative access for the patient.*

I. INTRODUCTION

The purpose of restorative treatment, using Osseo integrated implants, is to preserve the integrity of noble intraoral structures in addition to restoring the aesthetics and functionality of the stomatognathic system according to the objective and subjective satisfaction of the treated patient (WARRETH et al., 2017).

Some clinical conditions such as the location of the lower alveolar nerve, the pneumatization of the maxillary sinus, and the limitation of bone heights, such as severe mandibular atresia, directly interfere with bone availability, generating limits on the correct positioning of the implants by anatomical interference of the vascular bundle -nervous (HERNÁNDEZ-SUAREZ et al., 2020).

Several strategies have been developed, aiming to overcome these conditions, such as bone grafting, guided bone regeneration, osteogenic distraction, maxillary sinus lifting, mandibular nerve transposition, for the safe use of implants (SOTTO-MAIOR et al., 2014). Thus, the success of therapy with dental implants is attributed to the achievement of osseointegration, maintenance of the bone level around the crest of the implant, and high percentages of survival of the implants (KOSZUTA et al., 2015).

Thus, it is worth mentioning that these oral rehabilitations on Osseo integrated implants face increasing prosthetic and aesthetic demands, requiring precise prosthetic-surgical planning (LANCIONE et al., 2021).

One of the challenges faced in implantology is the three-dimensional positioning of the implant, which is a major factor in obtaining adequate functionality (OTTONI; GABRIELLA, 2011). It should be noted that the free hand transfer of the planned position to the surgical field is conditioned to the operator's skill, to his emotional conditions at the time of surgery and, above all, to the making of important decisions regarding the approach point, platform depth and inclination. of the implant (D'HAESE et al., 2012).

In this sense, static guided surgery is based on the use of a rigid surgical guide that reproduces the virtual position of the implant, not allowing intraoperative modification of its position. In view of this, it is possible to assist in the installation and location of osseointegrated implants during the surgical phase, and it is possible to obtain the appropriate angulation and inclination of the implants (COLOMBO et al., 2017).

It is in this context that the present study describes the planning and treatment of an oral rehabilitation on implants using guided surgery in the posterior region of the mandible with bone atresia, in order to optimize prosthetic success.

II. CASE REPORT

A 40-year-old female patient attended the Advanced Dentistry Center, COA Ilhéus, Brazil, reporting the need for rehabilitation of the posterior mandible by installing implants. On clinical examination, it was possible to observe that the patient had atresia of the posterior mandibles in the region of teeth 36 and 37.

Thus, computed tomography radiography (3D Accuitomo 170, Morita) was requested, in which it was found between the alveolar canal of the mandible to the upper bony edge of the mandible with a 7 mm measurement (Fig. 1). The patient was scanned using a Scanner Omica 2.0 Cerec Dentisply Sirona software version 5.1.3.

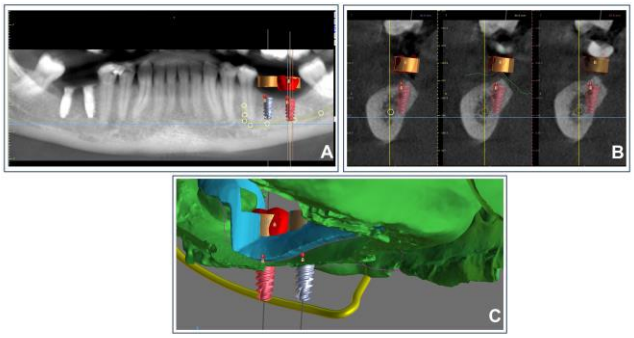

Fig. 1: A) Digital planning. Marked inferior alveolar nerve. B) Outline of the planned implant on the cross section. C) Guide for the virtual bone regeneration procedure.

Considering the severe atresia of the posterior region of the mandible, the direct installation of implants was not possible. The planning was carried out using the files STL, STereoLithography, and DICON, Digital Imaging and Communications in Medicine, where virtually the ideal positioning of the missing teeth crowns was planned. With reference to the virtual planning of the crowns, it was also possible to plan the positions of the implants virtually, seeking a positioning laterally to the alveolar canal in search of the preservation of the noble structures, and consequently avoiding the lesion of the neuro-vascular bundle in this region. Thus, the implants were compensated 1.5 mm lingually to this structure.

Through this planning, the surgical guide was made, printed on resin using the Anycubic Photon S digital printer, with reference to bone milling during surgery.

The patient initially administered 500 mg of amoxicillin 8/8h, one day before the procedure, persisting for another 6 days, 4 mg of dexamethasone 12/12h, for two days, starting on the day of the procedure and 500 mg of 8/8h dipyrone, if pain, orally. Thus, the surgical procedure was continued, with asepsis and antisepsis performed with 10% polyvinylpyrrolidone-iodine (PVPI) in front of and sterile fields affixed. Anesthetic blockade of the left lower alveolar nerve was performed, as well as anesthesia of the lingual, buccal and mental nerve, with the solution of articaine hydrochloride 4% with epinephrine 1:100.000, so that 1 tube was made in the lower alveolar, 1/3 tube in the lingual, 2/3 tube in the buccal and 1 tube in the mental.

After adequate anesthesia, the surgery was performed with the Speed Guide implant connection system guide (Connection, Prosthesis System São Paulo, Brazil). Implants were installed without opening a flap in the surgical field. In the region of tooth 36, the Torq® Morse Cone Implant (Connection, Prosthesis System São Paulo, Brazil) of dimensions 3.75 x 8.5 mm was obtained, obtaining primary stability with a load of 30 N. In the 37 regions, the Morse Cone Flash implant (Connection, Prosthesis System São Paulo, Brazil) of dimensions 3.5 x 8.5 mm was used, obtaining primary stability with a load of 30 N (Fig. 2).

The patient was followed up in the postoperative period 7, 15, 30, 60 and 90 days, with good healing, implant stability, absence of signs of infection and with paresthesia with signs of remission.

The prosthetic phase was performed 3 months after the surgery, through scanning, CAD-CAM system, CEREC for anatomical and functional planning of teeth 36 and 37. The crowns were milled 2 hours before installation in Ivolar Vivadent E-max porcelain in color A2. The crowns were milled using Dentisply Sirona's MCXL milling machine (Fig.3).

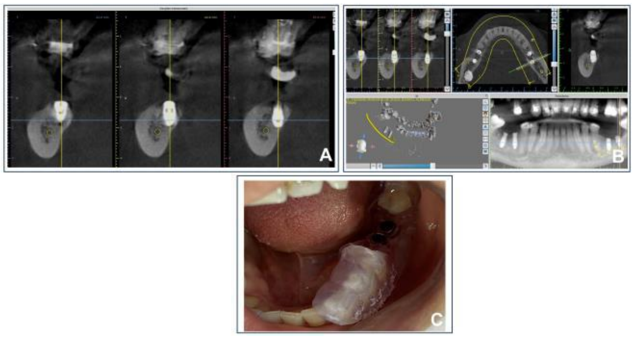

Fig. 2: A-B) 3D planning of a free-end situation. Implants inserted approx 2 mm supracrestally. C) Broken guide plate during the surgical procedure.

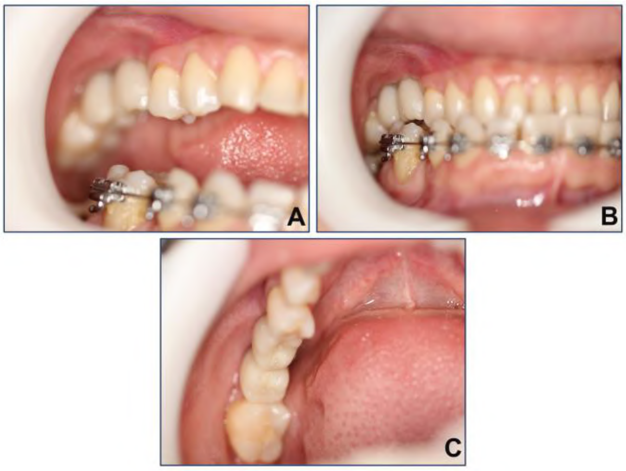

Fig. 3: A-C) Three-month postoperative images showing normal appearance of the operated regions.

After this period, it was possible to observe that the digital planning of the prosthesis associated with the surgical planning increased the predictability of the result, since the surgical guide indicated the best place for implant placement, without affecting the alveolar nerve, thus reducing the number of complications, as well as the CAD/CAM system provided greater precision in the adaptation of the final restorations, according to the previous planned procedure.

III. DISCUSSION AND FINAL CONSIDERATIONS

Dentistry, on a global scale, has shown evident technological advances, especially in implantology, with the digitization of the manufacturing process of prototyping biomodels, which offers patients a more comfortable, safe and fast service, enabling the execution of great short-term rehabilitation (MÜHLEMANN et al., 2018). Since, previously, only the direct printing technique provided patient models, with the implant placement not very aesthetically favorable (YOU et al., 2019).

With the evolution of digital dentistry, new resources have been used in order to plan, install and rehabilitate patients, boosting implant dentistry and the advent of aesthetic materials for rehabilitation on implants. This is because it allows the virtual molding of an element, scanning of dental preparation, and the production of a prosthesis by the CAD / CAM system, Computer Aided Design & Computer Aided Manufacturing, that is, digital production of the prosthesis on the scanning tooth and the production of the part by a milling machine (CERVINO et al., 2019).

In view of this, the information acquired in three-dimensional reconstructions allows determining the quantity and quality of the available bone and also the simulation of the implant installation in a virtual environment. This provides the predictability of techniques and difficulties that can be encountered during the surgical intervention, reducing the time, the possibility of errors, and the costs of oral rehabilitation (JACOBS et al., 2018).

In this context, since 2016, the sale of intraoral scanners has been growing, especially in radiology laboratories, allowing the professional to take the patient to radiology to obtain a virtual model of the arch, which will be used in an integrated way with tomography, for the production of surgical guides, also integrating all the treatment within a concept of totally digital reverse planning, which allows its continuity in the prosthetic development in a CAD / CAM system, which can be performed in the prosthesis laboratory (FAVERO et al., 2019; MORRIS et al., 2019).

Thus, in this case report, the patient's oral rehabilitation was performed by installing two implants in the posterior atrophic area of the mandible and the respective porcelain crowns, making it possible to achieve the aesthetics and functionality of these elements in harmony with the entire stomatognathic system of the patient.

Such result can be attributed to the digital planning that allowed the placement of implants in the program, as well as the preparation of a high precision surgical guide, leading to the possibility of performing surgeries without flaps, for the placement of implants and prostheses with a satisfactory success rate. (D'HAESE et al., 2017).

In addition, this study evaluated the effects of guided preoperative planning and oral rehabilitation applied by the technique of lateralization of the lower alveolar nerve, due to vertical bone atrophy, which promoted functional restoration, allowing the placement of implants. The virtual design was created according to the preoperative computed tomography and the placement of the prosthesis was performed 3 months after surgery.

It is inevitable to recognize that digital implantology is the sum of several digital methods and techniques that integrate digital planning and development. In this context, the implantodontist who adopts this new methodology will have a broader view of the treatment and, with the collaboration of the planning center, being able to develop digital workflows integrated with several areas of dentistry (BARONE et al., 2016).

It can be argued that dental implants smaller than 10 mm can be used in posterior mandibles with predictable results. In fact, short dental implants are a valid option for restoring the posterior mandibular regions, as well as vertical bone augmentation combined with standard length implants (ALTAIB et al., 2019).

However, as the objective of the present study was prosthetic-surgical oral rehabilitation using guided surgery in the posterior region of the mandible with bone atresia, the technique of lateralization of the lower alveolar nerve associated with virtual implants of standard length, 8.5 mm was adopted. guide the surgical procedure (LOPS et al., 2012; TANG et al., 2020).

Narrow implants, 3.5 mm, were used, as their successful application to the posterior mandible was previously reported in the scientific literature as an alternative to rehabilitation of the patient in a quick, predictable, and minimally invasive manner (KLEIN; SCHIEGNITZ; AL-NAWAS, 2014).

IV. CONCLUSION

It was concluded that it was possible to perform procedures in a region with a restricted amount of bone and important anatomical accidents, achieving a satisfactory degree of predictability, and success in treatment, in addition to allowing minimally invasive surgical access and with significantly safer and more comfortable postoperative access for the patient. patient.

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