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Usefulness and Reliability with CT-guided Surgery to Rehabilitate an ASA-III Patient: a clinical case report

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Abstract

Purpose: to evaluate safety and effectiveness of a CT-guided surgery implant placement with flapless technique and immediate functional loading in an ASA-III patient.

Materials and methods: this clinical case report involved a 74-year-old ASA-III patient. His hopeless teeth were extracted and a restorative evaluation was provided as prosthetic reference. Surgical procedure was based on flapless technique that let us to use local anesthesia. We used an All-on-4® concept restoration for maxilla and conventional fixed prosthesis procedures for jaw's rehabilitation. We placed four tilted implants in the upper maxilla and six right implants in the jaw. Implants were loaded with a provisional prosthesis the same day of surgery. Five months later, provisional restoration was removed; we placed into the ceramic crowns two frameworks, developed via a CAD/CAM technology.

Conclusions: CT-guided surgery is a minimally invasive technique that allows, through a flapless approach, safer and more predictable procedures. In this case we achieved accurate implant placement and precise fit of restoration with natural looking appearance; this patient-oriented-treatment led to a reduced healing time with better compliance.

Keywords: dental implants, flapless technique, CT-guided surgery, ASA-III patient

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INTRODUCTION

Implant surgery has markedly changed overtime following improvements in computer technologies. All patients treated in a department of Special Oral Pathology require particular care and special anesthesiological and surgical strategies. The majority of those patients has multiple risk factors and is at high risk for treatment-related complications. ASA-III patients who receive a dental surgery treatment have a significant anesthesiological risk management related to their different physical status risk (1,2). The choice for anesthetic technique is mainly influenced by all the existing preoperative medical conditions. Despite that, it is necessary that patients receive an adequate restoration of their pathological dental status. Those patients should be rehabilitated via implant surgery associated with fixed prosthesis, without increasing of morbidity and mortality. Nowadays the surgical approach to implant surgery follows a faster and minimally invasive protocol: the flapless technique increases the success of immediate loading due to preservation of the periosteum and blood supply and is able to reduce the postoperative discomfort for patients (3,4,5).

CASE PRESENTATION

A 74-year-old female, was referred by a local private dentist for an implant evaluation (Figure 1a) because of her medical condition; we examined her medical history and classified the patient as an ASA-III. Her oral hygiene wasn't good and she was a former smoker until five years ago (30 cigarettes per day) (Figure 1b). Active periodontal disease was present in different sites of her remaining teeth, as showed by periodontal diagnostic test. Moreover, pre-existing prosthetic bridges were damaged with considerable misfitting.

Patient Characteristics:

- Severe systemic disease with significant cardiovascular (CV) risk factors (hypertension, angina pectoris, chronic obstructive

Figure 1. a-b. Clinical Situation before Implant Treatment

bronchopneumopathy) and diabetes mellitus Type II;

- ASA-III and ORA (Oral Risk Assessment)-IV (this patient is characterized by a high risk in case of extractions or complicated procedures);
- Presence of teeth with unfavorable long-term prognosis;
- Severely reabsorbed maxilla;
- Informed consent of patient;

In the pre-surgical assessment, we evaluated the absence of:

- acute infections at the implant site;
- severe bruxing or clenching habits;
- any treatment with therapeutic radiation to the head within the previous 12 months;

(Figure 2 a-b).

Surgery required computerized tomographic scans. The patient, understood the protocol, the follow-up oral hygiene maintenance and finally gave written informed consent. The purpose was to place implants with a torque of 40Ncm in order to achieve a good primary stability and to avoid micromotions of the lever that could reduce osseointegration.

Pharmacological treatment before surgery

Before surgery's treatment, the patient was given antibiotics for prophylaxis:

- 2 g of amoxicillin and clavulanic acid three days before the surgery, to be continued for a further 4 days.

Every day for fourteen days after the surgery we prescribed:

- 0.2% chlorhexidine digluconate and 3% hydrogen peroxide, mouthwash.

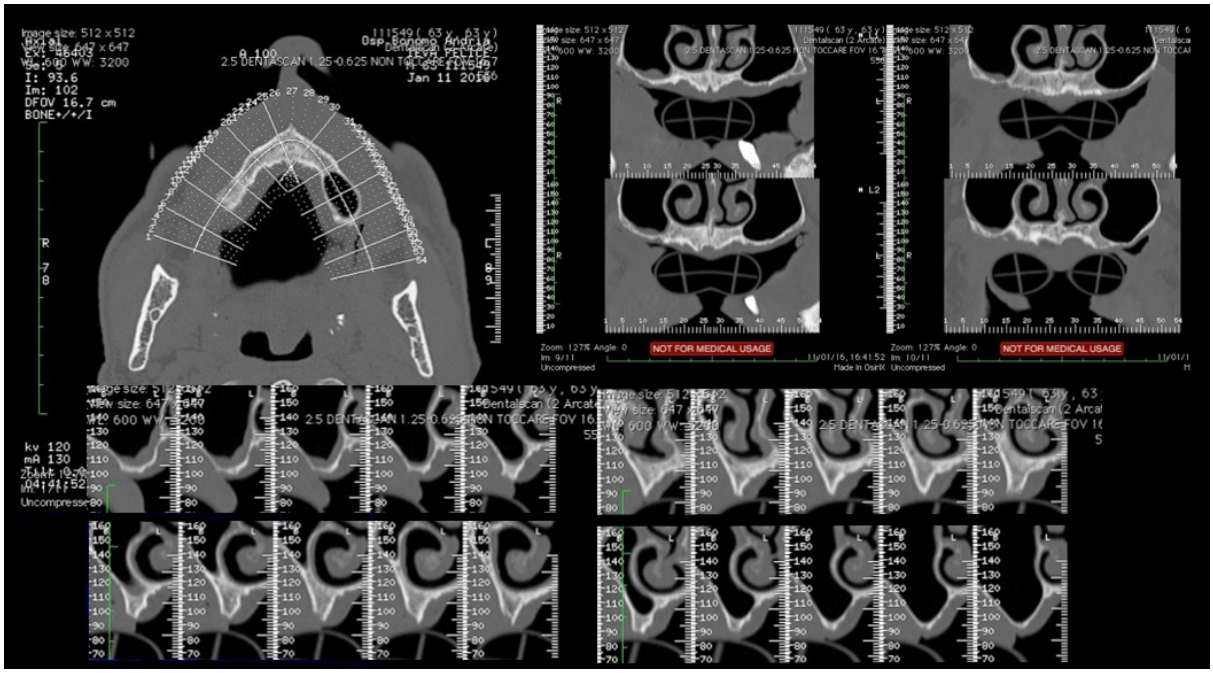

Figure 2a. Maxilla's CBCT Implant Evaluation after Tooth Extractions

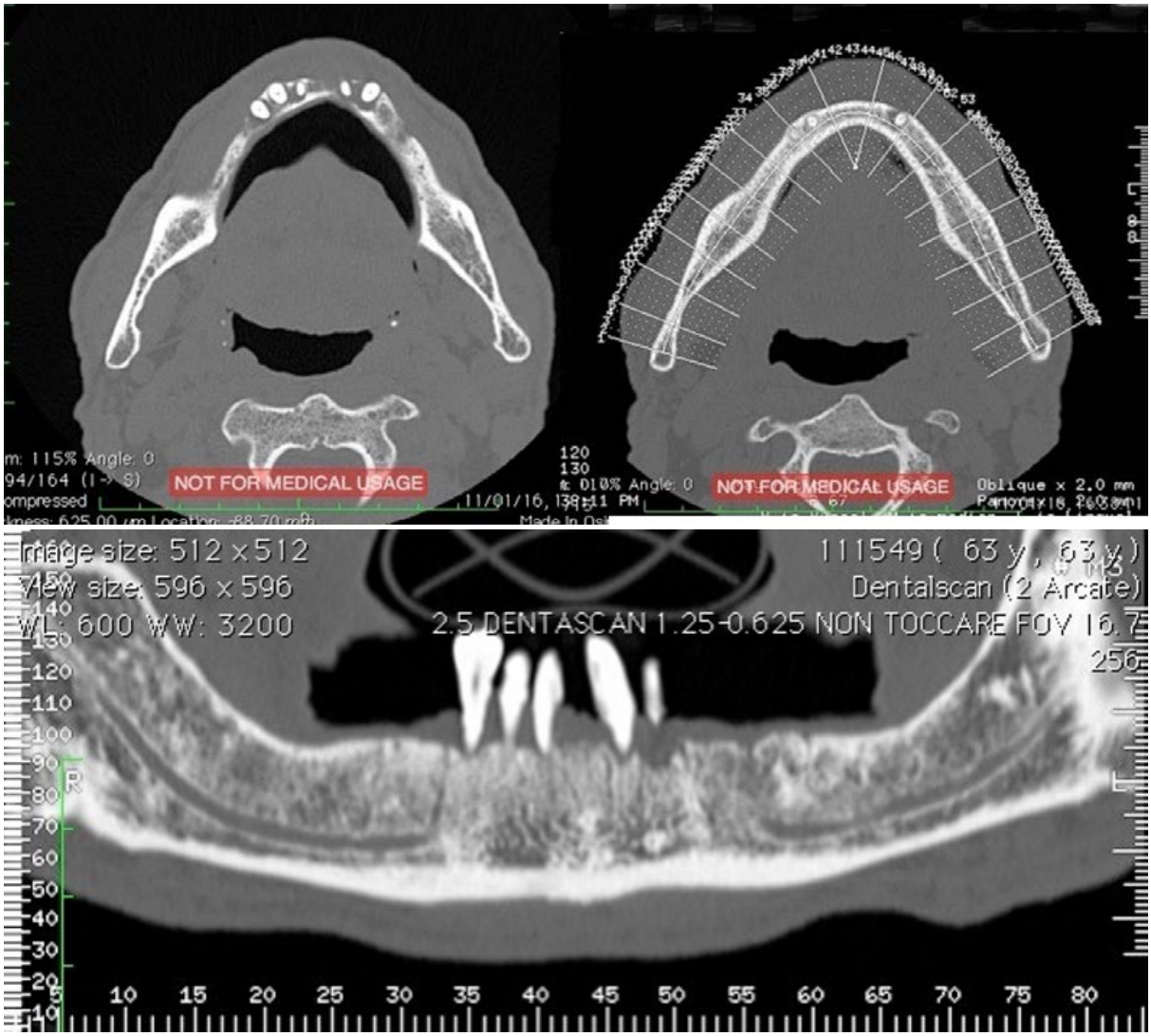

Figure 2b. Maxilla's CBCT Implant Evaluation after Tooth Extractions

Computer-guided software protocol

A simulation software processes DICOM (Digital Imaging and Communication in Medicine) data coming from CT Scan and creates a virtual pre-operative accurate plan for implant placement (6). Those analyses are related to a radiological template needed to evaluate the best choices for abutments and provisional prosthesis (7,8); the same scanning is useful to evaluate: future implant sites (9), to minimize possible damages to anatomic structures, to plan a better use of available bone thereby reaching the best implant stability (10,11). (Figure 3)

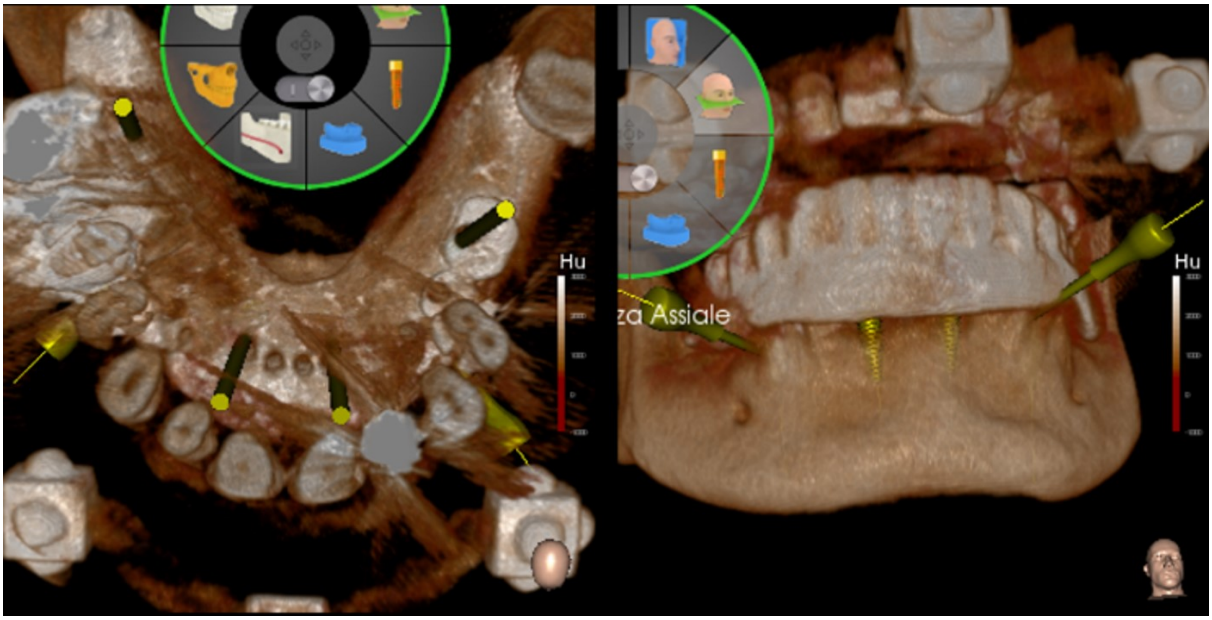

Figure 3. Virtual Pre-Operative Plan for Implant Placement

Subsequently all these virtual operations have to be accurately transferred to the patient via a stereolithographic surgical guides (12). Surgery with drill guides was shown to improve the accuracy of implant placement (13, 14, 15, 16, 17, 18) and this technique is specifically recommended for complex surgical procedures.

CT-guided surgery approach

First of all, patient's dental aesthetic was evaluated, in accordance to the surgical procedures and prosthetic rehabilitation. We accurately studied: length and shape of prosthetic teeth, physiological occlusion and correct phonetic, teeth exposure when patient spoke and laughed and finally relationship between teeth and gum contour. A polyvinyl siloxane bite registration was taken. The procedure was performed under local anesthesia during continuous anesthesiological assistance (respiratory rate, puls oximetry, CO2 capnography, ECG and non-invasive arterial pressure assessment).

Hopeless teeth were extracted and inferior premolar extraction sockets were treated with a guided bone regeneration (GBR) procedure using heterologous bone. Sixty days later the patient was reexamined. We took the impressions of both upper and lower arches, models were mounted and a wax-up was constructed. Preexisting patient's prosthesis was drilled with a number eight round bur, at ten different points to a depth of 1mm, positioned at a different level from occlusal plane and filled with gutta-percha: these markers placed in the old prosthesis served as radiographic guides when the double-scan protocol with a cone-beam CT scanner was applied. The scans were matched by the NobelClinician® software, and patient's anatomy was combined with radiographic guide

scans. The procedure allowed a more predictable and precise implant-location, according to a prosthetic-driven treatment planning. All implants were located with a flapless technique, that minimized postoperative pain and shortened healing time.

Upper maxilla implants placement (Figure 4 a-b):

- in the anterior zone we placed two implant (ø 3,5mm x length 10 mm).
- in the posterior zone we placed a two 35 degree angle implant (ø 3.5 mm x length 10 mm).

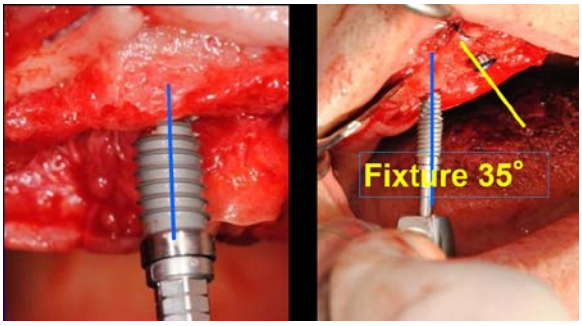

Figure 4a. Upper Maxilla Implants

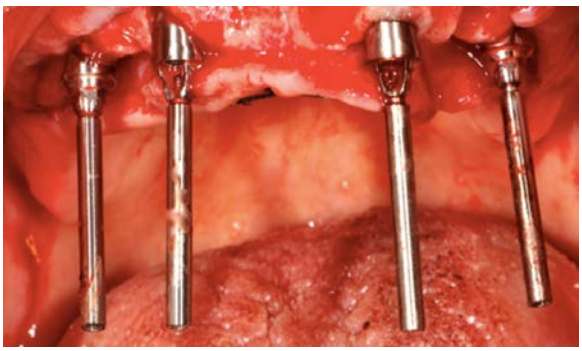

Figure 4b. Complete Fixture Insertion and mounter M.u.A. for the disparallelism correcting

Jaw's implants placement (Figure 5 a-b):

- intraforaminal implant were both off angle: on the right (ø4,3mm x length 10mm), on the left (ø4,3mm x length 15mm).
- in premolar regions two right implants: on the right (ø4,3mm x length 11,5mm), on the left (ø4,3mm x length 11,5mm).
- in molar regions other two right implants: on the right (ø4,3mm x length 11,5mm), on the left (ø4,3mm x length 11,5mm).

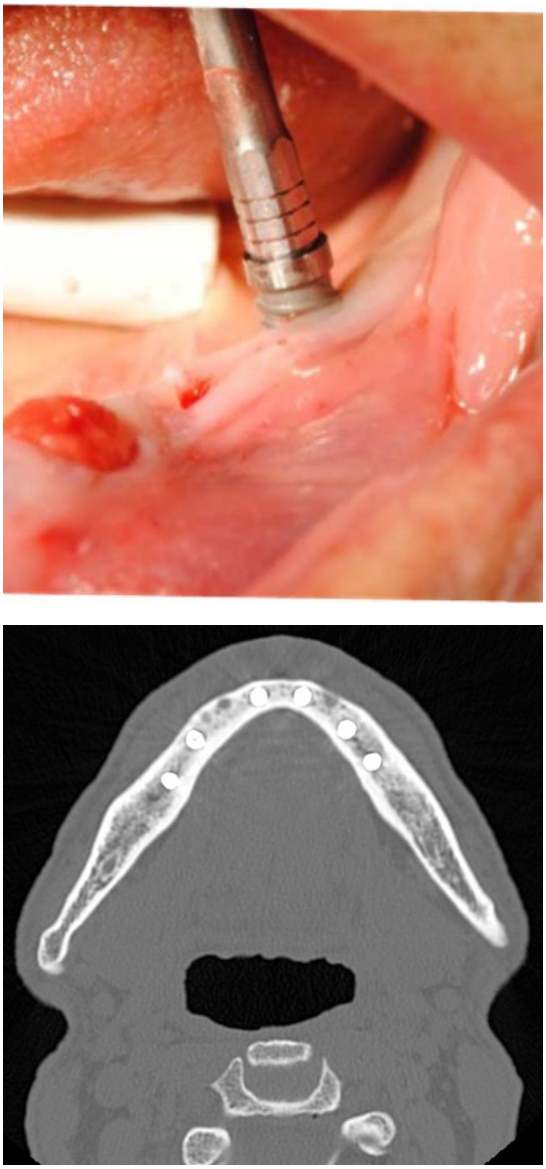

Figure 5a-b. Jaw's implants placement

All implants achieved 40 N/cm in torque. All implants were connected with respective titanium Non-Engaging temporary abutments; impressions copings were placed onto the implants and made an impression to fabricate a working model. We placed a plastic mold for temporary restoration filled with polyurethane cements (Figure 6 a-b).

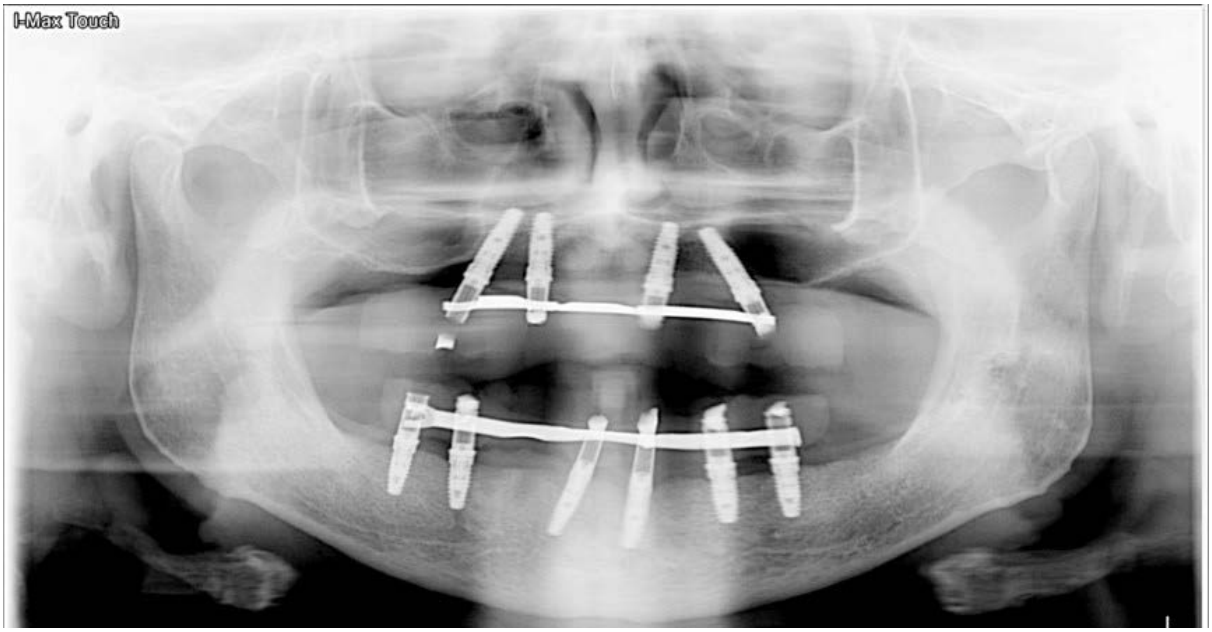

Figure 6a. OPT Radiography after Implant Placement

Figure 6b. Placement of Immediate Temporary Prostheses

Seven months later, permanent restorations were fabricated using Procera® Implant Bridge (PIB) (a CAD/CAM technology Ti Framework). The PIB was connected to the implants with abutment screws to 35Ncm. Procera® Implant Bridge (Nobel Biocare®) consists at the one-piece

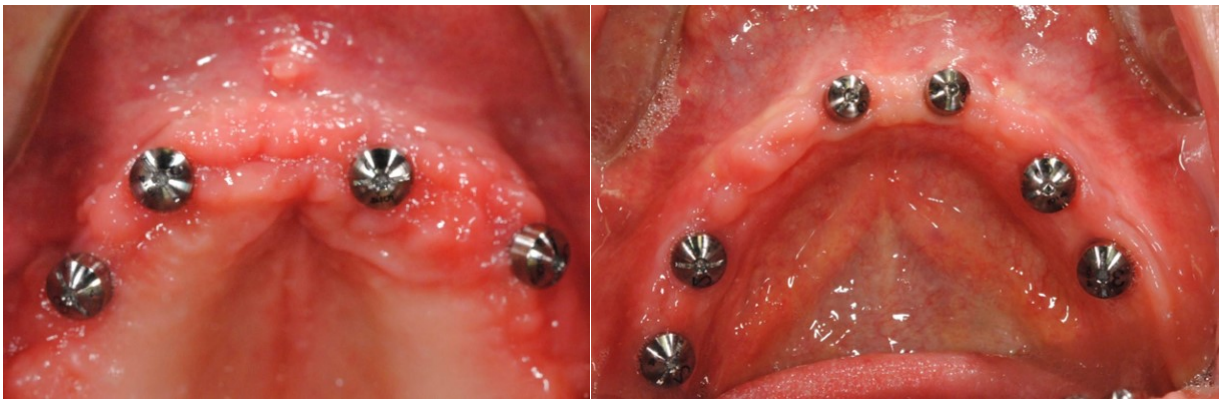

Figure 7a. Clinical Situation 6 months after surgery

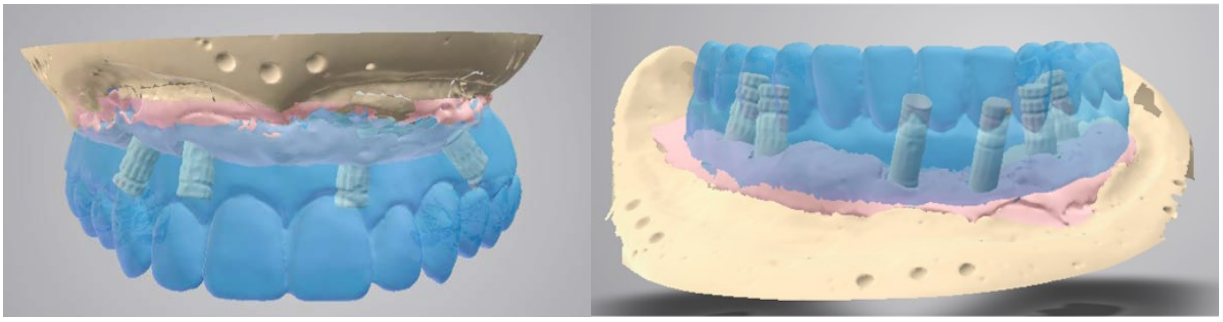

Figure 7b. Laboratory Work and CAD elaboration

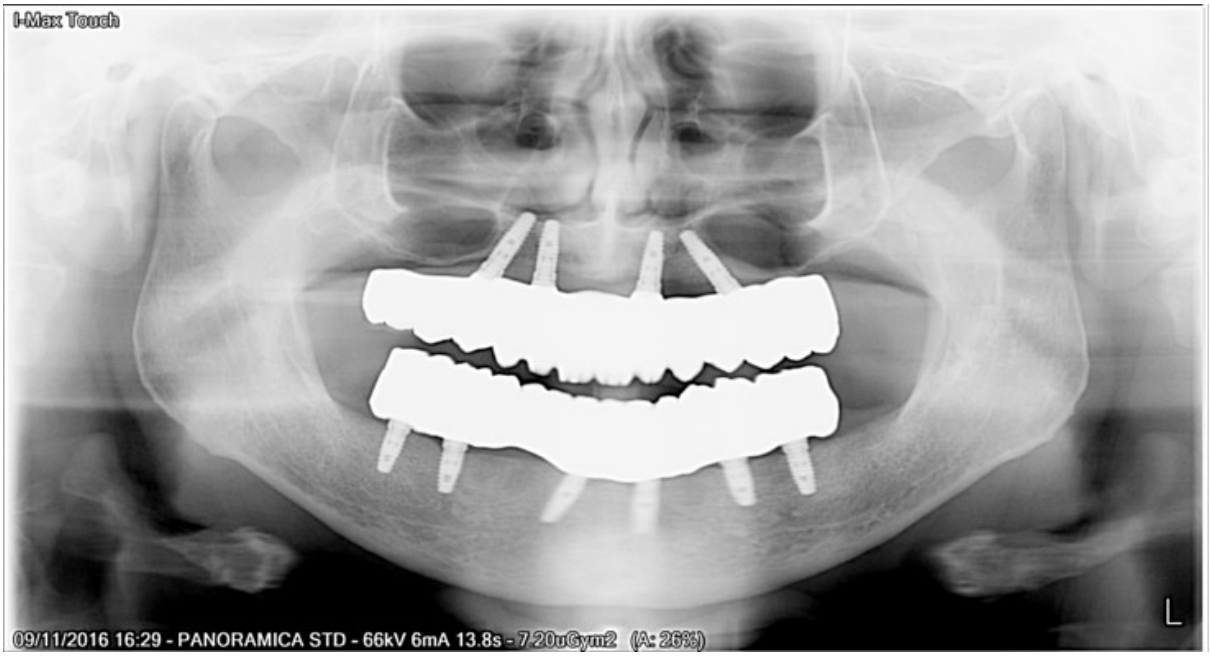

Figure 7c. Radiography Final Result before 8 months

Figure 7d. Clinical Final Result before 8 months

machined titanium substructure and the carbon-fibered framework; this kind of framework was fabricated thanks to CAD/CAM technology, created with a bar designed into ceramic prosthesis. Maxilla rehabilitation consisted of All-on-4® concept prosthesis whereas conventional fixed prosthesis procedures were used for jaw (Figure 7 a-b-c-d).

DISCUSSION

We report the case of an ASA-III patient who successfully underwent CT-guided surgery implant placement technique. The surgical procedure was well tolerated by the patient and no complications were observed during follow-up with results achieved within six months. Oral surgical procedures to treat ASA-III patients generally require conscious sedation or general anesthesia (19).

However, contraindications to those treatments are known and have been reported in several scientific papers. In this case the flapless technique allowed us to use local anesthesia. This is a fundamental advantage that can potentially quicken the healing process via a minimally invasive technique.

CONCLUSIONS

Patients with severe systemic disease and functional limitations always necessitate a specific surgical protocol. In this case report was shown how an ASA III patient can be treated with mini-invasive surgical procedures.

An accurate and reliable treatment planning was achieved via cad-cam technologies. CT-guided surgery and its minimally invasive techniques allowed safer and more predictable procedures.

Thus was achieved a higher accuracy of implant placement and provided precise fit of restoration with natural looking appearance; a patient-oriented-treatment can help to reduce healing time and morbidity and to get the best compliance of the patient.

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Conflict of Interest Statement: The authors declare that they have no conflict of interest.

REFERENCES

1. Jackson DL, Johnson BS. Conscious sedation for dentistry: risk management and patient selection. Dent Clin North Am 2002; 46(4): 767-780.

2. Jastak J.T., Peskin R. M. Major morbidity or mortality from office anesthetic procedures: a closed-claim analysis of 13 cases. Anesthesia Progress 1991; 38(2): 39-44.

3. Campelo LD, Camara Jr. Flapless implant surgery: a 10-year clinical retrospective analysis. Int J Oral Maxillofac Imp 2002; 17(2): 271- 276.

4. Becker W., Sennerby L. Minimally invasive flapless implant surgery: a prospective multicenter study. Clinical implant Dentistry and Relate Research 2005; 7: s21-s27.

5. Fortin T., Blanchet E. Effect of flapless surgery on pain experienced in implant placement using an image-guided system. Int J Oral Maxillofac Implants 2006; 21(2): 298-304.

6. Sarment D.P., Clinthorne N. Accuracy of implant placement with a stereolithographic surgical guide. Int J Oral Maxillofac Implants 2003; 18(4): 571-577.

7. Luciani F., Papa E., Leggeri A., Calabrese C, Coniglione F., Calabrese L. Diagnosis and Treatment Planning in Oral Surgery using Cone Beam Computed Tomography (Cbct): A Narrative Review". International Journal Of Clinical Dentistry 2022; 15(4):795-820.

8. Fortin T., Coudert J.L. Precision of transfer of preoperative planning for oral implants based on cone-beam CT-scan images through a robotic drilling machine: Clinical Oral Implants Research 2002; 13:651-656.

9. Homolka P., Birkfellner W. Bone mineral density measurement with dental quantitative CT prior to dental implant placement in cadaver mandibles: Pilot study. Radiology 2002; 224:247.

10. Kopp K.C., Abdo O.S. Predictable implant placement with a diagnostic/surgical template and advanced radiographic imaging. J Prosthet Dent 2003; 89:611.

11. Harris D., Dula K. E.A.O. guidelines for the use of diagnostic imaging in implant dentistry. A consensus workshop organized by the European Association for Osseointegration in Trinity College Dublin. Clinical Oral Implant Research 2002; 13:566.

12. Arisan V., Ozdemir C.Z. & T. Implant surgery using bone- and mucosa-supported stereolithographic guides in totally edentulous jaws: surgical and post-operative outcomes of computer-aided vs. Standard Techniques;

Clinical Oral Implants Research 2010; 21:980-988.

13. Ottria L., Luciani F., Piva P., Alagna A.M., Arcuri C., Bartuli F. The Flap Recovery On The Impacted Lower Third Molar Surgery Comparing 3 Different Flap Designs: A Clinical Study Oral&Implantology 2017; (10)3: 270-275.

14. Ganz SD Use of stereolithographic models as diagnostic and restorative aids for predictable immediate loading of implants. Pract Proced Aesthet Dent 2003; 15(10): 763771.

15. Ganz SD Presurgical planning with CT-derived fabrication of surgical guides. J Oral Maxillofacial Surg 2005; 63(9 SUPPL 2): 59-71.

16. Ganz SD Techniques for the use of CT imaging for the fabrication of surgical guides. Atlas Oral Maxillofacial Surg Clin North Am 2006; 14:75-97.

17. Koyanagi K. Development and clinical application of a surgical guide for optimal implant placement. J Prosthet Dent 2002; 88(5): 548-552.

18. Van Steenberghe D., Van Cleynenbreugel J. et al. Accuracy of drilling guides for transfer from three-dimensional Ct-based planning to placement of zygoma implants in human cadavers. Clin Oral Implants Res 2003; 14:131.

19. Cecchetti F., Luciani F., Bramanti E., Bartuli F.N., Ottria L., Arcuri C. Cemento-Ossyfying Fibroma Juvenile of the Oral Cavity. Oral&Implantology 2010; (3)1: 32-37.