

The use of stereolithographic surgical templates in oral implantology



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AIM: *The aim of this report is to analyze how to obtain a truly immediate loading in complete edentulous patients, using a dedicated software that provides beforehand both the information for a guided implant placement and the creation of a temporary prosthesis.*

MATERIAL OF STUDY: *A CT scan was taken with a complete radiopaque scan prosthesis; CT data were imported in the software to plan the exact position of the implants. Following these guidelines a mucosa-supported surgical template was developed. A flapless implant site preparation was performed. 22 implants were placed in a complete edentulous patient. The abutments were positioned and the impressions for the final restoration were taken. The patient received immediately the temporary prosthesis that was prepared prior to the surgery in the dental laboratory.*

RESULTS AND DISCUSSION: *Due to the flapless surgery, post-operative swelling and pain are limited. The computer-aided planning and the template guided surgery allow us to place a temporary fixed prosthesis within hours and an aesthetic and functional final restoration within some days.*

KEY WORDS: Computer-aided implantology, Immediate loading, Stereolithographic surgical guide, Surgical template

Introduction

In the last 30 years, the use of dental implants proved to be a valid alternative in treating partially or totally edentulous patients¹⁻⁴, but many of those who were eligible for this therapy preferred other treatment options despite the high success percentages and the esthetically satisfying results⁵⁻⁷. Frequently patients refuse a possible implant-prosthetic rehabilitation because of the

long waiting time for the fixed prosthesis delivery, or when eventually it is not possible to use a traditional mobile prosthesis due to the various problems that may arise during this waiting period⁸. The use of a "one step" surgery^{9,10} and the introduction of an immediate loading protocol determine a better approach of the patients to the implant therapies giving esthetically and functionally satisfying restorations with a drastic reduction of time^{11,12}. Nowadays we know that osseointegration is possible even in presence of functional loads applied immediately after the implant insertion, as long as the implant is not overloaded¹³. Literature unanimously sustain that the interface protection is a determining factor to obtain osseointegration and besides, the primary stability, associated to implant protection from overloading, constitutes an essential requisite of immediate loading¹³⁻¹⁵. The aim of this study is to show how it is possible to realize, in implant prosthetic restorations of completely edentulous patients, a tem-

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porary implant supported prosthesis before surgery, reaching a real immediate loading, using common and well known techniques together with the advantages offered by data elaboration of CT scans ¹⁶⁻³⁰.

Materials and Methods

A 45 years old male, completely edentulous, required a fixed implant-supported prosthetic rehabilitation. The patient did not present systemic health problems, para-functional habits, poor oral hygiene, severe alveolar bone deficiencies (absence of alveolar bone needed to allow the insertion of at least six implants with minimum length of 11.5 mm and diameter 3.75), uncontrolled diabetes, current irradiation to the head or neck, psychological disorders and alcohol or drug addiction. The patient underwent a CT-Dentascan wearing a “scan prosthesis” (Fig. 1). This is a removable radiopaque prosthesis realized by the dental technician according to the wax up or duplicating the removable prosthesis of the patients realized following correct inter-maxillary relationship.

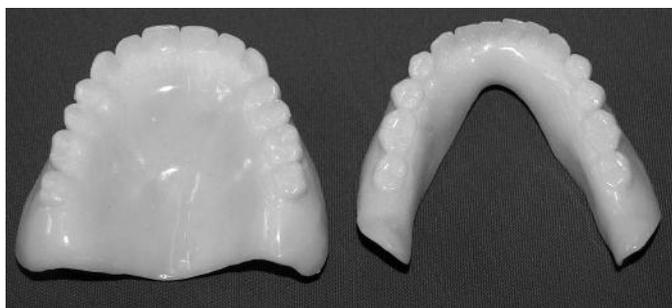


Fig. 1: The scan prosthesis of the upper and lower jaws.

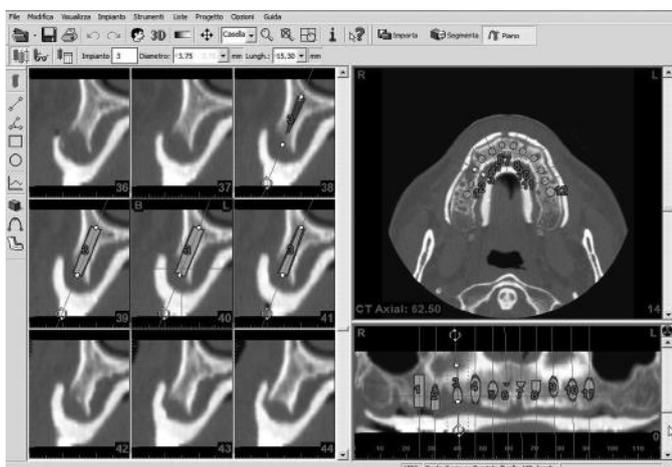


Fig. 2: Treatment planning and virtual implant placement using SimPlant software and CT scans, according to bone anatomy and prosthetic design. In a single time it is possible to obtain axial, ortho-radial and panorex scans.

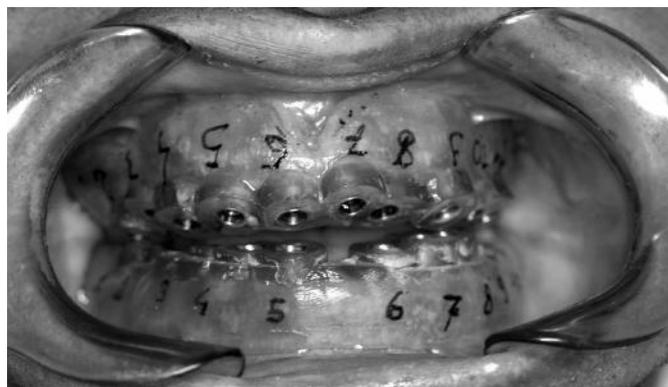


Fig. 3: The stereolithographic surgical templates before surgery.

The Scanno-Guide™ is the key of the entire procedure because it allows to transfer information of the initial prosthetic set-up to the X-ray step of implant planning, also consenting to evaluate the mucosa thickness. This implant planning is possible with the SimPlant Pro 12.3 software that allows to ideally position the implants considering the bone quantity and quality without neglecting biomechanical (bone characteristics, uni- or bicortical anchorage etc.) and esthetic evaluations. SimPlant gives us 2-D and 3-D images (Fig. 2).

The “virtual project” of SimPlant Pro 12.3 is then used to realize at least 3 mucosa surgical guides, with guide tubes of different diameters to accommodate the sequence of burs used for the implant site preparation (Fig. 3). The guide, realized with a stereo-lithographic procedure, contains stainless-steel tubes for medical use that guide the burs following the previously planned position and direction.

The SurgiGuide allows the optimal preparation of the implant site, but it can't be used for the implant insertion.

LAB PROCEDURE

One of the SurgiGuides is sent to the lab, possibly the one with the biggest caliber tubes. The dental technician, after connecting the transfer screws to the analogues through the steel tubes of the SurgiGuide, pours plaster inside the surgical template (Fig. 4). In this way surgery can be reproduced on the plaster cast that reproduces the maxilla. The result is a cast with holes where the analogues are positioned (“virtual cast”) (Fig. 5). This method gives to the lab sufficient information in order to prepare both milled prosthetic abutments and a temporary prosthesis. The temporary prosthesis (acrylic resin, metal or Carbonium fibers reinforced acrylic resin-made) has to be realized in order to allow a minimum of tolerance between the prosthesis and the implant abutments, in order to compensate the small deviation between pre-surgery implant planning and the final

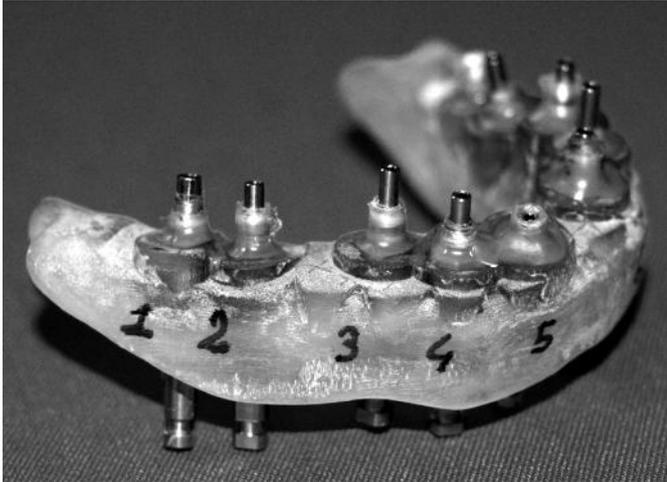


Fig. 4: The connection of the transfer screws to analogues through the steel tubes of the SurgiGuides.



Fig. 5: The upper "virtual cast".



Fig. 6: The site preparation and insertion of 12 implants using the flapless technique in a completely edentulous patients using a minimally invasive surgical technique ("one stage" surgery).



Fig. 7: The placement of abutments.



Fig. 8: The rebasing of temporary prosthesis using a self-curing acrylic resin. The implants are really immediate loaded.



Fig. 9: The post-operative orthopantomography.

implant position. The last step for the prosthesis development follows the surgery. Right after the implant insertion (Fig. 6), the abutments (Fig. 7) are positioned, and after checking for the absence of some eventual dis-parallelism, an impression for the definitive prosthesis development is taken. The temporary prosthesis is then rebased consenting teeth contact in a position of maximum intercuspation (Fig. 8). After the temporary prosthesis placement the occlusion was checked and every overload or misalignment was removed. The prosthesis was developed with sufficient interdental spaces to allow

optimal oral hygiene. In this way it is possible to reach a really immediate load allowing implant splinting and assuring optimal chewing, phonetic and esthetic function with a temporary prosthesis substituted by a metal-ceramic final prosthesis in a few days (Fig. 9).

Results and Discussion

Many Authors, regarding the immediate and early loading procedures, proposed different techniques for short-term prosthesis delivery, like rebasing and adapting previous bridges or making a new one quickly (right after surgery). This has been made for a long time but nowadays, with this new procedure, we are able to create prosthesis before the implant insertion, adaptable with slight changes. In order to reach these results some points have to be respected:

- to use validated scientific protocols and a software proven to be reliable;
- to be able to transfer implant position and angulation from virtual program to mouth having less than a millimeter accuracy;
- to be able to control implant depth;
- to use laboratory protocols with proven evidence in the international scientific literature;
- to be able to preserve the keratinized mucosa; mucogingival defects occur with great frequency when using mandibular surgical guides with a dedicated mucotome.

The scrupulous respect of all these requisites allows to achieve minimum difference between the real implant position and the planned one.

Conclusion

The described procedure proved to be really effective, allowing to face, in a single time, surgical and prosthetic phases and allowing to deliver the prosthesis to the patient immediately after the implant insertion. Using this protocol with a one-stage surgical technique, avoiding mucoperiosteal flaps and sutures, the periosteal vascular system is maintained intact without the risk of bone resorption ; furthermore pain and swelling are limited.

Riassunto

SCOPO DEL LAVORO: Lo scopo del presente lavoro è dimostrare come sia possibile effettuare, nelle riabilitazioni di edentulie complete, utilizzando un programma dedicato, una chirurgia minimamente invasiva con l'inserimento implantare guidato ed un reale carico immediato.

MATERIALI E METODI: È stata eseguita una scansione TC con una mascherina di scansione radiopaca; i dati della

TC sono stati trattati utilizzando il programma SimPlant Pro 12.3 che ha permesso di determinare l'esatta posizione implantare. Seguendo le indicazioni ottenute è stata costruita una SurgiGuide a supporto mucoso che ha permesso la preparazione del manufatto protesico provvisorio prima dell'inserimento di 22 impianti, con tecnica chirurgica trans-mucosa, in un paziente con edentulia completa del mascellare e della mandibola. Subito dopo l'inserimento implantare ed il posizionamento dei monconi protesici è stata rilevata l'impronta per la costruzione del manufatto protesico finale e consegnata la protesi fissa provvisoria precedentemente realizzata.

RISULTATI E CONCLUSIONI: Grazie alla tecnica chirurgica "flapless", il gonfiore ed il dolore post-operatorio sono ridotti. La tecnica di programmazione implantare computer-assistita e l'utilizzo delle mascherine SurgiGuide ci permettono inoltre di consegnare in poche ore una protesi provvisoria ed in pochi giorni una protesi definitiva nel pieno rispetto delle esigenze estetiche e funzionali del paziente.

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