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PRACTICAL EXPERIENCE WITH THE APPLICATION OF THE FACCO AND PILAR Z TECHNIQUE IN ZYGOMATIC IMPLANT SURGERY: A CASE REPORT

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ABSTRACT
This case report discusses the oral rehabilitation of a patient with severe maxillary atrophy and hereditary hemorrhagic telangiectasia (HHT), conditions that limit the use of conventional implants. The Facco technique was adopted, utilizing cone-morse implants in the zygomatic bone combined with the Z Abutment and anterior implants. The objective was to assess the accuracy of this technique and the importance of prototyping and guided surgery in surgical planning. A 59-year-old female patient with HHT and maxillary atrophy underwent the procedure, which incorporated dual surgical guides and digital technologies. Improvements were observed in masticatory function and facial aesthetics, with stable zygomatic anchorage and fewer complications. The Facco technique proved to be an effective and precise alternative, contributing to advances in dental implant surgery.

Keywords: Edentulous arch. Zygoma. Dental implants.

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Revista ARACÊ
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INTRODUCTION

Despite evidence supporting high success rates, ranging from 84% to 92%, in implant- supported rehabilitations in maxillary regions with adequate bone availability, atrophy in this area is a common occurrence, rendering conventional implant placement a challenging technique (Solà Pérez et al., 2022). This complexity arises from the centripetal resorption pattern of the alveolar process, maxillary sinus pneumatization, proximity to the nasal cavity and nasopalatine canal, as well as substantial bone volume loss, all of which contribute to the inherent difficulty of implant insertion in this clinical context (Borgonovo et al., 2021).

In situations where patients present with severe atrophy of the maxillary arch, isolated bone grafting procedures may be insufficient to adequately augment potential receptor sites for physiological integration of conventional implants. These procedures can necessitate multiple sequential surgical interventions over many months or years, without guaranteed successful outcomes (Gurjar, 2021).

Consequently, innovative approaches for the rehabilitation of severely atrophic maxillae have been investigated to overcome anatomical limitations and provide predictable and satisfactory outcomes for patients. In this context, an emerging alternative for the treatment of the atrophic maxilla has been the placement of zygomatic implants (Nave; Queralt, 2020)

The initial concept involved the placement of zygomatic implants, with distinct characteristics, typically inserted through the maxillary sinus (intra-sinusally) and apically stabilized in the zygomatic bone notch. However, the implementation of this classic protocol requires a comprehensive understanding of vital local anatomical structures, including the infraorbital foramen and nerve, the medial portion of the zygomatic body, and the zygomatic arch, which imposes limitations and reduces its applicability (Brånemark et al., 2004).

In this surgical approach for zygomatic implants, a direct access to the zygomatic bone is sought through lateral fenestration of the sinus wall, aiming to protect the sinus membrane from direct damage caused by drills and preserve anatomical structures of the region.

When considering intra-sinus zygomatic implant placement, it is crucial to highlight the potential increase in the probability of paranasal sinus complications, including sinusitis, infections, paresthesia, orbital perforation, and oroantral fistulas (OAFs).

Furthermore, the presence of a bulky prosthesis resulting from its palatal emergence is observed. The frequent intraoral position of the implant, inclined towards the palate, can result in discomfort, difficulty in hygiene maintenance, and phonation issues (Brackmann et al., 2017).

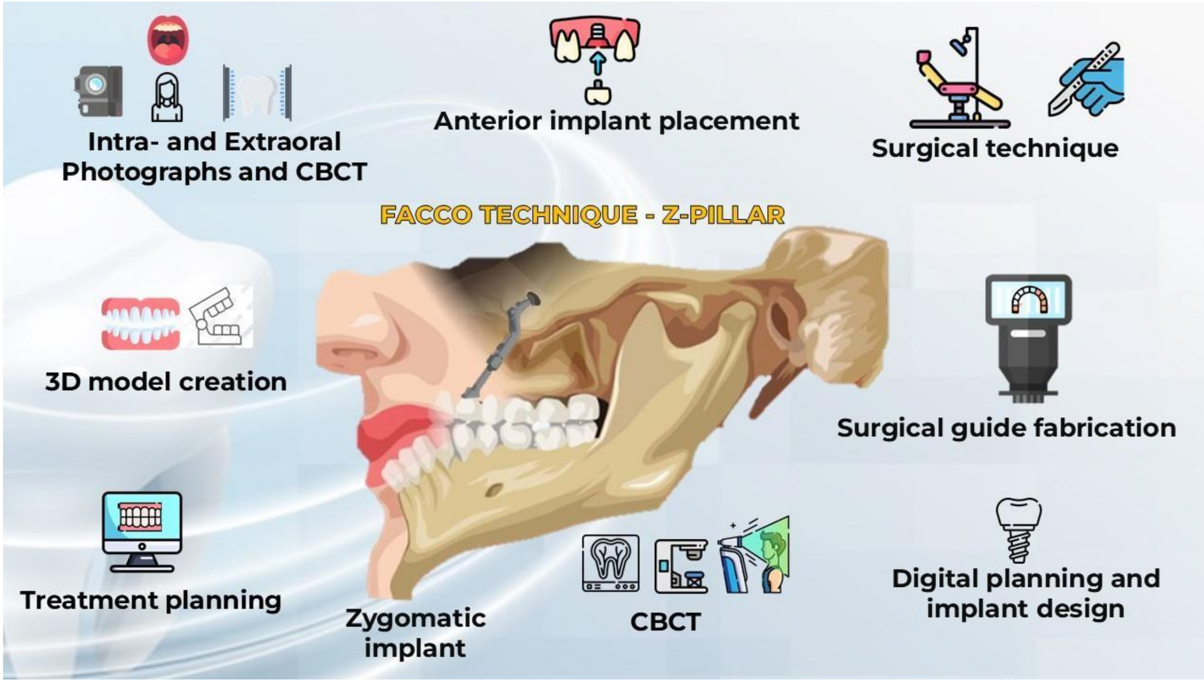
In an attempt to overcome these disadvantages, the extra-sinus surgical technique, involving the placement of the zygomatic implant external to the maxillary sinus before fixation to the zygomatic bone (covered only by soft tissue along its lateral maxillary surface), has emerged as an alternative. This methodology aims to preserve the sinus membrane and reduce the buccopalatal width of the prosthesis. However, it faces challenges related to the presence of extreme angulations and the lack of alternative materials to circumvent this limitation (Lopes et al., 2021).

In this context, the search continues for a surgical protocol with a technique executable in all stages, from the surgical procedure to prosthetic fabrication. This implies an approach that optimizes bone availability and enhances anchorage, allowing for the placement of implants with dimensions suitable for the region (Gallo et al., 2023).

The placement of a conventional implant in the bilateral zygomatic bone, in conjunction with the Z-Pillar and associated with anterior implants, is designated as the Facco Technique. This zygomatic anchorage system is composed of three parts named by the originator as part A – conical implant with Morse taper connection, part B – initial component of the Z-Pillar, transitioning between the implant and the oral cavity, part C – final component of the Z-Pillar with a self-tapping nut for length adjustment and prosthetic platform with external hexagonal connection.

Revista ARACÊ
ISSN: 2358-2472

Graphical Abstract 1: Facco Technique with Z-Pillar for Zygomatic Implant Placement: A Minimally Invasive Approach for Atrophic Maxillae (Graphical Abstract). This figure provides a visual overview of the Facco Technique with the Z-Pillar system (Implacil De Bortoli, São Paulo, Brazil), a novel approach for rehabilitating severely atrophic maxillae using conventional implants placed in the zygomatic bone in conjunction with anterior implants. The workflow encompasses: Pre-operative assessment using clinical photographs and cone-beam computed tomography (CBCT) to evaluate bone availability and anatomical structures. 3D virtual planning of implant placement, demonstrating the extra-sinus approach for zygomatic implants and the planned positioning of anterior implants. Design and fabrication of digitally designed and 3D-printed surgical guides for precise implant placement, ensuring accurate positioning and angulation of both zygomatic and anterior implants. Intra-operative



The use of prototyping and guided surgery has become prominent as essential resources in highly complex implant dentistry scenarios. These technologies, supported by computational systems, enable more precise and systematic modeling, resulting in optimization of time during surgical procedures (Wang et al., 2023; Vimarj et al., 2020). The creation of biomodels from cone-beam computed tomography (CBCT) scans enables the morphological replication of anatomical structures in true scale. Furthermore, it allows for three-dimensional visualization of complex anatomical structures, simplifying the pre-operative planning of osseointegrated implants (Gallo et al., 2023).

Dental implant surgery, especially in advanced procedures such as zygomatic anchorage, presents complexities involving various factors, ranging from image acquisition to intraoperative guidance. Deviations between virtually planned and actually placed implants represent a significant challenge, highlighting the need for approaches that enhance procedural accuracy (Wang et al., 2023). Previous studies have indicated that digital surgical guides have the potential to improve accuracy in implant placement, significantly limiting the issues associated with linear and angular deviation (Bolzoni et al., 2023). However, the literature emphasizes the critical importance of evaluating clinical accuracy to determine the acceptability of errors associated with guided surgery.

Discrepancies between the planned and actual implant position have emerged as a crucial point in this surgery, demanding a thorough evaluation (Varghese et al., 2023).

In light of this context, a case report was proposed addressing the placement of conventional implants in zygomatic anchorage, utilizing the Facco technique in conjunction with the Z-Pillar and dual surgical guides, implants, and osteotomy. The primary objective is to contribute to the understanding of this approach's efficacy, emphasizing the need for clinical accuracy assessment. This case report aims not only to provide valuable insights for refining surgical practices but also to validate the proposed technique, with the potential to positively influence clinical outcomes and the quality of maxillary rehabilitation.

Thus, this study aims to address a gap in the literature by providing an in-depth analysis of the clinical accuracy associated with this specific technique, broadening the foundation for the continuous evolution of dental implant surgery practices.

OBJETIVE

To develop a complete denture through a digital workflow, intended to serve as a radiographic guide for surgical planning of dental implant placement. This digitally fabricated guide will be used to guide the surgical placement of dental implants in the atrophic maxilla, utilizing the Facco technique with the Z-Pillar and dual surgical guides, encompassing implant placement and osteotomy. The objective is to present an integrated, effective, and precise approach for the rehabilitation of the atrophic maxilla, employing digital technology for both denture fabrication and surgical guidance.

HYPOTHESIS

The use of digital workflow for planning and manufacturing a double surgical guide in the Facco technique with Z pillar results in clinically acceptable precision in the installation of implants in atrophic maxillae.

Revista ARACÊ
ISSN: 2358-2472

CASE REPORT

DESCRIPTION OF THE Z-PILLAR SYSTEM: TRIPARTITE COMPOSITION AND TECHNICAL CHARACTERISTICS

The company's latest innovation consists of the launch of the Z-Pillar, a zygomatic anchorage system distinguished by its tripartite composition. This system encompasses Part A – a conical implant with a Morse taper connection, Part B – the initial component of the Z-Pillar, responsible for transitioning between the implant and the oral cavity, and Part C – the final component of the Z-Pillar, equipped with a self-tapping nut. This latter component is crucial for adjusting both the length and the prosthetic platform, featuring an external hexagonal connection that provides precise and secure integration. This triad of elements confers upon the Z-Pillar unique versatility and a remarkable capacity for adaptation to the specific requirements of each clinical situation (Costa et al., 2021).

PATIENT HISTORY

A 59-year-old female patient sought dental care due to the need for oral rehabilitation in the maxilla. During anamnesis, the patient reported having a vascular anomaly called hereditary hemorrhagic telangiectasia (HHT), characterized by multiple dilatations of capillaries and venules in the mucosa and skin, rendering them vulnerable to spontaneous rupture.

As a result of this condition, the patient is prone to bleeding, especially in the lips, palate, and tongue. This prevented her from using a removable maxillary complete denture due to trauma caused by the poor adaptation of the dentures to the alveolar ridges, resulting in oral cavity lesions and gingival bleeding. No pharmacological history or reports of allergies were present.

DETAILED MEDICAL HISTORY

Following anamnesis and clinical examination, a cone-beam computed tomography (CBCT) scan was requested to evaluate the existing bone structure. The results revealed significant alveolar bone resorption, indicating severe maxillary atrophy.

The patient's treatment plan was not suitable for conventional implant therapy due to the clinical characteristics of severe maxillary atrophy, including an alveolar ridge with inadequate height and width, classified as Cawood-Howell Class V (Cawood; Howell, 1988).

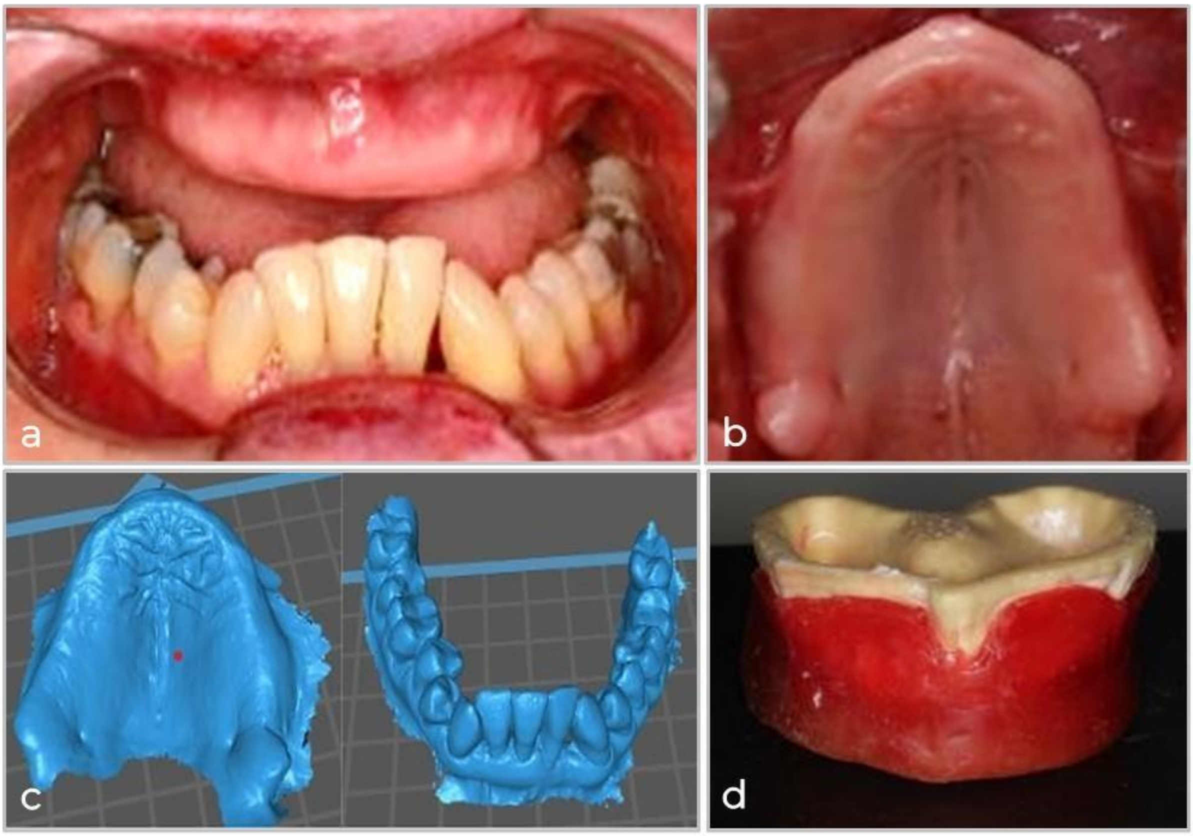
Revista ARACÊ
ISSN: 2358-2472

To restore masticatory function and provide predictable oral rehabilitation, adapting surgical procedures in a simpler and more precise manner to her systemic condition, zygomatic anchorage using the Facco technique combined with the Z-Pillar was indicated.

PHOTOGRAPHIC PROTOCOL AND SCANNING

The initial phase comprised the execution of the photographic protocol, capturing extra- and intraoral images, in addition to scanning the dental arches using the Trios 2 Intraoral Scanner (3Shape A/S, Copenhagen, Denmark). The maxillary model was printed, and a wax rim was fabricated. The vertical dimension of occlusion (VDO) was established with the aid of the wax rim. Subsequently, the wax rim was sectioned in half, allowing for a new intraoral scan that incorporated the new interarch relationship (Figure 2 a-d).

Figure 2: Initial Data Acquisition. (a-b) Intraoral photographs. (c) Digital scan of the dental arches. (d) Printed maxillary model and fabricated wax rim.



Using inLab CAM SW 19.0 software (Dentsply Sirona®, NC, USA), the model and the extraoral photograph in smiling position were imported to initiate denture design. The digital outlining of the gingiva and the dental arch was established (Figure 3).

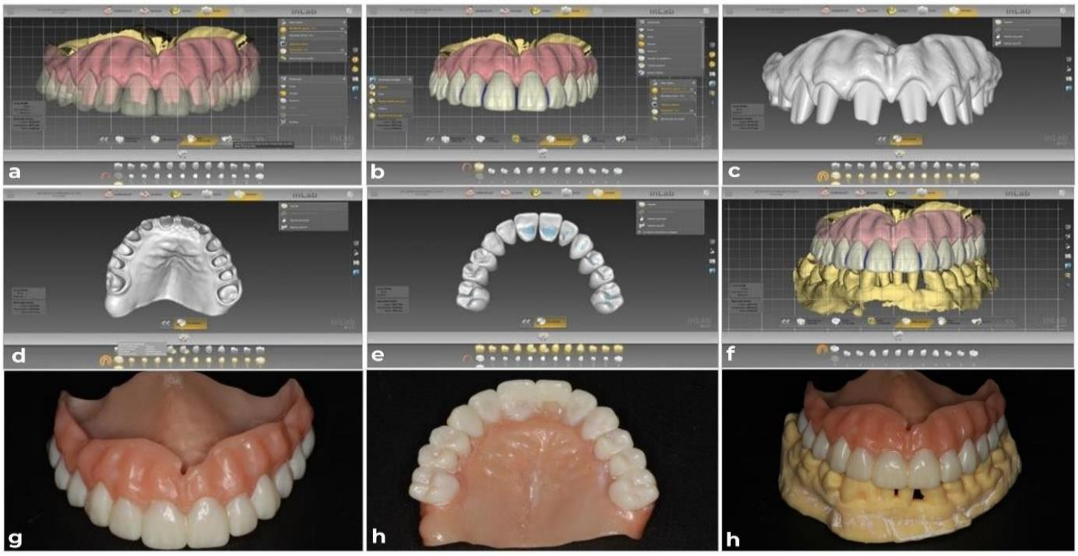
Revista ARACÊ
ISSN: 2358-2472

Figure 3: Model Integration in inLab Software (version number), initiating the denture design process.

Three-dimensional (3D) printing was performed in separate forms (Phrozen Sonic 4K 3D printer, Phrozen Technology, Hsinchu, Taiwan), starting with the denture base (gingival part) using Ronly Denture Base digital resin in shade R2 (Formlabs, Massachusetts, USA).

Subsequently, the dental arch was reproduced through 3D printing, using Printax Aa 3D printing resin in shade MP-A1 (Printax® Impressão 3D, São Paulo, Brazil). Bonding was performed using U200 resin cement, while markers were incorporated through the application of Tetric N-Ceram flow resin (Ivoclar Vivadent, São Paulo, Brazil) (Figure 4 a-h).

Figure 4: Digital Design and Fabrication Process. (a-f) Stages of the digital design process for the gingiva and dental arch. (g-h) Separate 3D printing of the denture base (gingival part) using Ronly Denture Base Natural resin, shade R2, and the dental arch using Printax 3D resin, shade MP-A1.

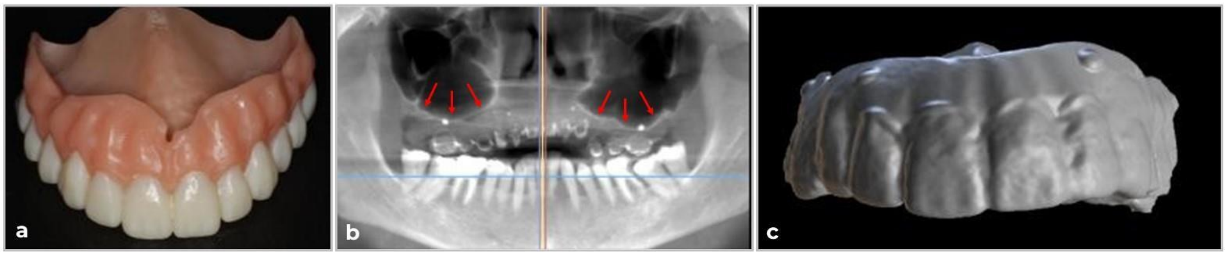


Revista ARACÊ
ISSN: 2358-2472

Using the Orthophos XG 3D device (Sirona Dental Systems GmbH, Bensheim, Germany), the dual cone-beam computed tomography (CBCT) technique was employed, consisting of two distinct image acquisition phases. Image analysis allowed for the observation of maxillary sinus pneumatization on both the right and left sides (Figure 5 a,b).

In the first phase, the patient wore a denture containing specific markers, enabling the acquisition of detailed information regarding the relationship between the anatomical structures and the existing denture (Figure 5 c).

Figure 5: Dual Cone-Beam Computed Tomography (CBCT) Technique for Prosthetic Assessment. (a) CBCT scan illustrating the dual tomography acquisition method. (b) CBCT scan acquired with the patient wearing the existing denture containing radiopaque markers. (c) CBCT scan of the existing denture alone, without the patient.



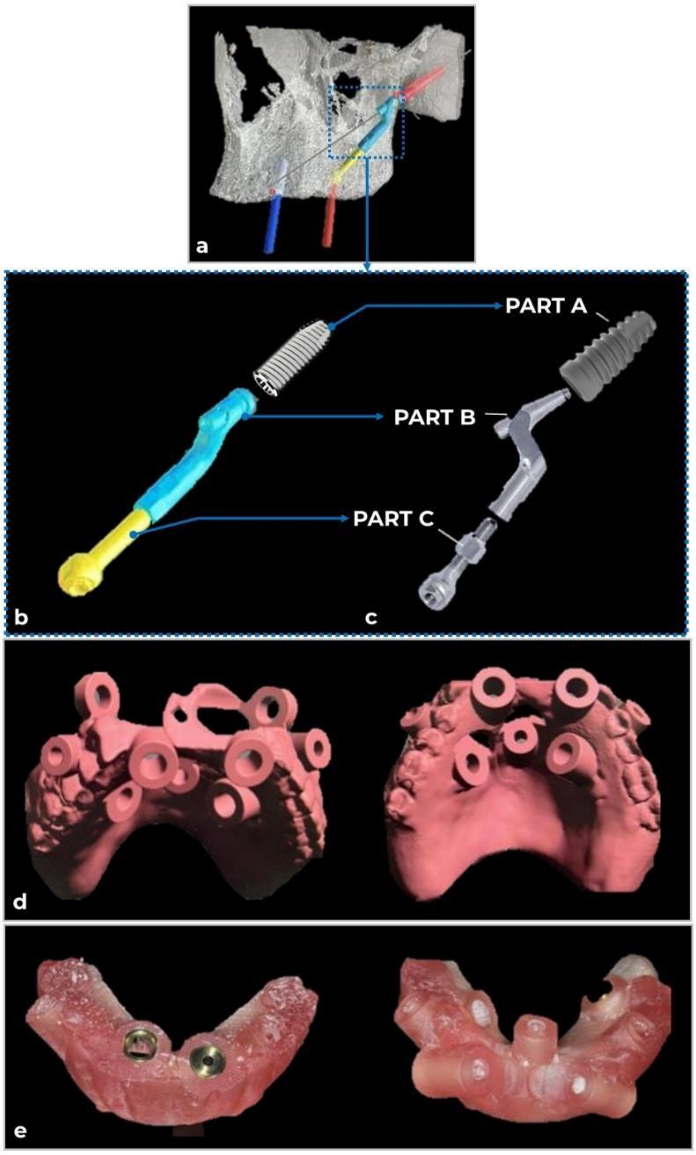
The second acquisition, carried out exclusively with the prosthesis, sought to obtain additional images relevant to surgical planning. This dual tomography approach provided a more comprehensive and accurate analysis of the orofacial structures, considering both the condition with the prosthesis in use and the prosthesis alone (Figure 6 a).

The CBCT data were exported as a digital file in DICOM (Digital Imaging and Communications in Medicine) format, along with the data from the optical scan of the maxillary model in STL format. These data were imported into the Blue Sky Plan planning software (Libertyville, USA), where the meshes were superimposed for a more detailed analysis.

Implants measuring 3.5 x 50 mm and 3.5 x 35 mm were created and correctly positioned, along with a repositioning of the osteotomy for Z-Pillar placement. Surgical guides were designed: one to stabilize the pins in the maxilla for anterior implant placement, and another for the zygomatic implants (Impalcil de Bortoli, São Paulo, Brazil) and the execution of the osteotomy for Z-Pillar placement. These guides were then 3D-printed using the P20 rapid shape printer (Figure 6 b,c).

Revista ARACÊ
ISSN: 2358-2472

Figure 6: Visual representation of the steps and components used in zygomatic implant surgery applying the facco and pilar z techniques. (a) virtual planning with 3d reconstruction of the maxillary bone, showing the insertion points for zygomatic implants. (b) structural components of the techniques, highlighting parts a, b, and c of the system. (c) 3d configuration of the connections for implant support and fixation. (d) anatomical models of the customized surgical guides. (e) final adjustments to the surgical guide to ensure precision and stability during clinical application.



SURGICAL PROCEDURE

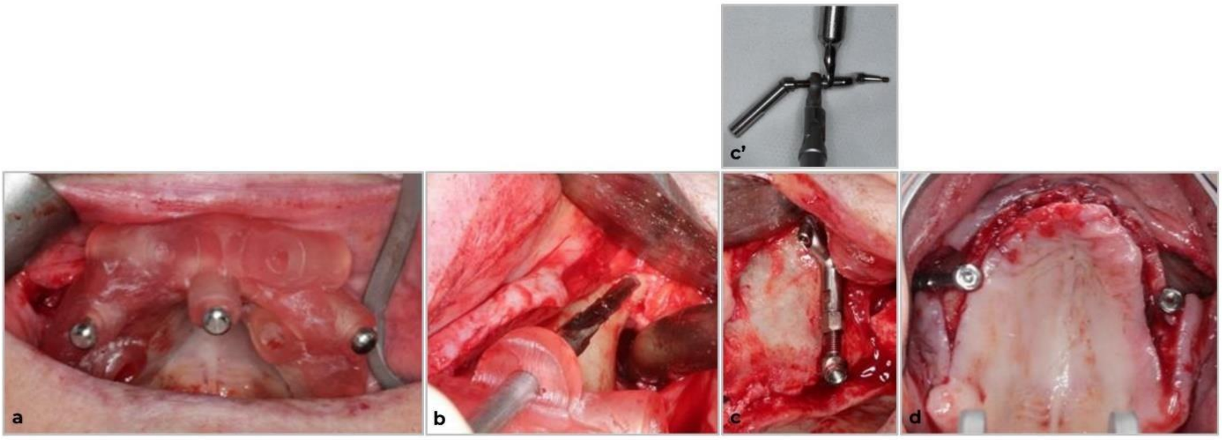
On the day prior to the surgical intervention, the patient received prophylactic administration of amoxicillin with potassium clavulanate (125 mg every 12 hours), dexamethasone (4 mg one hour before the procedure, repeated every 12 hours), and 1 g of dipyrone sodium immediately postoperatively.

During the surgical phase, after infiltration of 4% articaine hydrochloride local anesthetic with 1:200,000 epinephrine (Articaine® – DFL), the positioning of the first surgical guide was initiated. Subsequently, the osteotomy was performed, followed by the insertion of two anterior implants with an approximate tightening torque of 45 Ncm, respecting the biological width for gingival bone accommodation (Figure 7 a). Suturing was performed using 5-0 mononylon suture.

Subsequently, an additional 0.5 mL of the same anesthetic was administered, followed by a new incision on the crest. A vertical ascending and slightly posterior incision was executed between the canine and premolar. Mucoperiosteal flap elevation was performed, diverging from the masseter muscle insertion by 3 to 5 mm.

Using the second surgical guide, the 2.0 mm drill was positioned parallel to the canine pillar on the buccal aspect. Subsequently, the drill apex was inclined towards the zygomatic arch 4 mm from the anterior inferior border of the zygomatic bone. Drilling was performed using 2.0 mm and 3.5 mm drills (Figure 7 b).

Figure 7: Guided Implant Placement and Zygomatic Anchorage. (A) Use of surgical guides for precise positioning and installation of anterior implants following osteotomy preparation. (C, C') Zygomatic bone drilling with subsequent insertion of the Z-Pillar into the zygomatic implant with a tightening torque of 30 Ncm. Healing abutments were then placed, and the surgical site was sutured.



A conventional cone-Morse implant was installed in the zygomatic bone with a tightening torque of 60 Ncm. For proper preparation of the Z-Pillar seating, component installation, and torque application (20 Ncm), a spherical bur was used for maxillary bone reduction. Ensuring that the platform was parallel to the alveolar ridge to minimize cantilever, a torque of 80 Ncm was applied to the screw connecting parts B and C, followed by the micro Nites with 20 Ncm (Figure 7 c,d).

The soft tissues were readapted and sutured back to their original position using silk sutures. Postoperatively, the administration of amoxicillin with potassium clavulanate (125 mg every 12 hours) was maintained for an additional 9 days, dexamethasone (4 mg every

Revista ARACÊ
ISSN: 2358-2472

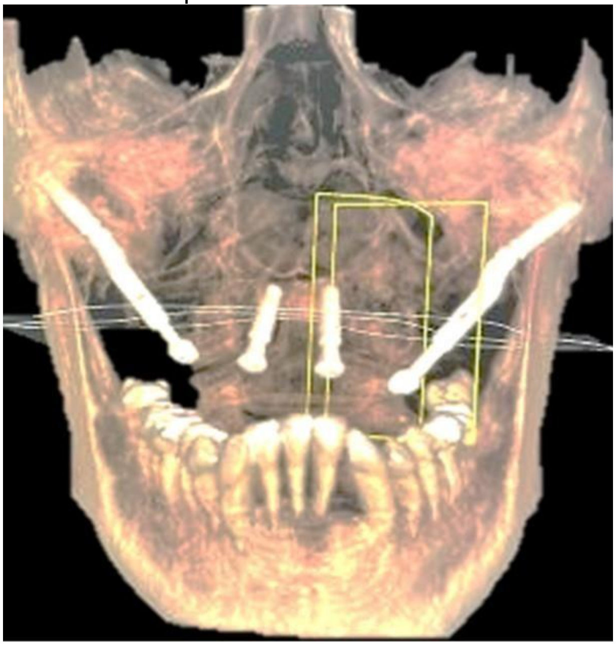
12 hours) for 2 days, and 1 g of dipyrone sodium was recommended as needed for pain management.

Given the inherent complexity of oral rehabilitation in a patient presenting with severe maxillary atrophy and hereditary hemorrhagic telangiectasia (HHT), the implementation of the Facco technique emerges as a promising innovative approach. This pioneering method involves the installation of cone-Morse implants in the zygomatic bone, combined with the use of the Z-Pillar, associated with conventional implants in the anterior region, potentially conferring an extended perspective of implant longevity.

The incorporation of prototyping and guided surgery proved essential in surgical planning, providing precise and systematic modeling. Simultaneously, the application of the Facco technique ensured stable zygomatic anchorage, overcoming the anatomical limitations inherent in cases of severe maxillary atrophy.

Postoperative analysis, conducted through tomography scans to evaluate implant position, evidenced the remarkable precision of the Facco technique (Figure 8).

Figure 8: Postoperative Evaluation of Implant Position. Postoperative cone-beam computed tomography (CBCT) was performed to confirm implant placement according to the digital surgical plan, allowing for the subsequent fabrication of the definitive fixed prosthesis.



The creation of biomodels allowed for detailed three-dimensional visualization, facilitating the verification of implant integration with the surrounding bony structures. The patient, after undergoing implant placement and fabrication of the digital complete denture, experienced a considerable improvement in masticatory function and facial

Revista ARACÊ
ISSN: 2358-2472

esthetics. The reduction in the buccopalatal width of the denture contributed significantly to the patient's comfort and oral adaptation, overcoming the limitations observed in conventional treatments.

DISCUSSION

This case report describes the application of the Facco technique, which utilizes cone-Morse implants in the zygomatic bone, combined with the Z-Pillar, along with conventional implants in the anterior region, in a patient with severe maxillary atrophy (Cawood-Howell Class V) and hereditary hemorrhagic telangiectasia (HHT). This patient presented with limited residual bone height and width in the maxilla, precluding the placement of conventional implants without extensive grafting procedures. Due to the patient's HHT, a multidisciplinary approach involving a hematologist was implemented to minimize the risk of bleeding complications. Preoperative coagulation tests were performed, and meticulous hemostatic techniques were employed during surgery. This approach demonstrated efficacy in overcoming anatomical limitations, providing stable implant anchorage and enabling successful prosthetic rehabilitation. The patient experienced significant improvement in masticatory function and facial esthetics. The Facco technique, combined with digital planning and guided surgery, offers a promising treatment option for patients with severe maxillary atrophy and complicating systemic conditions such as HHT.

Given the inherent complexity of oral rehabilitation in a patient presenting with severe maxillary atrophy and hereditary hemorrhagic telangiectasia (HHT), the implementation of the Facco technique emerges as a promising innovative approach. Zygomatic implants are a clinically documented alternative for rehabilitating edentulous patients with severe maxillary resorption and severe defects in the posterior maxilla after tumor resection. However, previous studies indicate risks associated with their placement due to the anatomical complexity of the site. Guided surgery is a suitable approach to minimize these risks and improve surgical accuracy, precisely transferring the preoperative plan to the operating room (Ugurlu et al., 2013).

However, previous studies indicate risks associated with their placement [of zygomatic implants] due to the anatomical complexity of the site. Guided surgery is a suitable approach to minimize these risks and improve surgical accuracy, precisely transferring the preoperative plan to the operating room. The methodology presented in

Revista ARACÊ
ISSN: 2358-2472

this report is distinguished by the use of 3D reconstruction, preoperative planning, registration, surgical guides (surgical implant orientation), and an extra-sinus installation in the zygomatic bone with a Z-shaped intermediate abutment, composed of three parts for zygomatic anchorage. This design facilitates the implant's location, angle, and depth of insertion, providing a precise link between planning and actual surgery.

This design facilitates the implant's location, angle, and depth of insertion, providing a precise link between planning and actual surgery. The Facco technique offers a notable advantage by eliminating donor site morbidity and preventing infections in the graft material. This results in a significant reduction in treatment time, avoiding the need for post-graft bone consolidation. Furthermore, its use results in a decrease in the number of surgical interventions and hospital costs (Garcia et al., 2024).

A significant reduction in bone loss around the region, accompanied by preservation of the alveolar crest, resulting from the strategic implant position below the bone level, culminating in a significant attenuation of bone resorption, is noteworthy (Garcia et al., 2024).

The biomechanics of the zygomatic implant vary compared to conventional implants. This is because it is much longer, the primary anchorage is distant from the loading point, and it is positioned at an angle, which results in an unfavorable biomechanical situation when considered in isolation. The trabecular structure of the zygomatic bone, not as suitable for implant support, is compensated by the stability provided by the cortical bone of the maxillary sinus located in the crestal region of the implant. Therefore, rehabilitation should be conceived as a single unit, composed of a rigid bar, which includes two to four conventional implants located in the anterior maxilla (Costa et al., 2023).

Previous studies have highlighted post-implantation challenges associated with these devices, such as soft tissue inflammation around the abutments. Notably, the palatal mucosa presents an atypical depth of 5 mm at the posterior implant level, characterized by parakeratinized epithelium discrepant with the normal sulcus, predisposing to gingival complications. The scarcity of soft tissue, associated with bone defects, can generate complications during or after the osseointegration phase (Tzerbos et al., 2016).

Seeking to overcome such limitations, the Facco technique, combined with the Z-Pillar, stands out as a clinically advantageous approach for zygomatic implant placement, mitigating complications frequently associated with other techniques. This differentiated anchorage in the zygomatic bone presents unique characteristics, with the Z-Pillar specifically designed to integrate precisely and compatibly with the conventional implant in the zygomatic bone. Its design ensures a firm and stable connection between the implant and the dental prosthesis (Garcia et al., 2024).

The perfect integration of the Z-Pillar refers to its ability to precisely and securely attach to the implant in the zygomatic bone, crucial for prosthesis stability and preventing unwanted movements that compromise patient function and comfort. By providing a stable platform for dental prosthesis fixation, the Z-Pillar is essential for the durability and effectiveness of the prosthetic restoration, preventing displacements or misalignments that would impair masticatory function and esthetics (Mousa et al., 2021).

Furthermore, the Facco technique, innovative in incorporating the Z-Pillar, enables precise corrections in the height and positioning of the prosthetic platform. The near-parallel insertion of the implant to the zygomatic bone intensifies bone-to-implant contact, contributing to more robust anchorage and enhanced biomechanical stability. This unique, versatile, and innovative design approach stands out as a significant contribution to the long-term efficacy and success of zygomatic implants, offering improved solutions for specific challenges (Tribst; Dal Piva; Borges, 2016).

The notable reduction in complications associated with the Facco technique, compared to other approaches, can be attributed to several factors. Firstly, the Facco technique demonstrates a considerable capacity to overcome anatomical limitations, minimizing risks of orbital floor perforation and preventing maxillary sinusitis. Additionally, the careful approach during implant placement, combined with the Z-Pillar, acts as an effective mitigator of potential complications, such as soft tissue infections around the implants and the formation of oroantral fistulas (Aparicio; López-Piriz; Albrektsson, 2020).

In summary, the Facco technique, in conjunction with the Z-Pillar, stands out as a promising strategy for zygomatic implant placement. This innovative approach not only mitigates complications associated with other techniques but also demonstrates significant advantages during the intraoperative period. This substantial advance not only elevates clinical efficacy but also contributes to favorable outcomes and the prevention of potential complications.

In concluding this case report, we evidenced that the delineated objectives were fully achieved. The detailed analysis of the technique not only allowed for a careful evaluation

Revista ARACÊ
ISSN: 2358-2472

of its clinical applicability but also highlighted the advantages observed during the intraoperative period.

However, it is crucial to emphasize the imperative need for longitudinal follow-up of these patients. This follow-up is essential for an in-depth investigation into implant durability, the identification and monitoring of potential complications, and the continuous analysis of the survival rate over time. This prospective approach plays a vital role in the complete validation of the technique in question, contributing substantially to a comprehensive understanding of its long-term outcomes.

CONCLUSION

In summary, the present investigation provided a comprehensive analysis of the innovative Facco technique with the Z-Pillar. The conclusive and satisfactory results attest to the efficacy of this approach in addressing anatomical challenges, emerging as a valuable and effective alternative for patients with severe maxillary atrophy.

The successful overcoming of anatomical obstacles highlights not only the promising clinical applicability of the Facco technique but also emphasizes its potential to fill gaps in the treatment of patients with severe maxillary atrophy. This conclusion encourages broader consideration and careful adoption of the Facco technique with the Z-Pillar as a viable option in clinical contexts that demand innovative and effective solutions for the rehabilitation of patients with specific challenges. This research thus establishes a solid foundation for future investigations and clinical improvements in this area.

Revista ARACÊ
ISSN: 2358-2472

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