Current Concepts in Guided Implantology Clinical Review of Two Case Report

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Abstract
The guided insertion of implants is part of the digital approach procedures for implant-prosthetic rehabilitation. It consists in the use of surgical templates through which osteotomies are performed and implants are inserted. The technique may vary depending on the implant system, providing for the use of drill holder keys or holders. The result is always to insert the implants in a position corresponding to that envisaged in a three-dimensional project carried out starting from the 3d images of the alveolar skeleton, to which the images relating to prosthetic devices present or object of the project can be associated, spatially oriented of clinician and technician. The diagnostic design process involves the registration of 3d datasets relating to the dentition and soft and hard periodontal tissues, the editing of a project and the production of tools necessary for the guided positioning of the implants. The aim of this work is to show the diagnostic-design-production process followed by our group and show the surgical results obtained. Despite the accuracy of the system and the obvious advantages of the technique, we believe that prospective and comparative studies still need to be carried out which sanction, once and for all, indications and critical issues without a shadow of a doubt the conclusion of a digital design cycle with guided surgery enhances the goodness, safety and usefulness of this new approach to the most delicate or problematic rehabilitations.

Keywords: Guided Implantology, Case Report, Diagnostic Flow, Current Concepts.

Introduction
Implantology, like all dental and medical branches in general, is also experiencing a period of rapid changes, I would like to say technological innovations, due to digital systems that are ready to modify all the therapeutic flow, from the collection of diagnostic data to the production of surgical and prosthetic devices and their assembly during the operating steps (Figure 1). Digital surgery, or rather digital technology, fits into a historical moment where two concepts reign supreme. FIRST: the implant is not a separate surgical unit that exhausts its purpose in integrating with the insertion bone site but it is part of a functional complex which also includes the prosthetic restoration and the periodontal unit to which both are inserted (the alveolar bone process and peri-implant gingival tissues). Therefore, any type of design approach will have to consider implant positioning according to all the components of the rehabilitation and not only the bone in which it is to be inserted (Figure 2). SECOND: the function of an implant does not consist only in supporting a dental element, but in guaranteeing a good level of biological, aesthetic and functional setting in order to guarantee full satisfaction of patient and clinical expectations. These considerations, in a broad sense the greater

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from analogical methods (physical plaster models mounted on the articulator. Prosthetic wax-ups and surgical, radiological templates for implant visualization on two-dimensional radiographs) to digital ones (stereolithographic models and 3D visual rendering, three-dimensional radiographic images). All this inevitably stimulated the clinician to spend more time on the computer viewing the case being treated [5] (Figure 3).

Digital then becomes the most efficient information system for the clinician. At all stages of the patient approach. The check-in, the collection of diagnostic data, the formulation of a treatment plan, the design, the production and, finally, the actual cure. By now consolidated and accepted evidence, the fact that the clinician was forced to adapt to a very articulated, standardized and binding cognitive-operational “flow”. In a sense, a sort of industrialization of the therapeutic path; industrialization which highlighted, in the original operating unit, the birth of “departments” such as an acceptance, a technical-design sector, a production unit (differentiated in most cases in the dental laboratory and milling center), and an “assembly sector” - the actual dental office (Figure 4).

Guided surgery (or rather guided implant positioning - as indicated in the Anglo-Saxon language), is part of the digital innovation of dental work. A rigid template provided with appropriately positioned holes guides the drill engaged in the preparation of the receiving alveolar site and, therefore, also the final positioning of the implant. The production of the coplanar template is based on three-dimensional drawings of the same relating to corresponding drawings indicating the certain position of the implants in the context of the alveolar bone planking in a 1:1 scale. This function of coupling and relativization of the position of the alveolar bone, implants and surgical guide, is obtained thanks to the use of dedicated software which provide to couple together the images relating to the bone structure, the patient’s dental structure, the
implants and to the Template itself which, in most cases, can be designated in the same environment that provides for the positioning of the implants. In this sense, the software is a sort of CAD (Computer Aided Design) platform, which in addition to the drawing functions provides the correct relative alignment of the components displayed there. The reproducibility of what is designed on the computer in the intra-oral environment is guaranteed by the support of the Template on the dental structures present or the alveolar bone process, details well visualized in the software design environment [6,7] (Figure 5).

The guided positioning of the implants should not be considered a separate technique, but an operational possibility to be chosen, in the context of a design diagnostic path aimed at functional rehabilitation of a dental sector. This statement

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**Figure 4:** Last approach work-flow and what changes from analogic to digital proceedings

**Figure 5:** An Overview of a guided Implant positioning approach from project to surgery
has two practical implications. FIRST: every digital design of rehabilitation always starts from a prosthetic project who reports the positioning of the implants that will act as support. SECOND: not necessarily a project of teeth supported by implants, it leads to an implant positioning through surgical guides.

In general, the surgical guides are used when the implants, either for the limited availability of alveolar support, or for an architecture of the same very special alveolar dare, or for particular positions that the prosthetic elements will have to assume with respect to the bone table itself? instead, in all cases of alveolar planks generous with regular architecture, will not be necessary to use of surgical templates. Relieving the patient of waiting times and additional costs. Another situation where it is advisable to resort to surgical templates is the one in which the implants are placed in close continuity with noble structures such as the lower alveolar nerve, the emergency foramina of the chin nerves, etc. etc. other considerations can be made in deciding whether or not to use surgical templates, including the experience of the operator, the position of the implants to be inserted, the degree of opening of the patient’s mouth. We will mention this in the following chapters in a more extensive way [8].

In this study we will analyze the technique of design, production and use of the surgical templates contextualized within two clinical cases. We will define its indications and clinical contraindications to use it, analyzing its strengths and weaknesses. We will see how among the major benefits of the guided method compared to the traditional one, there is the possibility of performing flap-less surgery even in the absence of large bone availability; this makes the surgeries much less invasive and the relative recovery times, very short, adapting well to times when the patient has less and less time available to devote to care and recovery. It also influences a lot in the amount of postoperative pain, clearly lower than in open field techniques, another factor that plays a key role in maintaining high patient compliance with current treatments.

Materials & Methods

Currently all patients who come to the observation are classified using digital acquisition, visualization and design systems. Not all cases of implant-prosthetic rehabilitation are conducted through the use of surgical templates for implant positioning. Given the activity carried out mainly in the surgical field, we have selected three groups of treatments that are subject to the use of digital protocols. 1) regenerative reconstructive surgery, 2) extractive resective surgery, 3) prosthetic-implant rehabilitation. In the latter, we use a digital approach for the initial and final design of the dental restoration, for the virtual positioning of the implants and for the architectural evaluations of congruity of the implant site. The guided positioning of the implants, as we will see, represents only a technical and operational moment that is part of an articulated procedure that goes from the first contact with the patient up to the delivery of the final prosthetic artefacts. The decision of using the templates for implant placement is made throughout the design diagnostic phase. As we illustrate the different operating steps, we will contextualize the selection criteria for the guided or non-guided positioning of the implants [9].

We believe that guided surgery should not necessarily be used for all cases of implant-prosthetic rehabilitation subject to daily clinical work. We have established inclusion and exclusion criteria to guide the choice towards guided insertion rather than the traditional one of the implants.

Inclusion Criteria: Upper and lower jaw // upper aesthetic sector with more than two contiguous sites to be rehabilitated // lower posterior sector in case of useful vertical availability less than or equal to 10mm // cases with excessive inclinations of the alveolar processes // cases of severe inconsistencies between the implant position and the final prosthetic restoration // cases in which a reconstructive surgery session is foreseen either bone or load on the soft gingival tissues.

Exclusion Criteria: Upper and lower jaw // reduced opening of the patient’s mouth // spatial inconsistencies due to the
required implant position (keep in mind that the Template includes passage holes or bushings that have a minimum preset diameter and that sometimes the proximity of two implants or their accentuated angular convergence prevents their correct juxtaposition) // availability of alveolar support exceeding the required for the correct spatial positioning of the dento-implant functional unit // insufficient economic availability of the patient (Figure 6).

The digitalized operational flow that we have developed for our clinical practice and which is currently the subject of teaching in the teaching activity foresees different phases that are obligatorily completed for each patient who comes to our attention. Let’s see a typical sequence:

1) **Check in**: Visit - anamnesis - physical examination - reason for consulting, clinical expectations and requests // impression taking both with analogical techniques (complete arches or full-mouth cases) and digital techniques (intraoral scanner) // registration of the usual bite // intra-extra oral photo dataset.

2) **Digital Processing Plan**: Processing of therapeutic sequences // recognition of critical data acquisition diagnostic data // list and mode of acquisition of diagnostic data // elaboration of the design strategy and of the flow of use of the software available.

3) **Acquisition of the Diagnostic Data Required**: Dental data // skeletal data // occlusal data // periodontal data.

4) **Prosthetic Project**: type of rehabilitation // type of connection to the implant system.

5) **Implant Project**: Number // position // size of the implant pillars.

6) **Reconstructive Project of the Implant Site**: Size and orientation of the alveolar process // measurement of muscle strength // measurement and characteristics of soft tissues [10] (Figure 7).

The acquisition of the diagnostic data will proceed only once ascertained A) the type of rehabilitation to be performed specifying the teeth-implant interrelation scheme B) the type of prosthetic restoration specifying the reinforcement structure and aesthetic part C) the connection to be used D) possible restoration temporary E) the methods of coupling between periodontal and bone dental images F) the need to build radiological stents that also act as temporary G) the possible contamination of the radiological images with metal artifacts present in the mouth. Once this is done, the necessary devices will be built and then traditional impressions, intraoral scans and cone beam radiological scans will be made.

In principle, the authors consider the project to be carried out after the acquisition of the diagnostic data, as the verification of the appropriate spatial and dimensional architectural correspondence of the three compartments that interact in recreating a functional dental unit: the prosthetic restoration, the periodontal unit of the site implant and the implants themselves. This congruity is sought starting from an ideal model where implants and alveolar support and prosthetic and soft tissue restorations assume predefined spatial and dimensional relationships, ensuring in principle the right amount of bone around the entire implant surface and the keratinized gingiva thickness and optimal area for the exercise of the correct seal function that the soft tissue tooth and implant stump must perform. In this concept we must look for the broader meaning of resorting to implant templates. When the physiological and functional space in which to implant a fixture decreases and therefore also the positional tolerance decreases accordingly, then the positioning template takes on its highest value. Proximity to noble structures, low amount of bone support or important architectural anomalies were the perfect indication for the use of the Template itself. The Template will also assume a great value for the execution of osteo-plastic levelers in case of non-congruous results of post-extraction healing. We will see a clinical case of use of the latter, simultaneously related to templates for implant positioning. The surgical guides are designed using cad technology. The work environment can be a dedicated cad software or a guided surgery software, where usually, there is a cad section specially optimized for the design of the templates making the flow very simple, through operating steps guided by the software itself. We will also show the use of a surgical template for the positioning of free gingival grafts in a plastic vestibule case.

Figure 7: Field of interest in data acquisition and rehabilitation design for both acquisitions and design steps we use to consider Restoration needed, implant site, implant to support restoration: at the end of the approach we’ll edit a list of what to do for each of the three fields of interest.
The production of the surgical guide takes place by printing or milling from blocks of various types of plastic materials (PMMA, PLLA, acrylic resins, etc. etc.). The surgical templates differ according to whether they use the residual teeth present in the arch (template with dental support), the oral mucosa of any arches (template with mucous support) or the alveolar process itself (template with bone support) as the locking means. The dental and mucous support templates allow to work in a flapless environment; usually used in cases where reductive alveoplastics or reconstructive phases of the alveolar process are not necessary. Bone-supported templates require the preparation of the site where they will be inserted. Mucous and bone-supported templates require their fixing by means of retentive pins / screws which ensure their stability during the packaging of the osteotomies for implant placement (Figure 8).

Guided implant surgery consists of the orderly repetition of phases that gradually lead to the creation of the implant site. The exact positioning is obtained by means of osteotomy drills which, by engaging the corresponding holes on the Template, will create the seat in the desired position. The passage of the drill inside the guide holes is mediated: sometimes from the use of guide keys that create an exact coupling between the drill shaft and the guide hole on the surgical guide. Special mounters coupled to the implant will allow insertion guided by the coupling of the router itself into the sleeves of the surgical guide (Figure 9).

The surgical phase includes a protocol identical to that for manual implant insertion, in the sense of preparation and condition of sterility of the operating field. A similar scheme for anesthesiological procedures whether it is a flapless technique or that the bone site is exposed. The positioning phase of the Template differs according to whether it is a Template with dental, mucous or bone support. Surgical transient osteotomies are performed. With cutters of predetermined length and increasing diameter (Figure 10).

Clinical Case # 1

A) Check-In: Female patient - 47 years - asks for full mouth rehabilitation on implants - results of dental reclamation of the upper and lower arches following caries on all the dental elements - wearer of upper mobile prosthesis and removable partial prosthesis lower - gingivitis state and poor oral hygiene - no systemic diseases affecting bone metabolism -

![Figure 8: Surgical guides and fixation system](image8)

![Figure 9: Guided Surgery typical set of instruments](image9)
non-smoker - no alcohol or drug intake // dental arches and prosthetic artefacts are made (Figure 11).

**B) Digital Processing Plan:** precision occlusal and positional reliefs - construction of complete removable temporary upper and lower arch - radiological stent relative to the final position achieved to obtain images of the skeletal structures already spatially oriented - cone beam execution with radiological stent - laboratory scan of models aligned with stents radiological - matching of all acquired 3d images - preparation of 3d models for design (Figure 12).

**C) Acquisition of Diagnostic Data:** The technical criticalities of prosthetic rehabilitation require absolute precision in the transposition of digital projects into clinical reality. Therefore, it was decided to resort to a stent for the acquisition of the 3d
radiological dataset. - dental data and data relating to the soft tissue asset are obtained from the impressions taken during check-in and from the digital extrapolation of the data relating to the dental arches of the temporary prostheses packaged as the first therapeutic action. - keep in mind that the radiological stent helps a lot in image matching operations in case of radiological datasets “contaminated” by scattering, even evident (Figure 13).

D) **Prosthetic Project:** in this case the prosthetic project was followed by production of two removable temporary prostheses for both arches, trying to bring what was recorded with a facial arch, Gothic arch and impressions during the check-in phase, until the final prosthetic reconstruction. The digital scans of the dental arches designed in this way it is used as a reference for the subsequent design phase (Figure 14).

E) **Implant Project:** obtained with classic software providing for the positioning of 7 implants for the lower arch (Figure 15).

F) **Implant Site Project:** in the case of the lower arch the site project will concern soft tissues; Given the need to perform
Figure 15: Case #1 implants design (a-b-c-d)

Figure 16: Case #1 guide production
an alveoplasty before placing the implants, we thought it is useful to postpone this phase until after the healing of the first surgical step for alveoplasty and implant positioning to be performed using a double surgery template.

G) **Production:** the removable temporaries were produced with traditional analogical methods. The surgical guides, on the other hand, were milled from solid using peek as a material (Figure 16).

H) **Surgery:** preparation of the operative site by drawing the median flap with para-median and distal vestibular discharges - insertion of the first guide and fixing with osteosynthesis screws - execution of the guided reduction alveoplasty - insertion of the second guide and fixing the first with prosthetic screws - insertion of the implants after osteotomies obtained with the systematic approach which provides drills with increasing diameter and predetermined length guided in place by means of bolts inserted in the guides of the surgical guide (Figure 17).

**Clinical Case # 2**

A) **Check-In:** male patient - age 54 - asks for rehabilitation in sector 4- results of dental reclamation of 44/45/46/47 occurred 6 years ago - wearer of removable partial prosthesis 44-47 - absence of gingivitis and good general oral hygiene - no systemic diseases affecting bone metabolism - nonsmoker - no alcohol or drug intake // dental arches and prosthetic artefacts are made (Figure 18).

B) **Digital Processing Plan:** gypsum models of the arches and temporaries - precision occlusal and positional reliefs - cbct radiological scan of bone structures - indirect matching of 3d images related to the dental, periodontal and bone compartments - preparation of 3d models for design.

C) **Acquisition of Diagnostic Data:** In this case, more than the implant positioning, the criticality detected was the soft tissue asset following an extraction technique that provided for the coronal repositioning of the mucous margin of the extraction rim. This caused the formation of a mucogingival line in the middle coronal position on the alveolar process. - a resin replica marked with radiopaque dots was used as a radiographic stent - the 3d images of the dental arches and soft texts were obtained from the original impressions scanned in the laboratory. - the matching was simple due to the completeness of the dental
arches and the absence of scattering at the level of radiological datasets (Figure 19).

D) **Prosthetic Project:** great attention to establish a priori the dimensions of the 4 single elements to be reconstructed, coronal-occlusal and (above all cervical) dimensions, useful for the periodontal evaluation of the implant site. Work performed by the clinician using software cad able to interpolate directly with the surgical management software for implant positioning.

E) **Implant Project:** Once the positions and dimensions of the required prosthetic restoration have been established, the design evaluation of the implant support is carried out. In principle, attempts are made to position the implants always aligned with the longitudinal prosthetic axis so that straight prosthetic connections can be used, reserving misalignments of the longitudinal axes to the inconsistencies of the resulting position of the implants. When a good correspondence has been reached between the position of the prosthetic restorations and the corresponding implants, this second design phase is considered completed (Figure 20).

F) **Implant Site Design:** In this case, given the position of the implant emergencies and the cervical support of the dental restorations designed, it was possible to verify the need for a vestibular repositioning of the mucogingival line, to be carried out by deepening the fornix and free gingival grafts taken from the palatine vault. Titanium guides were drawn on each cad which indicated the Palatine pick-up lines and the engagement position in sector 4. This will guarantee the final result expected during this design phase. Through this phase, we considered the rehabilitation project complete (Figure 21).
G) **Production** of sintered titanium for the guides of the gingival mucus surgery and peek for the milling of the surgical Template which, in this case, uses dental support (Figure 22).

H) **Surgery:** First surgical phase on soft tissues with classic scheme of incision and apical repositioning of the flap after checking the depth using the surgical template drawn - removal from the palatine vault after drawing from a surgical guide - positioning of the two grafts - positional control - insertion of the acetal resin protection masks - healing for 6 weeks and surgical phase of implant positioning according to the technique of the burs of increasing caliber and predetermined length inserted in the Template using appropriate drill guide keys (Figure 23).

**Discussion**

Writing a job on guided surgery after 13 years of clinical experience seemed right to us. To date, guided surgery is practiced in many fields. A striking case is orthopedics in orthopedics. This, in a certain sense, reinforces its scientific and technical value in a period like this in which surgery is increasingly taking on the connotation of exact and predictable science. In the dental field, where the activity is purely private and where, therefore, cultural and technical uniformity is less than that of the hospital environment, there is a slow and difficult procedural absorption. The object of schooling is the Odontologist. The management costs (only) apparently high, the need for schooling on dedicated software, combined with a real and objective executive difficulty, is delaying their spread in the clinical environment (we refer to the Italian case, although a similar situation exists in many countries of the European Asian and American area). Unfortunately, this modern technology must clash with the technical vanity of the operator who always considers himself able to perform correct implant positioning even “freehand” and therefore judging the guided procedure as unnecessarily expensive and delaying the normal course of therapies. It has been noted that this judgment,
almost an alibi to justify its non-use, also arises from the inability of clinicians to recognize and analyze their implant failures. If this were not so, one would realize that behind each failure there are evaluation errors or even the absence of the minimum assessments required on the congruity of the restoration-implant complex and on the relative architectural correspondence of the implant site. At the moment that these CRITICALITIES are recognized BEFORE undertaking any therapeutic action, of course, they can easily be avoided at least if not easily, at least profitably. The diagnostic design path that leads to the production and use of a surgical guide has always been very profitable and useful in this sense.

Efficiency, efficacy, speed and safety are the requirements that a therapeutic method must possess in order to define itself as modern.

1) **Efficiency**: Constant capacity of performance and responsiveness to one’s functions and purposes. Clearly the performance capacity or better the functionality of the surgical guide, is subject to the elimination of all possible procedural errors in the design, production and clinical use. This statement could also be read as a sort of direct proportionality between the technical development of the preparation of the artefact and its functionality as a transfer system from a virtual 3D environment to the real correspondent (therefore applied to the clinic) [11-13].

2) **Effectiveness**: The clinical results measured and compared with the virtual situation of the project indicate a decidedly lower mean linear and angular discrepancy in the case of guided surgery compared to that performed freehand (2). It is undeniable, after carefully considering this study, to recognize its full compliance with this very important requirement in the evaluation of a surgical technique.
3) **Rapidity:** It is not a prerogative of the guided approach to implant insertion. The sequence of cutters perhaps used in combination with holder bolts make it a lightning-fast insertion technique. The speed skills come out in extreme insertion conditions perhaps with limited availability and with extreme architectures of the bone support (reabsorbed alveolar processes or with marked horizontal deficiencies) in these cases the need not to draw access flaps to better view the site (as it happens in case of traditional insertion) positively influences the general duration of the surgical phase.

4) **Safety:** It is evident that the safety of the guided insertion is re-evaluated with respect to the risk of infringements of noble structures such as the alveolar nerve, the maxillary sinus etc. etc. In this sense we can see the modernity of the methodology in that it responds to the parameters with which the modernity of a surgical technique is classically evaluated [14].

Reproducibility of 3d reconstructions: why is surgery done? This is one of the questions that the author most often hears students ask during lessons. Guided implant insertion is used when, for anatomical and architectural situations, the planned one is recognized as the only technically acceptable solution; therefore in those cases in which the room for maneuver” within which implants must be placed and teeth supported by these supported, it turns out to be really tight. And not respecting it would be tantamount to predicting a certain aesthetic and functional failure in the term margin of maneuver, one can understand everything: limited availability of bone support; extreme dental architectures; particular periodontal assets. And given that digital design is able to intercept all these critical issues and stem them with adequate technical drawings, it would not make sense, at least in these cases to stop at the mere visualization of the problem and the safe solution, when a surgical guide represents a means of transposition sure of the virtual project in a material execution of the same, leaving aside to speak of the precision of the guided systems, precision already widely validated by the international literature on the subject. So in the precise and reliable reproducibility, we find the primum movens that pushed us and will always push us towards a growing optimization of the processes that lead to clinical use in the operating room.

Undeniable as compared to traditional techniques based on analog acquisition, design and production systems, guided surgery represents a very innovative resource; however, although the use is still very limited in daily clinical practice (and therefore for many it is still seen as an innovation, we must not forget that research, to date, is going further, starting to look at fields such as that of robotic surgery.

The learning curve issue is a topic to be addressed very carefully. FIRST QUESTION but should a technique created to avoid mistakes not be transferred as a first didactic choice to students? SECOND QUESTION: are we sure that it is really easier to insert the implants using a surgical guide? Let’s start from this and it will be easier to answer the next one. The difficulties inherent in technology, its critical points, are represented by the achievement of a good stability in the mouth, by the preparation of the mucous membrane by the management of the osteotomy drills in the “working spaces of the templates”. Often, even to the author, despite the experience gained over the years, it has happened to make a lot of effort in inserting the drill in the osteotomy guide, especially in the posterior sites of the cases in the lower arch, cases in which the solution, which in the surgical context it must always be found, it has sometimes proved to be very complex. And this is only one of the problems encountered. Fractures of the Template (albeit rare occurrence), dislocation during an osteotomic sequence, are other possible occurrences (fortunately - rare-) occur. To date, after 12 years of guided surgery, we can see these occurrences very rarely, but this does not mean that they do not occur. So it is a technique with an important didactic value even though it is relatively difficult to perform. These characteristics make it a technique not indicated for the inexperienced implantologist, at least if used as the only technique. That technical sensitivity, the operational malice, which the implantologists of previous generations have developed to the sound of implants, inserted in sites of all shapes and textures, remains a fundamental requirement in this surgical discipline. So the young person will not be able to ignore the development of his malice and operational sensitivity by relying on the guide that the surgical guides provide. The real purpose of the implant templates is not to relieve the surgeon from having to mold his own technical manual skills, but to guide him into increasingly narrow and finely anticipated operating spaces.

Accepting technology in a production environment is no small feat. To date, it is estimated that only 9% of Italian studies use digital fingerprinting methodologies [14]. To date we believe that the percentage of cases conducted with digital implant insertion methods in our clinical practice does not exceed 50% of the cases treated. Why is there still 50% of patients who have implants inserted in the traditional way? This question would require a very accurate study in its own right, or it would be very important to understand if, in clinical practice, there are cases in which digital methods are not used for clinical reasons (therefore no correspondence to the inclusive criteria) or there may be reasons behind related to technical deficiencies of the method or even commercial inconsistencies even cultural unpreparedness of the clinicians. Unfortunately, the cultural non-preparation of clinicians plays a key role in this type of choice. Often the lack of ability to use dedicated software plays the key role in the genesis of this negativistic approach to technique, a deficiency often masked by citing non-existent reasons such as the need for long times to have the surgical guide available in the office. Negative considerations regarding high production costs may be more pertinent though questionable. Another fundamental consideration to be made concerns the degree of schooling required to reach a management capacity of technologies and therefore the ability to package an adequate project to refer to for the production of surgical guides and for their use. The
lack of this schooling is absolute in the current population of dentists whose average age is, to date and at least in Italy still high, synonymous with a group of professionals belonging to an unfamiliar generation with the use of a PC for actions that are not be the elementary ones of web search or guided editing. And often those of these professionals who use digital techniques do it for the design support which is increasingly the prerogative of dental laboratories which deal with the design also surgical delegating their responsibility to the professional who requires this type of advice [15].

Results
The PRECISION in the insertion of the guided implants has never been evaluated with 3d radiological investigations that would allow the overlapping of the results obtained with the original projects. What we can say is that we have never encountered macroscopic problems due to incorrect positioning of the implants; that is, no inferior alveolar nerve damaged even in the case of scarce availability of bone tissue and minimum positional tolerances (always greater than 1.7 mm established a priori and preset in the software setting). This is also true in the case of bone architectures with very small diameter and / or very pronounced inclinations (especially in the case of upper jaws with evident horizontal deficiencies as a result of tooth loss). Even in the case of immediate loads with pre-packaged prosthetic restorations, we have never encountered such large intolerances as to not allow a finalization precise and rapid to the technician. In this regard, the work group to which the author belongs is developing a protocol for the production and immediate assembly of screwed metal structures on which the aesthetic part is assembled; to achieve this obviously, you will have to rely on the absolute correspondence between the original project and the final position the implant pillars. This could be achieved by means of fixing pins which, pre inserted in the district to be implanted and included in the first cone beam registration, allow to “fix the position of the surgical guide in a repeatable manner both on the project and in its intraoral situation.

The greatest operational DIFFICULTY almost always lies in the positioning of the Template inside the oral cavity and in maintaining the position once the correct insertion has been ascertained. Experience has clearly shown that this operational aspect, and therefore the precision of the product, is highly operator-dependent, i.e. it depends on the settings that whoever carries out the project pre-sets the offset between the Template and the support surface and settings set between the CAM (Computer Aided Machinery - the software that takes care of transmitting information to the printer-milling machine that will carry out the production of the Template) and the machine assigned to print / mill the product. The insertion of the fixing pins has never been difficult and, once inserted correctly, they fix the Template in a very profitable way, ensuring exceptional stability. Some difficulties can be found in practicing osteotomies in the posterior mandibular sectors in case of poor opening of the patient. It is also true that, the degree of opening of the mouth is part of the initial checks that must always be performed, and that a reduced degree of opening in the case of implants to be inserted in the posterior sectors, constitutes a contraindication relating to the use of surgical guides. So a problem of this type should never be a clinical finding if the diagnostic-design program was conducted correctly.

In our clinical experience (about two hundred documented clinical cases) we had to find the rupture of the surgical guide in three cases; in 1 case the detachment of the guide-sleeves; in one case the absolute non-correspondence and adaptability of the product to the pre-established support (it was a template with dental support)?! A detailed review of the clinical results is underway which, however, will not differ much from the report just shown. We must recognize that the problems encountered are to be connected to two technical sources and therefore must be ascribed to technical-procedural errors rather than problems inherent in the operating technique itself. Regarding the clinical cases presented, we found a problem of fixing the Alveoplasty Template in case # 2. Here too, however, the problem arose due to an incorrect choice of the fixing system of the Template to the bone surface, obtained by means of self-tapping screws of 12 x 1.5 mm on. Of a 5 mm bushing therefore with a gripping part of only 7 mm. The number of fixing points, together with the poor gripping power of the part of the screw that was related to the bone surface, determined the poor tightness of the system. Bear in mind that in this case, given the preparation of a full arch flap, despite the correctness of the flap design, mobilized soft tissues and material dimensions of the Template, contributed to causing an evident difficulty in the passivity of positioning the same on the bone surface receiving. In all three cases, however, we conducted the surgical procedures without major difficulties. In case # 1 we were able to place pre-packaged screw-retained provisional on a metal structure, finding a precise fitting. Bear in mind that this finding cannot be considered a scientific value since the implant connection systems used were of the “rotational” type, therefore with a fair degree of positional freedom, therefore the precision and clinical correspondence to the original project can be confirmed only when we make use of “non-rotational” connection devices, and so with an absolute degree of constraint to the implant engagement cone. The post-surgery was pain free in both cases presented in case 3 we found no surgical wound dehiscence or pain or infectious phenomena. None of the three patients after 6 months have lost their implants. Due to the lock-down following the well-known viral pandemic, we are unable to show the definitive prosthetic results.

Conclusion
When the clinical activity is related to the didactic one, it is absolutely necessary that the technical operators extrapolate from the clinical results A) A certain, safe and profitable orientation of the diagnostic-planning path in order to help novice professionals to identify the critical issues of the cases on which they try and the chosen therapeutic solutions. This means a clear idea of indications and contraindications to be applied in order to make the selection of cases as safe and
The guided positioning of the implants aims to optimize the relationships between prosthetic rehabilitation, implant site and implants. The characteristics of the software used in the design phase are optimized to help the designer (the clinician?) in spatially relativizing the position of these three compartments which must always be architecturally and spatially interrelated with each other. It makes no sense to use a guided positioning technique if not to reproduce a situation that at the design level we recognize to be ideal for aesthetic and functional purposes. Once this “anatomic-structural-functional” unit has been recognized, we will use the surgical guide systems to bring back the intra-oral project from which it was originally extrapolated. Today, there is no better technology than that used to pre-visualize an anatomical-architectural context present in the patient at the time of check-in and to redesign the mechanical-functional unit that will reconstruct the failed dento-periodontal anatomical unit in our patient. The transposition obtained with the surgical templates offers us, at present, a good precision, certainly better than that obtained freehand even by the most expert of professionals (for obvious reasons). In the future it would be excellent to arrive at “absolute predictability”; this would allow the immediate assembly of a practically definitive prosthetic product. However, this operating scheme would imply the immediate loading of the implants, and on this issue there would be (which is desirable) very conflicting opinions.

When to use these guided techniques? Certainly in all cases with particular peri-implant periodontal site architectures (therefore hardly implantable and prosthetic). Certainly in all cases of rehabilitation of the aesthetic sectors (especially the upper one). Certainly in all cases of rehabilitation extended to a dental quadrant, an arch or even to the complete mouth. The use on the single tooth to be reconstructed on implants is quite complex due to the problem of managing the space in which to place the template. For sure, in the future we will see a progressive increase in the use of guided surgical techniques; this for a desirable decrease in the average age of the dentists. Secularization of young people should go hand in hand with university studies and practical placements, notwithstanding adequate experience gained with traditional analog techniques. The discourse relating to clinicians with a more advanced age remains more delicate and uncertain. However, since it is a private sector, it is necessary to rely on an ethical, effective and profitable information and training system. The future will give us all the answers to these questions.

References
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