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USE OF VIRTUAL GUIDED SURGERY FOR A REHABILITATION OF A COMPLEX MAXILLARY FULL ARCH WITH IMMEDIATE LOADING

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CLINICAL CASE

RESUMO

O avanço da tecnologia na odontologia permite realizar reabilitações complexas com mais segurança e alto grau de precisão, excluindo a necessidade em realizar cirurgias corretivas antecedendo a reabilitação com implantes dentários. Com o uso do fluxo digital é possível transferir a posição correta do implante para o leito cirúrgico através de um guia, utilizando equipamentos digitais como a tomografia computadorizada e softwares de planejamento cirúrgico. Caso clínico: Paciente compareceu a clínica para reabilitação funcional e estética. No exame clínico notou-se presença dos dentes 18, 15, 12, 11, 21, 22, 23, 25, 38, 35, 33, 32, 31, 41, 42, e 43 com lesões periodontais generalizadas e mobilidade. O exame tomográfico mostrou pouca disponibilidade óssea. Para resolução inicialmente foi realizado as exodontias e o planejamento protético prévio incluiu o uso de tomografia dupla e o software CoDiagnostiX. Foram instalados 4 implantes (Helix Grand Morse, Neodent) na maxila através de um guia virtual cirúrgico em carga imediata. A prótese implantossuportada híbrida foi confeccionada por fluxo analógico e digital, o que permitiu a entrega em poucas horas pós-operatórias e reproduziu função e oclusão corretas. Conclusão: Com base na experiencia coletada na condução deste caso, é possível concluir que a cirurgia virtual guiada é uma técnica que otimiza a qualidade e precisão da reabilitação. Além disso, é de natureza minimamente invasiva, entregando conforto e segurança trans e pós-operatória, resultando em boa experiência para o profissional e para o paciente.

Palavras-chave: Reabilitação Bucal; Implantes Dentários; Cirurgia Virtual Guiada; Maxila Atrófica

ABSTRACT

Advances in dentistry technology allow complex rehabilitations to be performed with greater safety and a high degree of precision, eliminating the need for corrective surgeries prior to rehabilitation with dental implants. By the use of digital workflow, it is possible to transfer the correct position of the implant to the surgical bed through a surgical guide, using digital equipment such as digital tomography and surgical planning software. Clinical case: The patient attended the clinic for functional and aesthetic rehabilitation. The clinical examination noted the presence of teeth 18, 15, 12, 11, 21, 22, 23, 25, 38, 35, 33, 32, 31, 41, 42, and 43 with generalized periodontal lesions and mobility. The tomographic examination showed low bone availability. To resolve the problem, extractions were initially performed and prior prosthetic planning included the use of dual tomography and the CoDiagnostiX software. Four implants (Helix Grand Morse, Neodent) were installed in the maxilla using a virtual surgical guide in immediate loading. The hybrid implant-supported prosthesis was manufactured using analog and digital flow, which allowed delivery in a few hours postoperatively and reproduced correct function and occlusion. Conclusion: Based on the experience gathered in conducting this case, it is possible to conclude that virtual guided surgery is a technique that optimizes the quality and precision of rehabilitation. In addition, it is minimally invasive in nature, providing comfort and safety during and after surgery, resulting in a good experience for the professional and the patient.

Keywords: Oral Rehabilitation; Dental Implants; Virtual Guided Surgery; Atrophic Maxill

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INTRODUCTION

Total rehabilitation with dental implants has had a great social impact, especially in complex patients who have little bone availability, such as in atrophic maxillas[1].

The possibility of having fixed teeth again and "fitting into society" became the main focus of edentulous patients. The methods that were used often caused major inadvertent consequences of misdiagnosis and poorly executed planning[2], resulting in inadequate positioning and angulation of the implant[3], making it necessary to perform reconstructive surgery prior to implant placement, such as bone grafts[4], guided bone regeneration, elevation of the maxillary sinus floor and distraction osteogenesis[5].

Virtual guided surgery emerged as a way to guide the surgeon to perform the procedure with greater safety, a high degree of precision, better postoperative care and reliable results in complex patients, eliminating the need for corrective surgeries[6]. In some cases, when correctly indicated, it does not require opening a flap[6], which means that there is no separation of epithelial, connective and periosteal tissue, referring to the minimally invasive nature, avoiding serious intraoperative complications such as sinus perforations, fenestrations and dehiscence[7].

Using the digital flow, it is possible to obtain a surgical guide made through specific planning software, using cone beam computed tomography (CBCT) and intraoral scanning of the patient[8]. The planned position of the implant is transferred to the surgical bed, through a prototype printed on a 3D printer using CAD/CAM technology, the angulation and milling depth are guided through a washer embedded in the guide[9].

A study conducted by Ravida[10] evaluated the survival and complication rates, and cost/benefit ratio, between the virtual technique and the conventional technique in the long term, and concluded that virtual placement ensured a longer implant life and better cost/benefit ratio compared to the conventional technique. Thus, virtual guided surgery has become the technique of choice to optimize the quality and precision of total rehabilitation with implants, ensuring high success rates[11].

Careful patient selection, correct diagnosis and appropriate treatment are essential factors for achieving predictable results[12]. Therefore, this study aimed to describe a complex clinical case in which virtual surgical planning was performed for

guided installation of implants in an atrophic maxilla under immediate loading technique.

CLINICAL CASE

A 58-year-old, caucasian, male patient attended the Implantology Specialization Clinic at ILAPEO College (Curitiba, PR) with the main complaint of “I dream of having my teeth fixed and being able to chew again”. In the anamnesis, he reported having hypertension, with a history of cardiorespiratory arrest due to acute myocardial infarction, which required coronary angioplasty 9 years ago. He also reported being followed up by a neurologist, as he began to develop seizures after cerebral hypoxia and tremors of the extremities. He also has a history of depression and anxiety for over 15 years, and is being followed up by a psychiatrist and psychologist, with a diagnosis of recurrent depression and panic syndrome, and takes the medications Fluoxetine (20mg/day), Chlorpromazine (25mg/day), Gabapentin (300mg/day), Enalapril (10mg/day), Spironolactone (25mg/day) and Metformin (850mg/day), ASA (100mg/day), Atorvastatin (40mg/day), Exetimibe (10mg/day), Carvedial (6.25mg/day), and Omeprazole (20mg/day). Laboratory tests, cardiological assessment and surgical risk assessment were requested. The laboratory tests showed results within the normal range and low surgical risk certified by your doctor.

During clinical examination, the presence of teeth #18, 15, 12, 11, 21, 22, 23, 25, 38, 35, 33, 32, 31, 41, 42, and 43 with generalized periodontal lesions, and grade 3 mobility was noted; also, residual root of tooth #24; endodontic treatment in teeth #21 and #11 with the presence of a cast metal core, this being the area of greatest discomfort reported by the patient. Panoramic radiography (Figure 1) and cone beam computed tomography (CBCT) of the maxilla and mandible were requested.

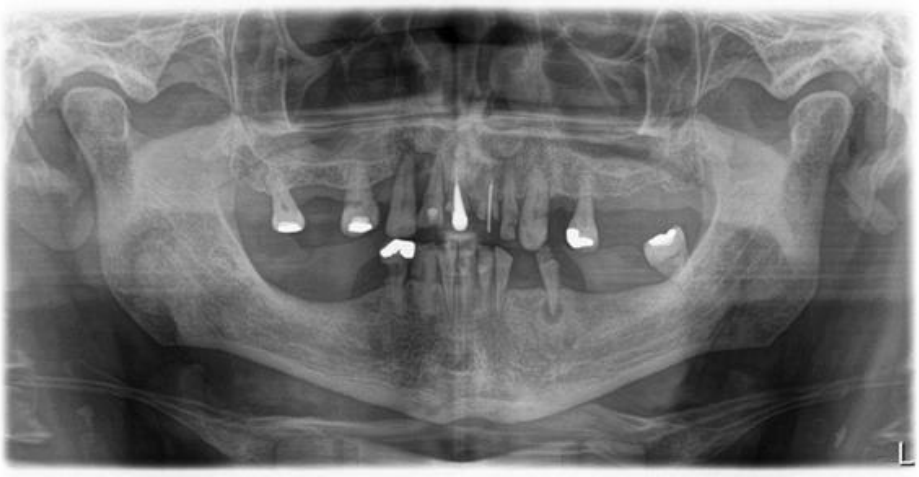


Figure 1 - Initial panoramic radiograph showing periodontal disease and bone resorption.

The CBCT showed alveolar extension of both maxillary sinuses with variations of normality, and great alveolar bone resorption in all teeth. Extraoral and intraoral photographs were taken for prosthetic planning (Figures 2A-B, 3A-C) showing all the changes that was necessary for the final rehabilitation.

Figure 2- Facial analysis showing reduction of vertical dimension of occlusion (VDO). A. Initial aspect in vertical dimension at rest (VDR); B. Initial aspect in VDO.

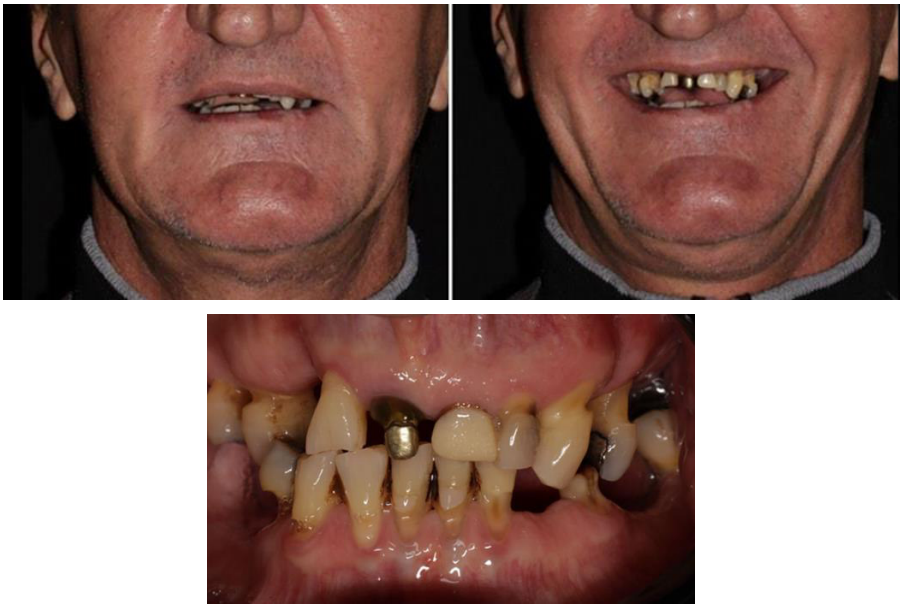


Figure 3- Facial analysis showing the smile appearance and quantity of teeth exposure. A. Appearance at lip rest, with lips half-open; B. Appearance of the initial smile; C. Intraoral appearance in occlusion.

Due to the indication and the complexity of the case, the rehabilitation with doble full arch implant-supported hybrid dentogingival prostheses was indicated and planned. The maxillary treatment included extractions of teeth #18 to #25, with bone regularization in the anterior maxillary region by prosthesis indication and the installation of a total upper prosthesis to be used during the bone healing phase. At the same surgical time the lower teeth were extracted with immediate installation of 4 implants between mentual foramens (Helix Grand Morse implants, Neodent, Curitiba, Brazil) and a mandibular hybrid dentogingival prosthesis were installed after 48 hours. In this phase all the facial and prosthetic changes were made, including the reestablishing of VDO and centric relation, correct exposure of teeth, labial support, Spee curve, smile line, among other characteristics that was planned before by analogic prosthetic planning.

After bone healing, the maxillary complete denture was used as a tomographic guide for a new CBCT for virtual surgical planning. Two CBCTs were performed; the first scan was performed with the tomographic guide in the patient mouth with putty body addition silicone interocclusal registration (Figure 4); and the second scan was performed only of the tomographic guide. The internal area of the complete denture was duplicated, obtaining a model for digitalization into a STL file, through lab scanning.

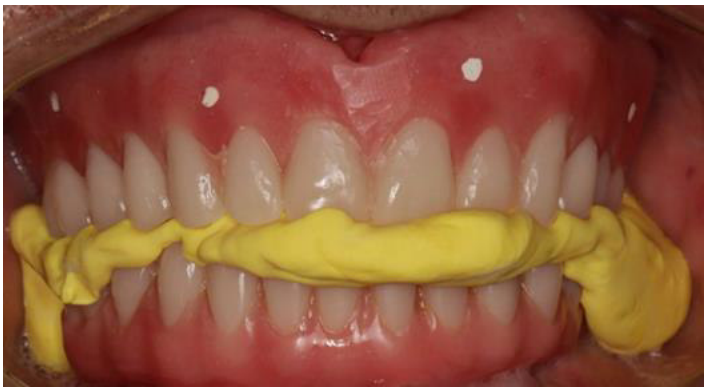


Figure 4 – Complete denture in position serving as a tomographic guide, with interocclusal silicone registration. Note the 4 gutta-percha points for alignment of both CBCTs in the surgical planning software.

The files were sent to a planning center (DLab Digital, Curitiba, Brazil), where, after evaluation, reduced bone availability was verified in the posterior areas (Figure 5) indicating the use of 4 implants between the maxillary sinus. The surgical planning was performed using the CoDiagnostiX software (Dental Wings, Montreal, Canada).

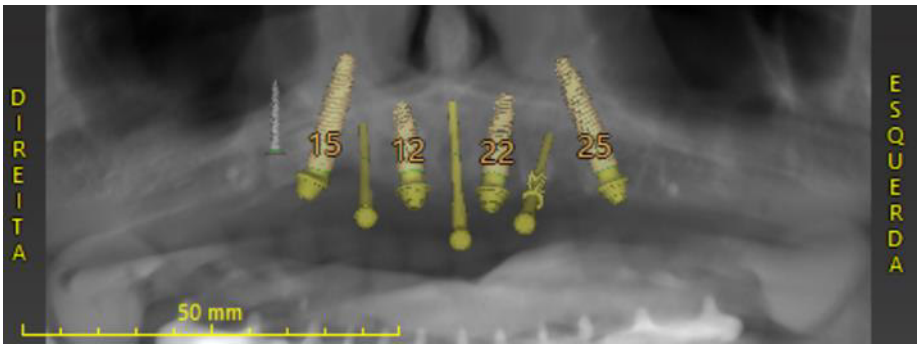


Figure 5 – Panoramic view of the surgical planning in the CoDiagnostiX software.

The surgical planning resulted in a virtual surgical muco-supported guide, indicating the use of the system Neodent Guided Surgery Grand Morse (NGS-GM, Neodent) with the installation of 4 implants (Helix Grand Morse, Neodent) in the region of the remaining bone between the maxillary sinuses in the region of #15 (3.75 mm x 16 mm), #12 (3.75 mm x 10 mm), #22 (3.75 mm x 11.5 mm), and #25 (3.75 mm x 16 mm) (Figure 6).

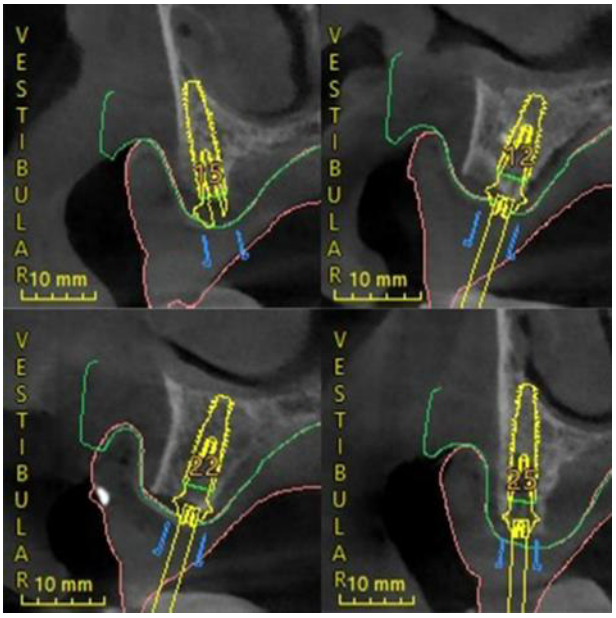


Figure 6 – Virtual planning using coDiagnostiX software showing the region of the 4 implants.

One hour before surgery, the patient was medicated with Diazepan (10mg), Amoxicillin (2g) and Dexamethasone (8mg), and the blood pressure was measured. Extra and intraoral antisepsis was performed, and local anesthesia with mepivacaine 2% with epinephrine 1:200,000 (DFL, Rio de Janeiro, Brazil) with bilateral regional block of the anterior alveolar superior, posterior alveolar superior, greater palatine and nasopalatine nerves was made. The surgical guide was initially fixed with a bone graft screw (Neodent) in the hard palate medial area, with 3 fixation pins in the buccal region of the guide (Figure 7) showing total adaption on the mucosa.

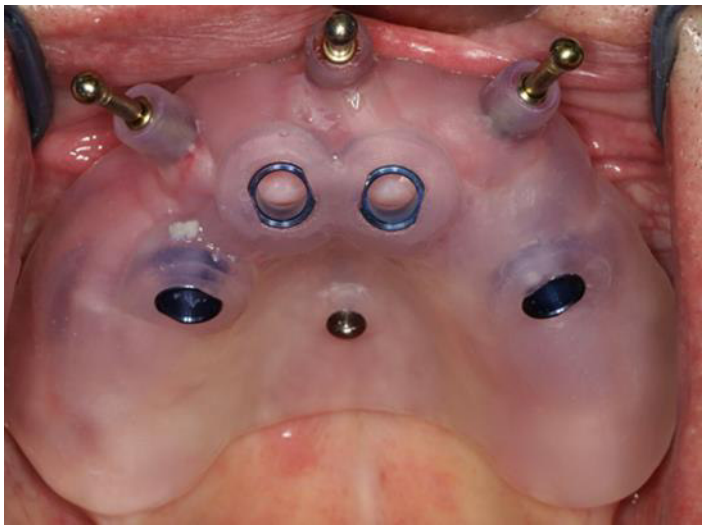


Figure 7 – Surgical guide fixed in place showing mucosal tissue ischemia. This indicates proper adaptation of the guide.

The instrumentation sequence followed the company's protocol (Figure 8A) without a flap. The implants were installed through the sleeves (Figure 8B), and all achieved adequate primary stability indicating the immediate loading technique (>45 Ncm).

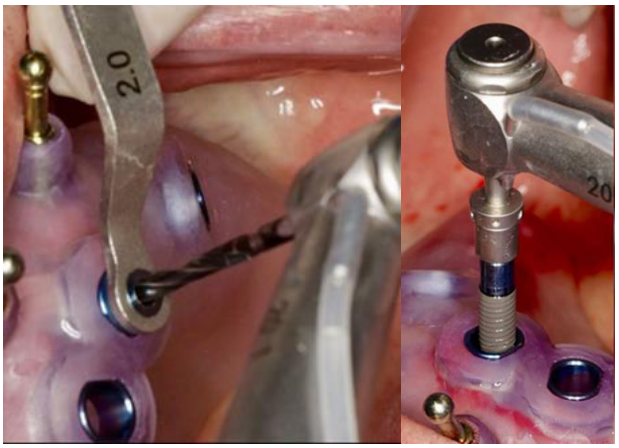


Figure 8 – Surgical technique. A. Flapless instrumentation using the surgical guide. B. Installation of the implants through the sleeves.

After removing the surgical guide, the abutments were confirmed using the GM abutment selection kit (Figure 9A). The abutments planned in the software were confirmed and installed (Figure 9B).

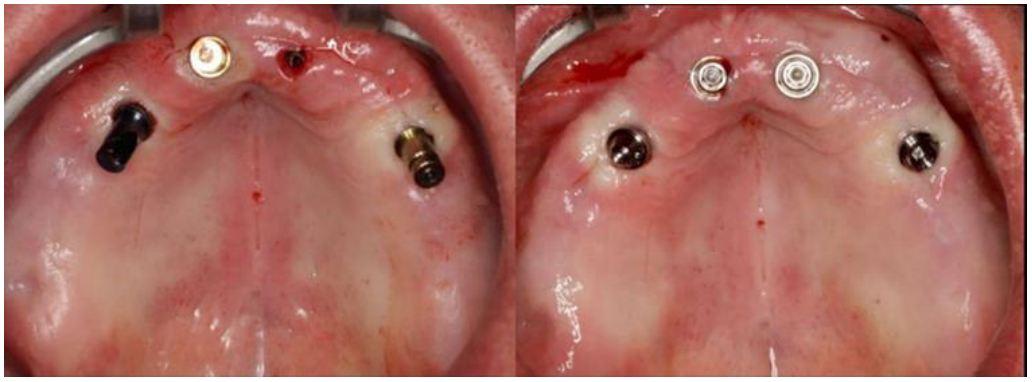
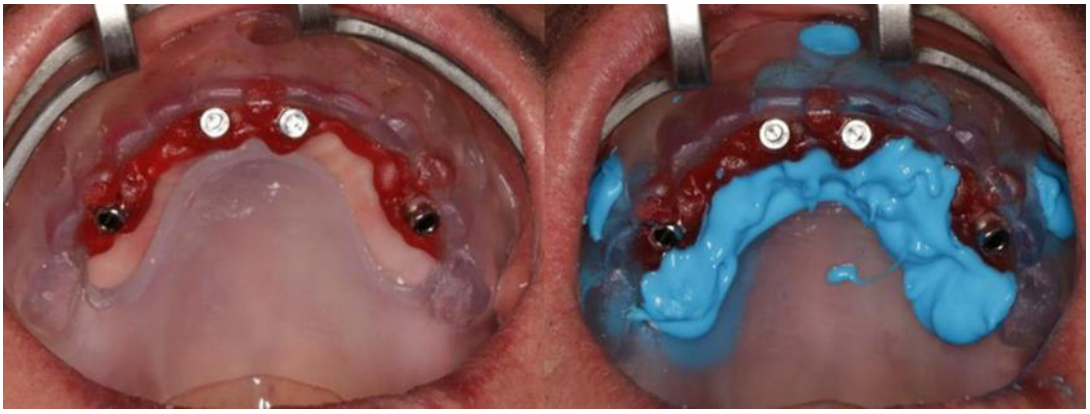


Figure 9 – Abutments installation. A. Confirmation of the abutments using the GM abutments selection kit. 9B – View of the surgical area with all the abutments installed.

For the impression, the transfers were installed with prosthetic short screws, and the multifunctional guide was connected to the transfers and the guide using pattern

resin (GC LS, GC America, Alsip, USA) (Figures 10A and 10B).



Figures 10 – Prosthetic fase. A. Multifunctional guide in position connected to transfers with short prosthetic screws. B. Impression with lighted body addition silicone (Yller, Pelotas, Brazil).

Three occlusion points were made with pattern resin and lighted body addition silicone (Yller, Pelotas, Brazil) was used for impression. The patient was medicated with Amoxicillin (500 mg, 8/8 hours for 7 days), Ibuprofen (600 mg, 12/12 hours for 4 days) and Dipyrone (1g, 6/6 hours for 3 days).

After 48 hours, the maxillary implant-supported hybrid dentogingival prosthesis was installed, and a panoramic radiograph was taken (Figure 11) showing total adaption of the prosthetic cylinders.

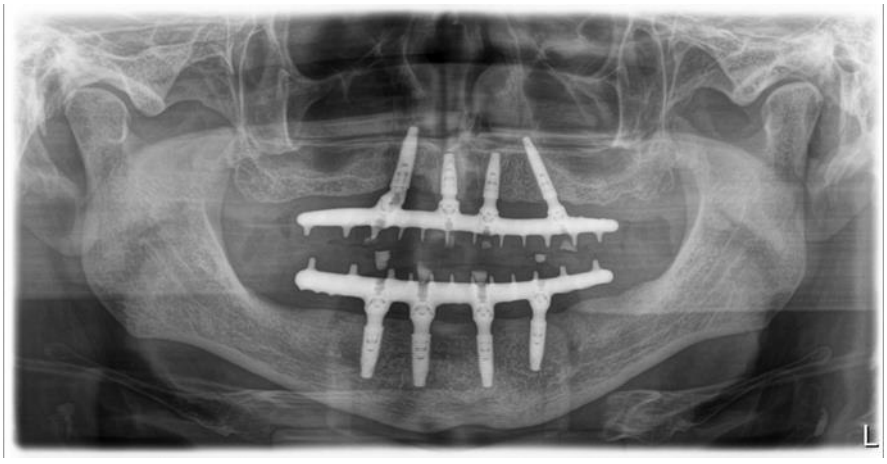


Figure 11 - Panoramic radiograph after treatment.

Also, a postoperative CBCT was performed to evaluate the positioning of the implants (Figure 12). The patient was followed up after 20 days (Figure 13).

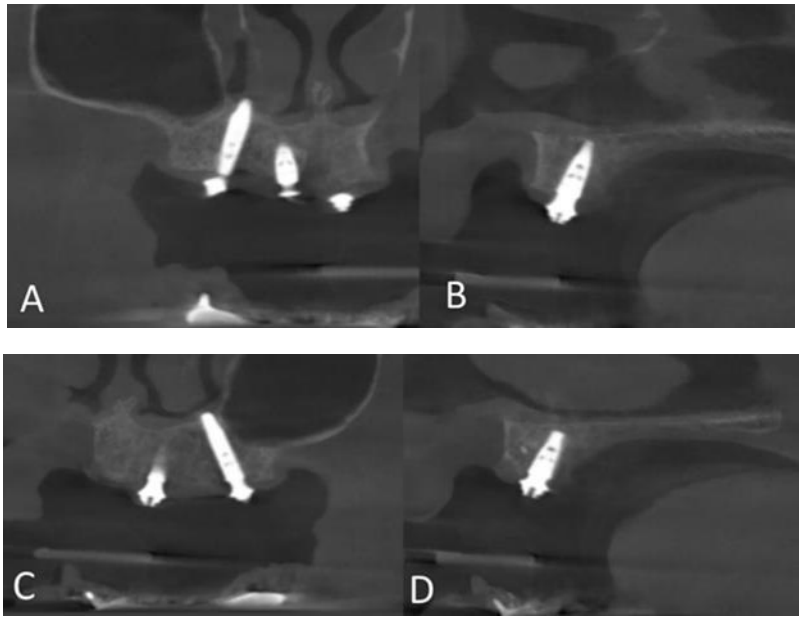


Figure 12 – Postoperative CBCT. Tomographic sections showing the implants in regions 15 (A), 11 (B), 21 (C) and 25 (D).

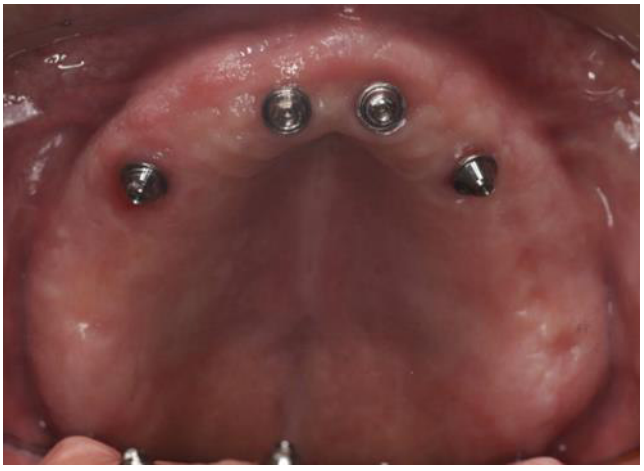


Figure 13- Twenty-day postoperative follow-up.

After treatment the patient related total satisfaction with the esthetic and prosthetic function (Figure 14). It was indicated the need of follow-ups and the hygiene maintenance.

Figure 14 – Facial aspect of the patient after treatment.

DISCUSSION

Virtual guided surgery for dental implants guarantees great precision to the surgeon, making it possible to operate on complex patients with compromised health, who require less surgical time[6,7]. With good planning and the necessary care, the final result of the treatment becomes predictable and safe.

The increasing development of technology in oral surgery has made it possible to perform surgical procedures more efficiently. This is especially true for patients who are completely edentulous, who dream of having their teeth fixed again, but this could not be done, as they would have to undergo major reconstructive surgery and then the placement of dental implants.

According to the literature[4], reconstructive procedures in maxillary defects have high success rates when an accurate assessment is performed, adequate surgical technique is used, and correct management is used in the pre- and post-operative period. It is indicated to regenerate bone in areas of great atrophy, ensuring the stability and success rate of the implant, corroborating the study by La Monaca G et al[8].

Despite being a predictable technique, the reliability of the procedure depends on the anatomical and technical knowledge of the surgeon, as well as the available resources and time[9].

Therefore, the combination of technologies such as planning software together with good tomography and correct diagnosis, allows rehabilitation in complex patients, through guided virtual surgery[8,9]. This advanced technique delivers a reliable and precise result, reducing healing time[7] and increasing the success rate of the dental implant and its osseointegration.

However, it is important to emphasize that there are limitations and challenges in the guided technique, since the quality of the 3D prototype and the surgeon's knowledge regarding planning can affect the final result[11,12]. Together with correct diagnosis and good planning.

FINAL CONSIDERATIONS

Based on the experience gathered in conducting this case, it is reasonable to conclude that the use of surgical digital flow in full arch rehabilitations with dental implants, transfers the correct positioning of the implant, ensuring the success of the treatment. In addition, it reduces surgical time, being minimally invasive, providing comfort, precision and safety during and after surgery, which is of great importance in complex cases.

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