MedNEXT
Journal of Medical an Health Sciences

CASE REPORT

DOI: 10.54448/mdnt25303

Preoperative evaluation and surgical planning for dental implant in a patient with systemic comorbidities: a case report

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DOI: https://doi.org/10.54448/mdnt25303
Received: 04-05-2025; Revised: 06-13-2025; Accepted: 07-07-2025; Published: 08-04-2025; MedNEXT-id: e25303

Editor: Dr. Mohammad Barakat Jamil Alnees MD.

Abstract

Oral rehabilitation with dental implants in patients with systemic comorbidities presents a challenge that demands heightened attention and meticulous surgical planning. Conditions such as systemic arterial hypertension, type 2 diabetes mellitus, and periodontal disease can directly interfere with healing, increase the risk of infection, and compromise the long-term success of implants. Therefore, a thorough clinical evaluation, prior control of these conditions, and an interdisciplinary approach are essential to ensure a favorable prognosis. Hypertensive patients, for instance, may exhibit vascular alterations that heighten the risk of bleeding during and after the procedure, necessitating strict blood pressure control in collaboration with the attending physician. In diabetic patients, chronic hyperglycemia impairs the inflammatory response and healing process, making glycemic monitoring, prophylactic antibiotic therapy, and rigorous aseptic measures imperative. In cases of periodontal disease, the presence of active gingival infections may predispose the patient to peri-implantitis, underscoring the importance of eliminating infectious foci prior to surgery. Thus, the success of implant-based rehabilitation in patients with these conditions depends not only on the surgical technique but also on comprehensive planning. This includes laboratory and imaging examinations, careful selection of materials, and diligent postoperative follow-up.

Keywords: Interdisciplinary clinical assessment. Surgical risks in implantology. Card for patients with chronica diseases. Preoperative oral rehabilitation strategies.

Introduction

Oral rehabilitation using dental implants in patients with systemic comorbidities requires careful surgical planning to minimize risks and ensure the success of the procedure. Systemic arterial hypertension (HAS), type 2 diabetes mellitus, and periodontal disease are conditions that can directly impact the healing response, the risk of infection, and the longevity of the implant. Therefore, prior evaluation, systemic control, and an interdisciplinary approach are essential to ensure a favorable prognosis [1,2].

Hypertensive patients often have vascular alterations that can compromise tissue perfusion, increasing the risk of intra- and postoperative bleeding. Therefore, adequate blood pressure control, in collaboration with the attending physician, is essential before any surgical intervention [1]. In the case of type 2 diabetes mellitus, chronic hyperglycemia compromises the inflammatory response and the healing process, increasing susceptibility to peri-implant infections [2]. Planning should include glycemic monitoring, prophylactic antibiotic therapy, and strict

aseptic measures. Periodontal disease, in turn, is a determining factor for implant success.

The presence of periodontitis may indicate a predisposition to peri-implantitis, which reinforces the need for periodontal control before implant placement. Studies show that patients with a history of periodontal disease have a higher risk of implant loss compared to those without this condition [3]. Therefore, disinfection of the oral cavity, removal of infectious foci, and patient education are fundamental steps in the preoperative period. Adequate surgical planning includes laboratory and imaging tests, careful selection of the surgical technique, and choice of the most appropriate type of implant and prosthetic material. The use of surgical guides and technologies such as computed tomography help predict the procedure and reduce the risk of complications. Furthermore, strict postoperative monitoring is essential to detect any signs of complications early [4].

Given this, this report described the case of a 64-year-old white female patient with systemic arterial hypertension (SAH) and type 2 diabetes mellitus who had advanced periodontal disease.

Methods

The present study was elaborated according to the rules of the CARE case report (https://www.care-statement.org/). A descriptive literature review was also carried out to provide sufficient scientific data for the theoretical basis of this study.

Ethical Approval

This study adhered to the human rights principles outlined in the 1964 Declaration of Helsinki, and by the 75th WMA General Assembly, Helsinki, Finland, October 2024. The Informed Consent Form was applicable. Data from the patient under study were obtained through the collection and analysis of information contained in the patient's medical record.

Case Report

Oral rehabilitation using dental implants in patients with systemic conditions requires careful planning and an interdisciplinary approach to ensure successful treatment. This report describes the case of a 64-year-old white female patient with systemic arterial hypertension (HAS) and type 2 diabetes mellitus who had advanced periodontal disease, resulting in mobility and structural impairment of teeth 13, 12, 11, 21, 22, and 23. Given the unfavorable prognosis of these teeth, treatment with extraction and prosthetic rehabilitation using dental implants was indicated.

To minimize surgical risks and promote a better postoperative response, intensive prophylaxis was performed, including preoperative antibiotic therapy, aiming to reduce the risk of infection and promote bone healing. Preoperative laboratory tests demonstrated inadequate glycemic control, with glycated hemoglobin (HbA1c) of 9.3%, estimated mean blood glucose of 220.21 mg/dL, and serum glucose of 173.6 mg/dL, factors that could compromise the osseointegration of the implants and increase susceptibility to infectious complications. Given this situation, strict blood glucose control was recommended before the intervention, in collaboration with the medical team responsible for monitoring the patient.

The surgical plan included the installation of Neodent dental implants, model GM HELIX ACQUA, distributed in the following regions: 11 (3.5 mm x 10 mm), 13 (3.5 mm x 11.5 mm), 21 (3.5 mm x 8 mm), and 23 (3.5 mm x 10 mm). The surgery was performed following biosafety protocols and advanced surgical techniques to optimize the predictability of results and the longevity of implant-supported rehabilitation.

Discussion

Preoperative planning is crucial in the oral rehabilitation of patients with systemic comorbidities, as it ensures the safety of the procedure and the long-term success of dental implants. In hypertensive patients, as demonstrated in this case study, altered tissue perfusion can lead to complications during the surgical process, such as excessive bleeding and the risk of poor healing [4]. Hypertension can also affect tissue oxygenation, resulting in a less effective inflammatory response, which can impair the osseointegration of implants. Therefore, strict preoperative blood pressure control and collaboration with the attending physician are essential to mitigate these risks [5].

In addition, the presence of type 2 diabetes mellitus in the patient in this study increases the risk of infectious complications and delays the healing process due to chronic hyperglycemia [2]. The scientific literature is consistent in indicating that adequate glycemic control before surgery, combined with antibiotic prophylaxis, can minimize the risk of peri-implant infection and promote osseointegration [6]. According to a study by Almeida et al. (2015) [7], patients with poor glycemic control have a higher rate of implant failure, which reinforces the importance of treatment adjustments before surgical intervention.

The patient in question was under continuous use of Clorana (chlorthalidone) and Enalapril, medications

commonly prescribed for the management of systemic arterial hypertension. Chlorthalidone, a thiazide diuretic, contributes to blood pressure reduction by promoting the excretion of sodium and water, while Enalapril, an angiotensinconverting enzyme (ACE) inhibitor, facilitates vasodilation. During the surgical planning for dental implant placement, it was essential to consider the pharmacological effects of these agents, particularly regarding hemodynamic stability, the risk of intraoperative hypotension, and potential interactions with local anesthetics. Rigorous blood pressure control, in collaboration with the attending physician, was maintained to ensure procedural safety.

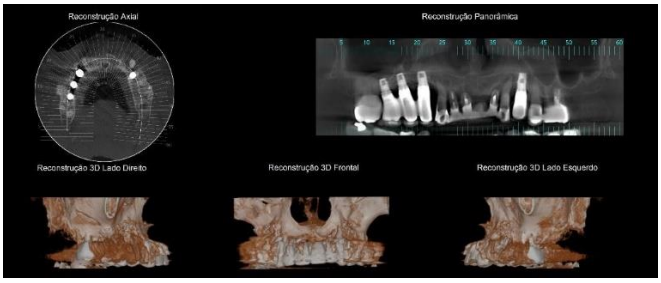
In the case of type 2 diabetes mellitus, the patient was taking metformin at a dose of 250 mg, considered low but effective in improving insulin sensitivity and achieving glycemic control. Metformin is widely used due to its favorable safety profile and minimal risk of inducing significant hypoglycemia when used as monotherapy. Nevertheless, during the planning phase of implant surgery, it was necessary to assess the patient's metabolic stability based on updated laboratory tests, including glycated hemoglobin (HbA1c) and fasting plasma glucose. In addition, strict aseptic protocols and prophylactic antibiotic therapy were implemented to minimize the risk of infection, considering that chronic hyperglycemia may impair immune function and delay the wound healing process.

Periodontal disease, as observed in the case report, is another critical factor in preoperative planning. Studies indicate that the presence of active periodontitis is directly related to an increased risk of peri-implantitis and implant loss [3]. Eliminating infectious foci and controlling periodontal health before implant installation are fundamental steps to ensure the longevity and success of the treatment [8]. Disinfection of the oral cavity, use of antibiotics, and patient education on maintaining good oral hygiene are essential to minimize the risk of long-term complications. The use of technology in surgical planning, such as computed tomography and surgical guides, has been shown to improve the accuracy and predictability of dental implant procedures, especially in patients with systemic conditions [9]. The choice of implant type, adequate sizing, and choice of prosthetic material are also decisive factors that must be meticulously evaluated in preoperative planning.

Tomographic Assessment and Surgical Planning for Implant Installation in the Anterior Region of the Maxilla

Three-dimensional (3D) reconstruction using cone beam computed tomography (CBCT) is an essential tool in surgical planning for oral rehabilitation with osseointegrated implants. In the present study, we captured 3D axial reconstruction images, including frontal, right and left lateral views, as well as full-size cross-sections (Figure 1). The initial tomographic assessment allowed a detailed analysis of bone density in the regions compromised by periodontal disease between teeth 13 and 23.

Figure 1. Tomographic Assessment.



Source: Own authorship.

Based on the images, it was possible to determine the feasibility of implant installation, considering essential parameters such as bone height and thickness, which are fundamental for selecting the most appropriate implant size and type. In addition, the assessment revealed areas of bone resorption and possible anatomical alterations that could impact the predictability of the surgical procedure. Critical aspects such as proximity to important anatomical structures, including the nasal septum and incisor canal, were analyzed in order to avoid intraoperative complications (Figure 2).

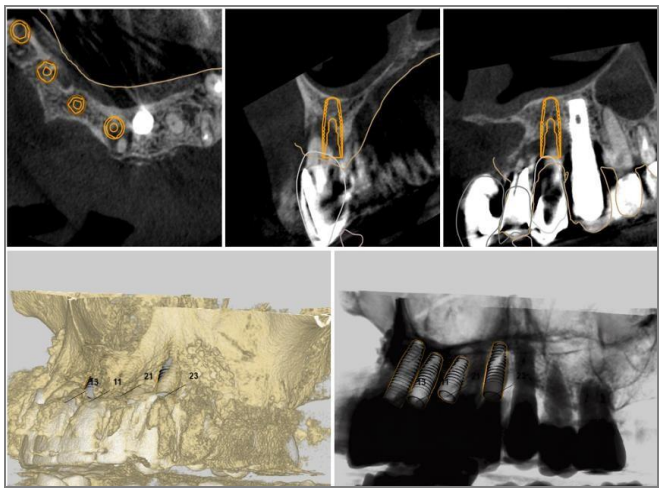
Previous studies reinforce the importance of using CBCT for the diagnosis and planning of implantology in the anterior region of the maxilla. Lekholm and Zarb (1985) [10] developed one of the first bone quality classification systems based on tomographic images, while Misch (1999) [11] proposed a bone density classification system that guides implant selection and surgical approach. The relationship between bone resorption and surgical predictability was also widely discussed by Aghaloo and Moy (2007) [12], who highlighted the need for detailed assessment of bone morphology for successful osseointegration.

Based on this analysis, bone reconstruction may be indicated in cases of advanced atrophy, aiming to improve the primary stability of implants. The use of biomaterials and bone grafting techniques, as described by Urban et al. (2009) [13] has demonstrated efficacy in recovering adequate bone volume for implant-supported rehabilitation.

Therefore, detailed tomographic analysis and the

application of evidence-based clinical-radiographic criteria are essential for surgical predictability and long-term success of rehabilitation with dental implants in the anterior maxilla.

Figure 2. Surgical plan for choosing the implant type.



Source: Own authorship.

Definition of Implant Type and Biomechanical Considerations

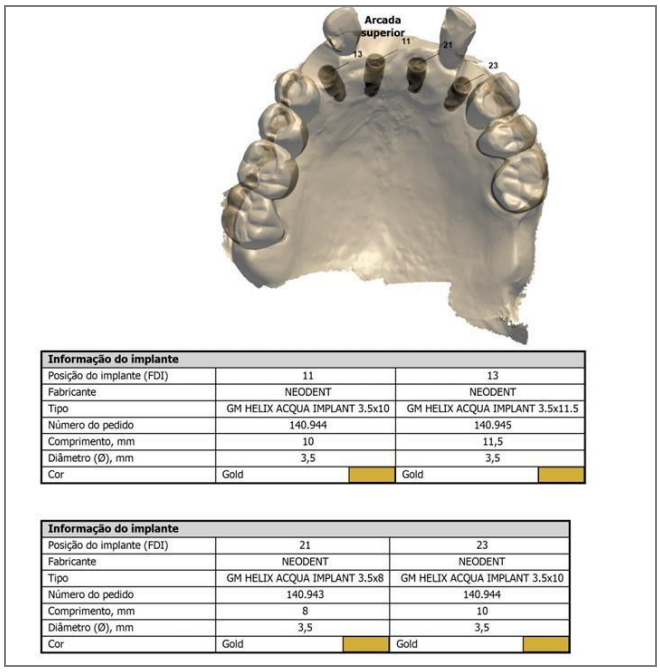
The selection of the implant type is a critical step in oral rehabilitation, requiring a detailed analysis of the bone characteristics of the region to be implanted. To this end, we carefully consider the vestibular, mesial, lingual and distal areas, observing the bone density and the three-dimensional availability of bone tissue, fundamental aspects for the compatibility of osseointegration [14,15].

In this process, the length and diameter of the implants are defined based on bone availability and biomechanical need, as recommended by Misch (2005) [16] and Buser et al. (2017) [17]. Tomographic analysis helps to identify possible bone deficiencies and is essential to indicate complementary procedures, such as bone grafts, in cases of severe atrophy [12].

The choice between immediate or conventional loading in anterior teeth depends on the primary stability obtained, a critical factor for successful osseointegration [18]. Studies indicate that implants with high insertion torque can successfully support immediate loading, reducing total treatment time and improving smile aesthetics [19].

Therefore, the therapeutic approach should be individualized, considering anatomical, biomechanical and functional factors, always based on consolidated scientific literature.

Figure 3. Dental implant information.



Informação do implante		
Posição do implante (FDI)	11	13
Fabricante	NEODENT	NEODENT
Tipo	GM HELIX ACQUA IMPLANT 3.5x10	GM HELIX ACQUA IMPLANT 3.5x11.5
Número do pedido	140.944	140.945
Comprimento, mm	10	11,5
Diâmetro (Ø), mm	3,5	3,5
Cor	Gold	Gold

Informação do implante		
Posição do implante (FDI)	21	23
Fabricante	NEODENT	NEODENT
Tipo	GM HELIX ACQUA IMPLANT 3.5x8	GM HELIX ACQUA IMPLANT 3.5x10
Número do pedido	140.943	140.944
Comprimento, mm	8	10
Diâmetro (Ø), mm	3,5	3,5
Cor	Gold	Gold

Source: Own authorship.

Dental implant information associated with Surgical Planning

The surgical planning included the installation of Neodent brand dental implants, model GM HELIX ACQUA, with the following specifications: implant 11 (3.5 mm x 10 mm), 13 (3.5 mm x 11.5 mm), 21 (3.5 mm x 8 mm) and 23 (3.5 mm x 10 mm). The choice of the GM HELIX ACQUA model was based on its excellent clinical performance, standing out for its high-resistance structure and optimized design for better bone integration, as demonstrated in long-term success studies in the specialized literature [20].

The surgery was performed following strict biosafety protocols and using advanced surgical techniques, aiming to optimize both the predictability of results and the longevity of implant-supported rehabilitation. During the procedure, special attention was paid to determining the axis of insertion of the implants, ensuring a balanced distribution of masticatory forces, in accordance with the principles of implant biomechanics discussed by Misch (2014) [20].

Given the patient's systemic medical history, including systemic arterial hypertension and type 2 diabetes mellitus, the selection of postoperative medications was carefully planned with the objective of preventing infections, managing pain and inflammation, and promoting proper wound healing, while always considering the patient's clinical limitations.

Amoxicillin 500 mg every 8 hours for 7 days was prescribed as antibiotic coverage to reduce the risk of bacterial infection, particularly important for patients with comorbidities such as diabetes, which can impair healing and increase susceptibility to infection. For pain

control, dipyrone (1 g every 8 hours for 3 days) was used due to its effective analgesic properties and minimal impact on blood pressure. As an anti-inflammatory, nimesulide 100 mg every 12 hours was selected for its selective action and good tolerability in hypertensive patients.

Dexamethasone was avoided due to its hyperglycemic potential, which could destabilize glycemic control in patients with type 2 diabetes. In addition, the use of a 0.12% chlorhexidine digluconate mouth rinse (e.g., Perioxidin/Periogard) was recommended, 15 mL every 8 hours for 7 days, to assist in the control of oral microbiota and help prevent local infections during the healing process, especially in the initial postoperative period. This pharmacological approach was individualized to ensure the patient's safety, comfort, and therapeutic effectiveness during the postoperative period.

In addition, the use of a surgical guide was considered to increase the precision of implant placement, minimizing errors in angulation and positioning, as demonstrated in recent studies [21]. The prosthetic phase was also planned from the beginning, aiming at an adequate aesthetic and functional result, based on the implant-supported prosthetic planning guidelines of Pjetursson et al. (2015) [22]. The anticipation of the prosthetic phase allows not only greater predictability in the alignment and adaptation of the prosthesis, but also an approach that favors the long-term success of the rehabilitation.

Regarding the specific treatment of this case, intensive prophylaxis, glycemic control and careful selection of implants were essential approaches to ensure a good prognosis. Collaboration between the dental team and the medical team is essential for the success of the treatment, especially in cases with multiple comorbidities. Strict postoperative follow-up is equally important to monitor the patient's response to the treatment and prevent possible complications, such as infections or failures in the osseointegration process.

Conclusion

Oral rehabilitation using dental implants in patients with systemic comorbidities, such as systemic arterial hypertension, type 2 diabetes mellitus and periodontal disease, requires a careful multidisciplinary approach. Well-structured surgical planning, combined with rigorous control of systemic conditions, is essential to reduce the risk of complications, such as excessive bleeding, infections and failure of osseointegration. In this case, adequate glycemic control, antibiotic prophylaxis and periodontal health management were decisive for the success of the treatment, highlighting the importance of collaboration between the medical and dental teams. The use of advanced technologies, such as computed tomography and surgical guides, also contributed to the precision of the procedure and the longevity of the implants. Strict postoperative follow-up was crucial to monitor the evolution and prevent complications, confirming that personalizing the treatment to the patient's needs is essential to achieve satisfactory and long-lasting results.

CRediT

Author contributions: **Conceptualization-** Ricardo Roberson Rivero, Claudir Lopes da Silva, Daniela de Cássia Cabral, Clairenise Lopes da Silva, Eduardo Mansur Azzolin Maruf; **Formal Analysis-** Ricardo Roberson Rivero, Claudir Lopes da Silva, Daniela de Cássia Cabral, Clairenise Lopes da Silva, Eduardo Mansur Azzolin Maruf; **Investigation-** Ricardo Roberson Rivero, Claudir Lopes da Silva, Daniela de Cássia Cabral, Clairenise Lopes da Silva, Eduardo Mansur Azzolin Maruf**; Methodology-** Ricardo Roberson Rivero, Claudir Lopes da Silva; **Project administration-** Ricardo Roberson Rivero, Claudir Lopes da Silva; **Supervision-** Ricardo Roberson Rivero; **Writing - original draft-** Ricardo Roberson Rivero, Claudir Lopes da Silva, Daniela de Cássia Cabral, Clairenise Lopes da Silva, Eduardo Mansur Azzolin Maruf; **Writing-review & editing-** Ricardo Roberson Rivero, Claudir Lopes da Silva, Daniela de Cássia Cabral, Clairenise Lopes da Silva, Eduardo Mansur Azzolin Maruf.

Acknowledgment

Not applicable.

Ethical Approval

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Informed Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images.

Funding

Not applicable.

Data Sharing Statement

No additional data are available.

Conflict of Interest

The authors declare no conflict of interest.

Similarity Check

It was applied by Ithenticate®.

Application of Artificial Intelligence (AI)

Not applicable.

Peer Review Process

It was performed.

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