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Case-report

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The use of the Transnasal implant associated with the zygomatic implants in the treatment of atrophic maxilla: A Case Report

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Abstract

Introduction: Rehabilitation of atrophic maxillae can be a real challenge, even for experienced surgeons. The search for faster and less morbid treatments, with the possibility of immediate loading, has led surgeons to apply bone anchoring techniques, with longer implants, anchored in areas further away from the alveolar ridge. **Objective:** The objective of this article is to describe a case report of rehabilitation of atrophic maxilla with Transnasal and Zygomatic implants. **Case report:** Female patient, 70 years old, with a 30-year history of total maxillary edentulism, with severe bone resorption that made rehabilitation with conventional dental implants impracticable. Through virtual planning, adequate conditions were found for the placement of zygomatic implants on the left side, but the right side had insufficient bone availability. Bone availability was observed in the region of the right inferior turbinate and frontal process of the maxilla, for the placement of a Transnasal implant. The rehabilitation was performed with 3 zygomatic implants and 1 transnasal implant, with composite torque of the implants, greater than 230Ncm, allowing immediate installation of the abutments. A definitive acrylic prosthesis was installed 5 days after surgery, with local edema already controlled, facilitating installation. The patient has 13 months of follow-up without peri-implant alterations, with the implants osseointegrated and her dental occlusion reestablished. **Conclusion:** The Transnasal Implant may be an auxiliary option for the total rehabilitation of the atrophic maxilla. Virtual planning with computed tomography to analyze local anatomical conditions, such as adequate bone availability, are essential to guarantee the success of the technique and reduce the chances of problems related to the installation of transnasal implants.

Highlights

1- The Transnasal Implant can be an option in the rehabilitation of the atrophic maxilla. 2- Bone grafts can considerably increase the morbidity and cost associated with the rehabilitation of the atrophic maxilla. 3- The use of bone anchorage techniques such as zygomatic, transnasal, palatal approach and pterygoid implants reduces rehabilitation time, procedure costs, increases the chances of immediate loading and has high success rates.

1. Introduction

The rehabilitation of atrophic maxillae with dental implants is a complex procedure that involves several variables such as: Possibility of immediate loading, degree of bone resorption lack of bone volume, low bone density, pneumatization of the maxillary sinus, need for bone reconstruction, among others, making the procedure a real challenge for surgeons[1][2].

Cawood and Howell 1988[3], defined the concepts for the classification of edentulous jaws, and how bone resorption occurs over time. The maxilla can be considered atrophic, in class IV, V and VI cases, where there is significant bone loss in thickness, and or thickness and height, generally requiring bone reconstruction through bone grafts, or the use of more advanced techniques such as zygomatic, Trans-sinusal or pterygoid implants[3][4].

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Maxillary reconstruction with bone grafts is an option for rehabilitation with dental implants. This reconstruction can be performed using intra or extra oral autogenous bone grafts, or biomaterials, however, depending on the technique, it can involve greater morbidity, unpredictable bone resorption, increase treatment costs, and a long rehabilitation time with several surgical steps, since in general, it is not possible to carry out immediate loading[2][5].

Immediate loading is a desirable situation when rehabilitating atrophic jaws, especially because it significantly reduces total treatment time and costs. However, performing immediate loading on a grafted maxilla is quite complex since the newly inserted or even reconstructed bone does not present adequate density for the immediate function of the implants[5]. In contrast to bone grafting, Maló et al 2005[6] published a retrospective study with a 1-year follow-up in which they described the All-on-4 technique. This technique, in short, consists of installing conventional implants in the maxilla, with the two anterior axial implants, and the two posterior titled implants, bordering the maxillary sinus, with success rates exceeding 98 percent [6][7]. Later variations of the technique emerged to solve other clinical situations, such as the All-on-4 Hybrid, where the posterior implants are zygomatic, and the All-on-4 zygoma (Quad Zygoma), where 4 zygomatic implants are installed to perform the rehabilitation, demonstrating success rates similar to those of traditional All-on-4[8].

Although the Zygomatic implants are an excellent option for cases of severe bone resorption, with low morbidity and low complication rates, however, they may present some important limitations for their execution, especially in the Quad Zygoma technique, such as: Small zygoma, implant path close to the infra-orbital foramen, orbital cavity with large volume, a large part of the implant passes internally to the maxillary sinus and concavity in the anterior region of the maxilla, making positioning of the anterior implant difficult[4].

Another option to rehabilitate the atrophic maxilla is the use of Extra-Long dental implants. Maló et al 2013[9] classified extra-long implants with lengths between 20-25mm, used especially to guarantee immediate loading, when the zygomatic implant is contraindicated or simply not an option for the professional either reduce it as much as possible or avoid cantilevers in dental prostheses[9]. Extra-long implants showed a high success rate, proving to be a viable option for this type of rehabilitation[9]. Pterygoid and trans-sinusal implants are examples of techniques where extra-long implants can be used, seeking areas of bone anchorage distant from the base of the maxillary bone, generally with bone of greater density and allowing immediate loading[10][11].

Thinking about alternatives to rehabilitate the atrophic maxillae, the Transnasal implant technique could be another option, and unlike pterygoid or trans-sinus implants, transnasal implants are placed in the anterior region of the maxilla[12][13]. In this technique, the implants are placed with their path through the lateral wall of the piriform process and having their apical anchorage in the frontal process of the maxilla or at the level of the inferior turbinate, in a dense bone and with a great possibility of immediate loading[12][14].

Camargo et al 2019[12], determined that for the installation of the Transnasal implant it is necessary to have at least 4mm of height between the ridge crest and the floor of the nasal cavity and at least 3mm of apical bone in the frontal process of the maxilla or in the inferior turbinate so that there would be adequate stability of the implant and immediate loading was carried out. It is important to note that many patients have a good amount of bone in the region of the inferior turbinate, which can allow good bone anchorage, however there is no standard for this thickness. The choice of technique must always be made through virtual planning with computed tomography, which can accurately determine the precision of implant installation in this region. Preoperative visualization in biomodels is also recommended[12][14].

The aim of this article is to report a case of rehabilitation of an extremely atrophic maxilla with extra-long Transnasal implants and zygomatic implants.

2. Case Report

Patient female, 70 years old, non-smoker with no systemic diseases with complete upper edentulism and had been using a removable total prosthesis for around 30 years. Clinical and tomography examination, showed extreme maxillary bone atrophy, with absence of alveolar bone in zones 1 (anterior maxilla), 2 (premolars) and 3 (molars) of the maxilla[15] for rehabilitation with conventional implants. Digital planning was then carried out (ImplantViewer®, Brazil) with the possibility of installing Zygomatic or Transnasal as an option for oral rehabilitation, however, the region of the frontal process of the maxilla, and inferior turbinate on the right side presents good bone availability ((Figure 1 A), the region of the frontal process of the left maxilla did not have good bone availability, because there was pneumatization of the left maxillary sinus in the area, limiting the installation of the transnasal implant in the left size (Figure 1 B).

In the tomographic examination, it was possible to observe the appropriate conditions for the installation of the right transnasal implant, as well as a safe distance (>5mm) from the anterior wall of the frontal process of the maxilla to the nasolacrimal duct, avoiding injuries

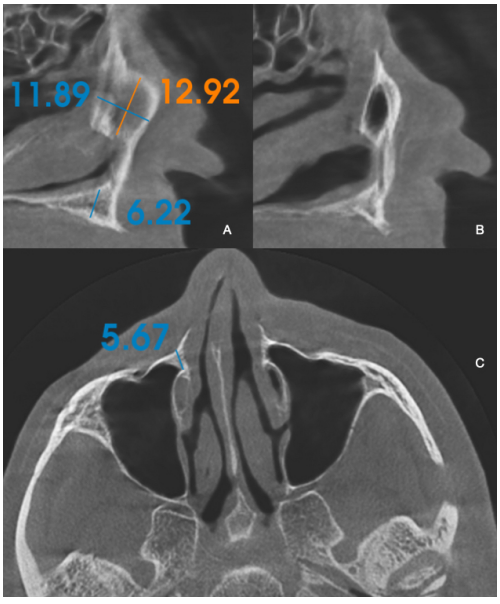

Figure 1. In A: Sagittal image of the computed tomography of the region for installation of the right Transnasal implant, showing adequate bone dimensions; In B: Sagittal image of the computed tomography of the region for the installation of the left Transnasal implant, showing the pneumatization of the maxillary sinus, making the installation of the implant unfeasible; In C: Axial section with the distance between the anterior wall of the frontal process of the right maxilla and the nasolacrimal duct.

to this anatomical structure in the transoperative period, which are the main contraindications of the technique (Figure 1 A and C). The right zygomatic bone was small, making it difficult to install the second zygomatic implant and consequently the Quad Zygoma technique, furthermore, there was a concavity in the maxilla in that region that made it difficult to correctly position the zygomatic implant. (Figure 2A). It was decided together with the patient to place one Transnasal implant (right side) and three zygomatic implants for rehabilitation with implant-supported prosthesis (Figure 2B), in a hospital environment under general anesthesia.

2.0.1. Surgical technique (Transnasal Technique)

Nasotrancheal intubation was performed to use a surgical guide during surgery. The surgical guide used was created by duplicating the upper removable total prosthesis used by the patient, with the aim of verifying the anteroposterior position of implant placement. A full-thickness mucoperiosteal incision was made on the maxillary ridge with a palatinized incision, and relaxing incisions were made in the region of the zygomatic buttress bilaterally and in the midline. For the installation of Transnasal dental implant, the floor of the nasal cavity and the side wall of the pyriform process were gently

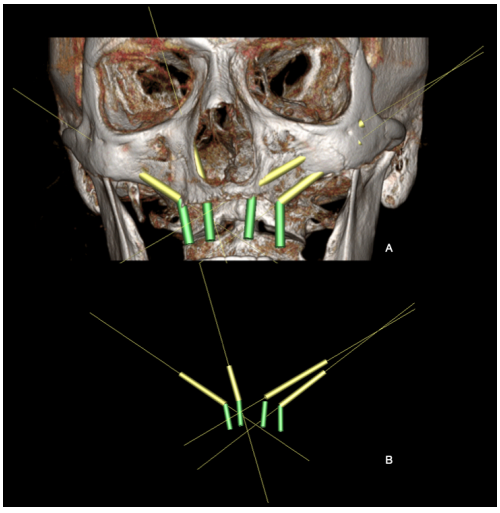

Figure 2. In A: Three-dimensional reconstruction of the tomography with planning for implant installation; In B: Distribution of Implants.

detached so as not to lacerate the membrane. Instrumentation was performed through the residual alveolar ridge, with a slightly palatinized approach, with 800 RPM, towards the frontal process of the maxilla (Figure 3A). The visualization of the entry point of the inferior turbinate is crucial for instrumentation and subsequent implant placement (Figure 3B).

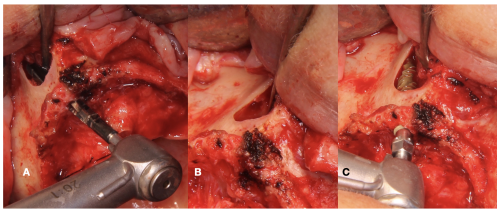

Figure 3. In A: Positioning of the initial drill for the preparation of the surgical socket.; In B: Bone drilling towards the frontal process of the maxilla; In C: Transnasal implant installation and final positioning.

A Transnasal implant, (Epikut Long Plus® SIN Implant System®, Brazil), 3.8mmx 24mm was placed with torque greater than 45Ncm (Figure 3C). The zygomatic implants (Helix GM® Zygoma Neodent®, Brazil) were placed, with torques greater than 60Ncm. (Figure 4A). 45 degrees prosthetic abutments were installed, and a small amount of particulate bovine bone graft (Cerabone® Botiss®) is placed between the implant and the membrane of the detached nasal cavity, avoiding contact between the membrane and the implant, and possible fenestration of the implant in the nasal cavity later (Figure 4B). The prosthesis was installed five days after surgery.

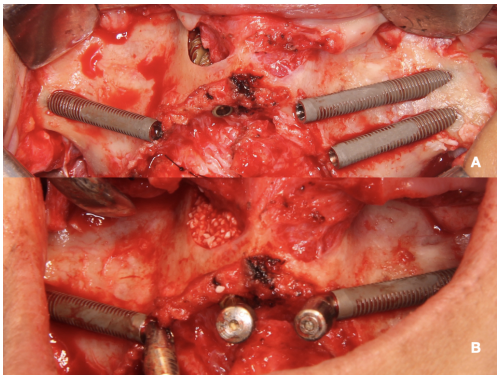

Figure 4. In A: Intraoperative image after installation of the zygomatic implants and transnasal implant; In B: Biomaterial placed in the nasal cavity to prevent the implant from contacting the nasal membrane.

In the postoperative panoramic radiography, the excellent distribution of the implants was observed, with ideal conditions for rehabilitation with implant-supported prosthesis (Figure 5). the patient is in the 13th month postoperatively, and follow-up shows adequate peri-implant health, with lack of mobility of the implants, and reestablished dental occlusion and facial aesthetics.

3. Discussion

Total edentulism in the maxilla evolves with bone resorption and pneumatization of the maxillary sinus, which in severe cases may make it impossible to install dental implants, and anchorage techniques with Zygomatic, Transnasal or Pterygoid Implants are a highly predictable option, with high success rates and few associated complications[10][14][16].
Bone reconstruction of the atrophic maxilla is a therapeutic rehabilitation option. However, the use of bone grafts presents some disadvantages in relation to anchorage techniques, with emphasis on the significant increase in treatment time, the need for several surgical steps until the installation of the prosthesis, and the impossibility in most cases of carrying out immediate loading[17]. Thinking about immediate loading, this is a very important factor that we take into consideration when recommending bone anchorage techniques, since with immediate loading it is possible to install the prosthesis in up to 7 days fixed to the implants, increasing patient satisfaction in relation to the treatment and increasing their quality of life[17].

Although zygomatic implants represent an excellent option in the rehabilitation of the edentulous maxilla, in cases of severe atrophy it is necessary to implement the Quad Zygoma technique, which can be complex to be performed in cases of narrow zygomas, infra-orbital nerve in the path of the implant and large maxillary concavity making it difficult to seat the implant in the bone and increasing the chances of gingival recession in this area, as the implant tends to be at the level of the alveolar crest, without bone insertion[4][18].

Transnasal implants can be an option to avoid Quad Zygoma, in the cases mentioned above, or even as an option by the surgeon just to rehabilitate atrophic maxillae. Camargo et al 2021[14], published a study where 12 patients were rehabilitated with transnasal implants with a 26-month follow-up, with a 100 percent success rate and immediate loading, showing that the technique is safe and clinically feasible[14]. Other studies prove the effectiveness of the therapy with high success rates and no reported complications[13][18][19].

A very important point in the Transnasal implant technique is digital planning using tomography using specific softwares. This step is essential because many patients do not have sufficient bone availability in the region to properly install the implant as indicated[12][14]. Oh et al 2023[19], call "Z-Point", the area between the nasal side and the lateral wall of the maxillary sinus at the level of the inferior turbinate. The authors state that this point is crucial for the installation of the Transnasal implant, with many patients having sufficient thickness and density for the installation of the implant. However, they state that only with tomography is it possible to accurately visualize this anatomical condition[19].

Although current studies have not reported complications, it is important to remember that this is a sensitive and accurate technique that must be performed by experienced professionals. Furthermore, it is observed in the literature that the technique is recent, and with scientific evidence limited to a few case reports and retrospective studies, with short follow-up[13][14][18][19]. For this reason, the results presented in this article and in current literature should be viewed with caution.

Although published studies on transnasal implants did not report complications or even loss of implants, the complex anatomy of the region where the implant is installed must be taken into consideration. Without a doubt, the main anatomical structure to be observed when planning and executing the technique is the nasolacrimal duct. Injuries to this structure can lead to epiphora and require complex surgical treatment[18][19]. To minimize the chances of injury to the nasolacrimal duct, digital tomographic planning is essential. Simmen et al 2017[20], carried out a tomographic study with 100 patients, evaluating the distance between the anterior wall of the maxilla at the level of the frontal process of the maxilla and the nasolacrimal duct. The authors concluded that 56.5 percent of patients have this distance between 7 and 3 mm, 12.5 percent have a distance greater than 7 mm and 31.5 percent of patients have a distance of less than 3 mm[19]. It is important to highlight that

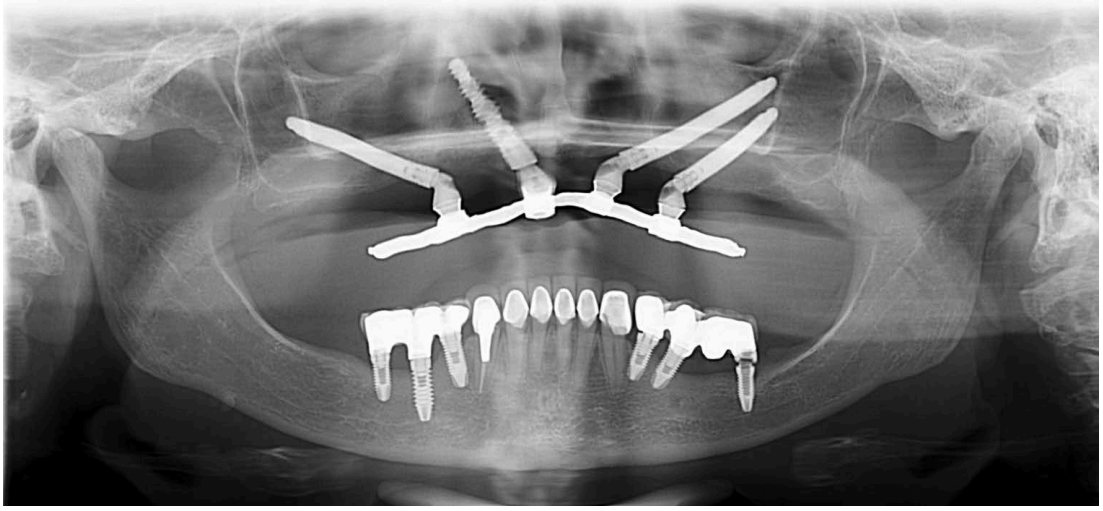

Figure 5. Postoperative panoramic radiography, showing the final result of the rehabilitation.

Camargo et al 2019[12] defined a safe parameter of at least 5mm distance, with the aim of avoiding injuries to the nasolacrimal duct, therefore prior planning and measurement of this distance are essential to prevent complications, as carried out in the present clinical case.

Thinking specifically about the future of the technique and minimizing possible complications, some authors have been working with the piezoelectric system[21]. The advantages are interesting, as piezo wears only the bone tissue, preserving adjacent structures such as the nasolacrimal duct and the membrane of the nasal cavity. The bone preparation for implant is carried out using specific tips, providing greater safety to the surgeon[21]. This technology should certainly be applied with more emphasis in the coming years, minimizing the chances of complications inherent to the surgical technique.

As previously mentioned, prior tomographic evaluation is essential for the installation of transnasal implants, however, a prior evaluation of the nasal cavity must also be carried out. The technique should be avoided in patients with a very wide nasal cavity, in which there is no contact between the implant and the lateral wall of the nasal cavity[18]. Sahin et al 2023[18] claims that this may affect nasal function in some way, however, no changes in nasal function related to transnasal implants have been found in the available literature.

As reported, the Transnasal implant can be an important option to help in the rehabilitation of the atrophic maxilla, especially in cases where it is not possible or desirable to install a conventional or zygomatic implant in the anterior region of the maxilla, however scientific evidence at the moment still presents limitations, and it is necessary prospective controlled studies, with a greater number of cases and longer follow-up time are necessary to determine the safety and efficacy of the technique in the long term.

4. Conclusion

Transnasal implants are viable options for the rehabilitation of the atrophic maxilla. Virtual planning, detailed tomographic analysis, surgical expertise and adequate prosthetic management are essential to guarantee the success of the technique and avoid intra- and postoperative complications.

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Consent For Publication The patient consented to the exposure of his images in this article, through an informed consent form.

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