Integrating Analog and Digital Streams to Simplify Daily Clinical Practice

A maxillary overdenture case

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About the Author

Dr. Roberto Scrascia, graduated from the University of Bari in Dentistry and Dental Prosthetics with an experimental thesis in Oral Pathology with Prof. Massimo Petruzzi - removable prosthesis and implantology activities. Studied "Bone Regenerative Surgery Oral" at the University of Chieti. Active member of AIC Italia by Osstem - Speaker & member of the executive board. 2015-2018 - elected director of the CAO (Commission for the Register of Dentists) Order of Surgeons and Dentists of the province of Taranto. International tutor for Rhein83 - Speaker at national and international congresses. 2016 specialized in "Fixed Prosthesis" at the University of Foggia. Author of numerous publications in dental sector journals. 2018 elected Cultural Secretary by ANDI Taranto. Didactic tutor at the University of Foggia. Currently carries out clinical activity private and research in his office and in consultancy.

Introduction

With analog working protocols, everything was written, and continue to be our foundation and we can always refer to them. The digital field is different where the range of paths to take is really wide, where a lot has been written but there is still so much to explore. Obviously, there can be no future without the past and that's exactly where we take our starting point for the sentence: true freedom, today, consists of getting in and out of digital, at will, and integrating it with analog, in order to get the best out of every technique.

The goal is to improve the communication between practice and laboratory, simplify work steps and minimize appointments. In this article we will describe the creation of a self-supported and implant-retained overdenture in the maxilla. Treatment is not always a patient's first choice as fixed solutions are preferred but that in specific cases, like extreme bone atrophy and oral hygiene, the overdenture is easily cleansable, and appears to be elective.

Clinical case

The patient A.A. aged 79 presented with a desire to improve the stability of his complete maxillary prosthesis (Figs. 1 and 2). The patient requested an implant retained overdenture as he already has implants and two attachments in his lower jaw.

Fig. 1 — Photo of the patient's smile with the old prosthesis

Fig. 2 — The upper lip of the patient without the prosthesis. Note collapse of support of the soft tissue of the lip. The prosthetic flange is sometimes elective to overcome this problem

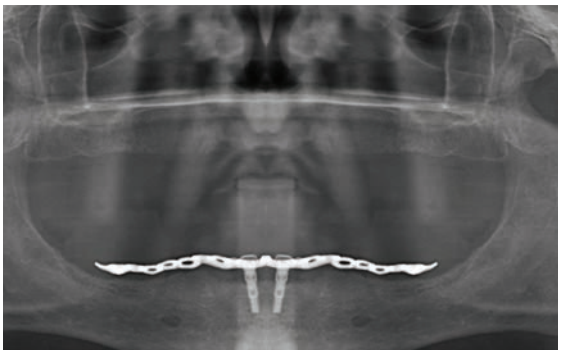

Fig. 3 — Initial radiograph of the patient

Fig. 4 — Collection of analogue information for initial prosthetically guided surgery

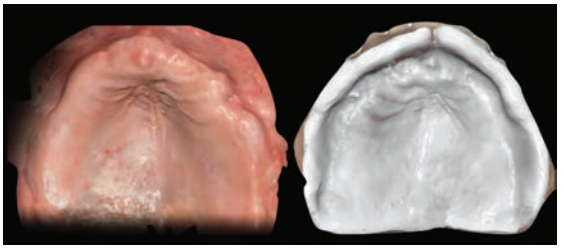

Fig. 5 — Collection of digital information for the initial prosthetically guided surgery

Fig. 6 — Thanks to intraoral scanners, in just one appointment we manage to collect a lot of information to design the treatment plan

In in a nutshell: a complete prosthesis retained by two implants and two attachments, that in fact, even if minimally invasive, radically improves the quality of life of patients.

After a careful clinical analysis, we move on to the acquisition of information to be able to create a treatment plan. It is noted that the lower prosthesis is still adequate, the abutments have several years of activity but are in perfect condition being of nitrided titanium (TiN) which is highly resistant to wear. The upper prosthesis will correct the vertical dimension and position of the teeth. Periodic rebasing maintenance will be recommended (Fig. 3). The next step is to make a duplicate of the prosthesis and order a CBCT to evaluate the patient for implants. In this step analog and digital differ greatly.

In analog we should (Fig. 4):

- take impressions to obtain plaster models
- duplicate the upper prosthesis for the CBCT with the related laboratory steps.

In digital, by contrast (Fig. 5):

- we scan the mandibular prosthesis to have an antagonist
- we reline with a provisional material like FITT (Kerr) prosthesis superior; after a few minutes when it stabilizes, we finish it off with a scalpel blade, scan it and couple it with the mandibular prosthesis. In this way we have everything - vertical dimension, position of the teeth and above all the negative of the mucosa of the maxillary (Fig. 6).
- if we want, we can add a scan of the mucosa, but actually what we will really need is the scan of the correctly relined maxillary prosthesis. We send the information obtained with the i500 intraoral scanner (medit) to the laboratory that, thanks to the CAD design and Exocad department, design

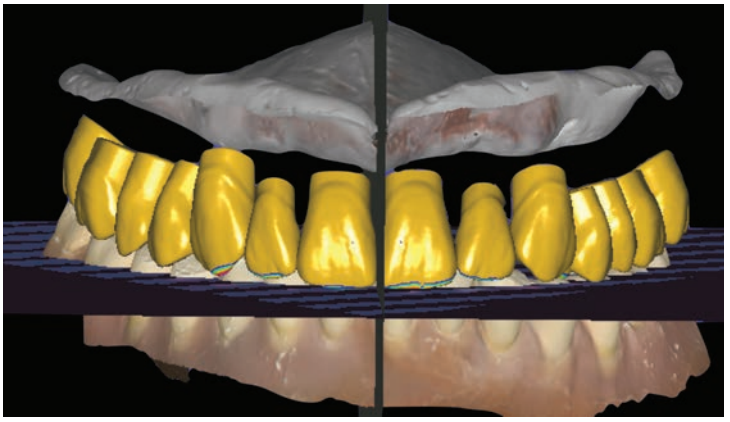

Fig. 7 — CAD design of the new teeth assembly; in particular we see the profile of the mucosa obtained with the direct relining of the pre-existing prosthesis

Fig. 8 — The prototype obtained with a 3D printer

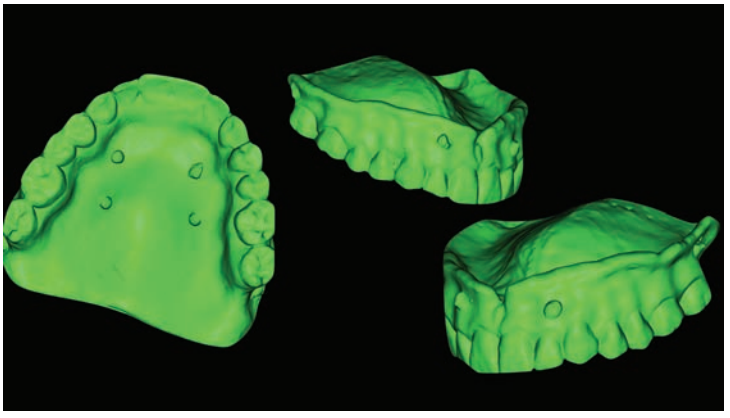

Fig. 9 — The prototype with landmarks in composite for CBCT and dual scan protocol modified

Fig. 10 — The virtual patient … face scan, impressions, project and coupled CBCT

a prototype to print. As in analog, mostly digitally, cross mounting, i.e. the transfer of information is a smart technique (Figs. 7 and 8). In just one clinic appointment we have transferred all the information necessary to create a prototype and if all goes well, obtain a CBCT of the patient.

The printed prototype test is exciting, exhibiting great stability and esthetics that are approved by the patient. But this is not only about digital and 3d printing that will increasingly be the protagonist of our daily life, but also the merit of the well-executed and transferred digital relining; so we enter and exit digital and analogical by taking the best of each one and searching to be ever more efficient.

There is another point in favor of digital: efficiency. Because we must clearly distinguish two terms, effectiveness and efficiency.

Efficacy is getting from point A to point B in any way, medium, technique and use of time.

Efficiency, on the other hand, is getting from A to B as linearly as possible and in less time.

Per protocol, I check the internal surface of the prototype with Fit Checker to evaluate any points of pressure; with this done, we move on to optimize it for CBCT and the modified dual scan protocol. The technique involves the placement of 8 composite markers, all on the outer surface of the prothesis, 4 on the palate and 2 on each side flanges (Fig. 9).

Before the patient is discharged, we scan everything with the i500 intraoral scanner (medit). A further means of communicating with the laboratory can be by facial scanner. There are many types and levels of resolution, but if our aim is to visually communicate clinical details and evaluate the prosthetic volumes, a good entry level may be sufficient. Bellus3D Face App is a face scanner that works on cameras with True Deph properties, i.e. detecting the surrounding environment in 3 dimensions of space. For example, from the iPhone X (Apple) onwards, smartphones are equipped with this particular camera and can scan faces and objects and get an .stl or .obj file. Once the face is scanned, we can import the file into the intraoral scanner software and match it to the scans. Once the CBCT is obtained, we can also import those files (Fig. 10).

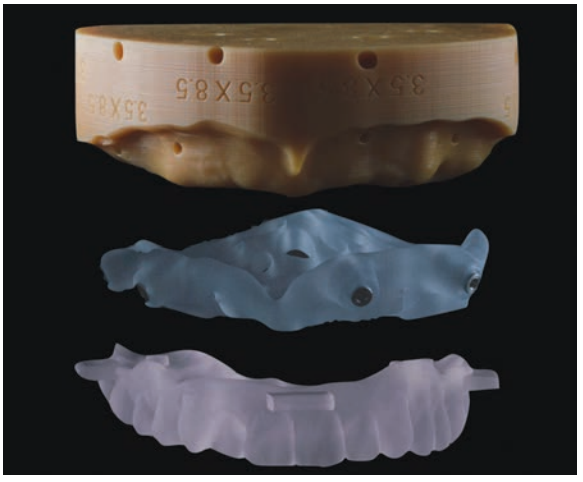

Fig. 11 — The decomposable templates, a real revolution in guided surgery

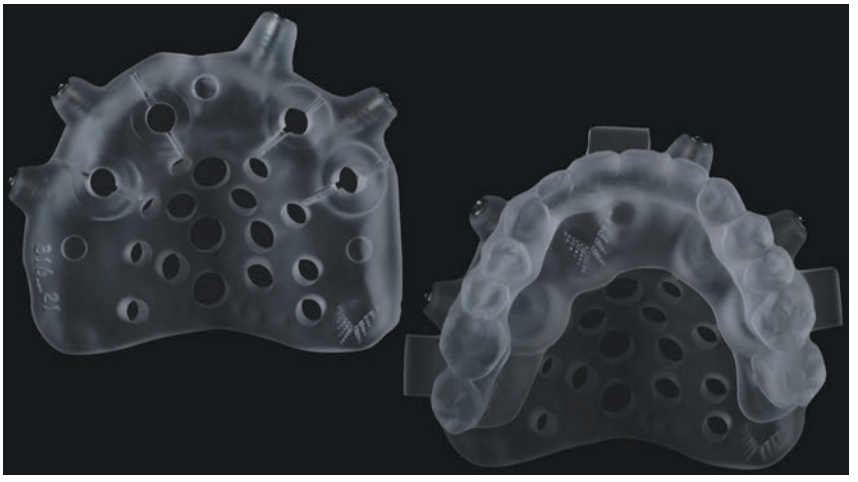

Fig. 12 — On the right we see the template with positioning lines and on the left the sleeves for implant information

Fig. 13 — Analog cross mounting, from prototype to Surgery formation

Fig. 14 — Digital cross mounting, the prototype with landmarks, and the surgical template scanned

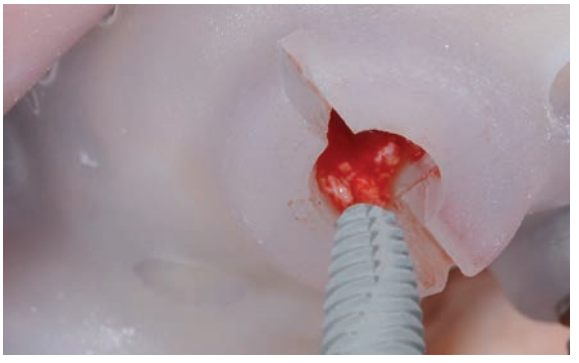

Fig. 15 — Operative phase with details of the sleeve in totally printable resin using the One-Guide system of Osstem

The patient will have the CBCT taken with the prosthesis in place and the radiological center will email the DICOM file raw. We don't have to wait for the patient to bring us the DVD. The ideal would be to have the CBCT study to streamline procedures even further - receive raw DICOM file that we open with software for prosthetically guided surgery such as Real Guide (3DEmme) and import the scan of the prosthesis.

The advantages of prosthetically guided surgery are many: it forces us to collect all the information before taking action, so that any compromises or critical steps are first evaluated before intervention. It allows us to have an overview of the position of the teeth, the bone and the prosthetic volumes so that we can better evaluate the position and inclination of the system and also the size of the prosthetic components.

From the protocol we plan 4 implants to form a quadrilateral which cancels the anteroposterior and lateral tilting forces, positioning the implants in the region 14-12-22-24. The system used is Osstem TS III with diameters of 3.5 and 4.0.

Once the plan has been reviewed, we send it to print in a centre dedicated and specialized in printing operator templates (NewAn corvis).

Guided surgery is not synonymous with flapless surgery. Very often, a flap is needed to optimize interventions. But when we plan a flapless surgery in elderly patients, we can add a further advantage to this technique.

The template has a peculiarity as it is decomposable (Fig. 11). So, we have the outside with the teeth which will serve us well to place it in mouth to the patient and insert the pins. AND the inner part contains the information for correct positioning implant with totally plastic retentive caps, called system One-Guide (Osstem) and a series of inspection windows that can serve to inject anesthesia during the surgical phase (Fig.12).

For cross mounting - the transfer of information from one phase to another of the treatment, the operational template and the prototype are identical, and if we scan them, they are stackable (Figs. 13 and 14).

In summary, we saw the patient for the first visit, for the prototype and for the surgery. We simplified the technique without losing precision, which was definitely appreciated by this elderly patient.

The patient left with the screws capped and a small opercula, resulting from the surgical procedure that will heal in a very short time (Figs. 15 and 16). We check the patient after a few days to make sure that the prosthesis he is wearing is adequate after the slight change of the mucous surface for the intervention.

After 3 months, the second surgical phase takes place using the surgical template to easily locate the implants and position the healing screws. After some time, we evaluate the transmucosal space that goes from the implant head to the super mucosal surface; in an overdenture, it is of fundamental importance to verify this height because incorrect information would affect the functioning of the attachment which must always be above the gum for optimal function.

We use the initial prototype that was used for the CBCT as an impression tray for the definitive work (Fig. 17). We check it with Fit Checker for any pressure points and if necessary, we seal the edges and we use Permlastic impression material.

So, let's go back to analog using cross mounting. In just one session we measured the mucous membranes, the vertical dimension, and the position of the teeth.

For the antagonist, we can print the scanned file from first session or use a plaster model from the impression taken of the prosthesis.

In the upper impression, you can see the heads of the healing screws that show the location of the attachments. We will need metal reinforcement because the resin around the steel housing - i.e. the metal containers for the elastic matrices of Ot Equator are subject to fracture. So it is always better to support it with a metal reinforcement, made with prefabricated castings from Rhein83.

Another impression technique can be the use of tear-off transfers for Ot Equator attachments and therefore have a master model with analogs. Fortunately we have the possibility of following different paths thanks to the completeness of the prosthetic components, and then make choices based on the clinical case. Building the prosthesis with a cross mounting technique and duplicates is really faster, as the information is already there, then assembly and resining is performed with read characterizations (Figs. from18 to 20). Above all, it is recommended not to put any physical characterizations on the surface which should be as shiny as possible, to support hygiene.

As per the protocol, the prosthesis is loaded without functionalizing the attachments. It is controlled more in the following days in order to intercept any sore spots, and if after 7 - 10 days, there are no particular problems, we then functionalize the attachments transforming the total

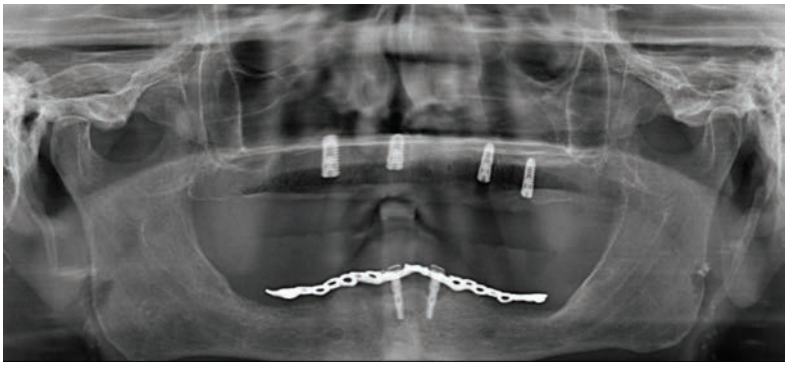

Fig. 16 — Post-operative X-ray

Fig. 17 — Precision impression made thanks to the use of the prototype as an individual impression tray

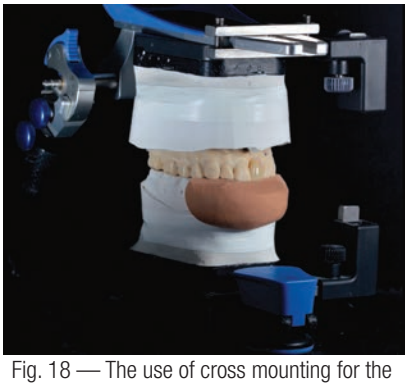

Fig. 18 — The use of cross mounting for the realization of the final prosthesis

Fig. 19 — Internal detail of the final reinforced prosthesis

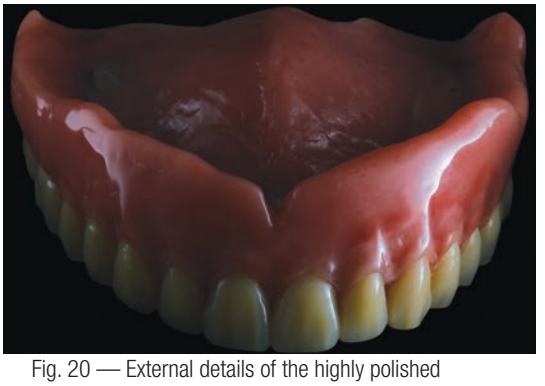

Fig. 20 — External details of the highly polished prosthesis for hygiene reasons

Fig. 21 — The OT Equator housings mounted in the mouth

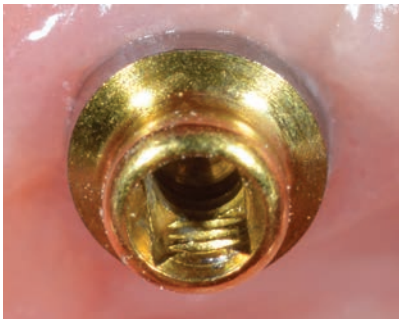

Fig. 22 — Detail of the attachment prosthetic that must be a thread above gingiva to work optimally for overdentures

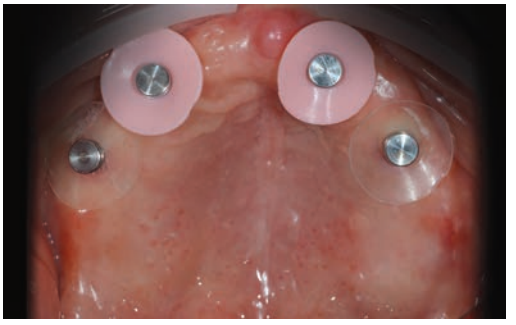

Fig. 23 — Bindings with separate disks and steel housings ready for functional loading

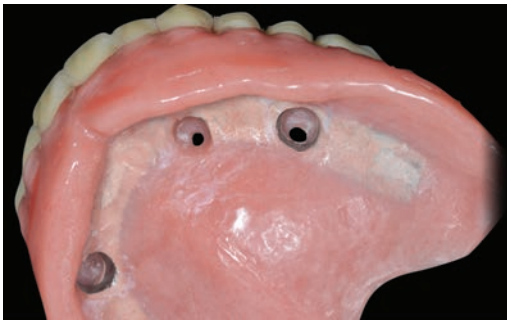

Fig. 24 — Detail of the vent holes for excess resin when the attachments are loaded

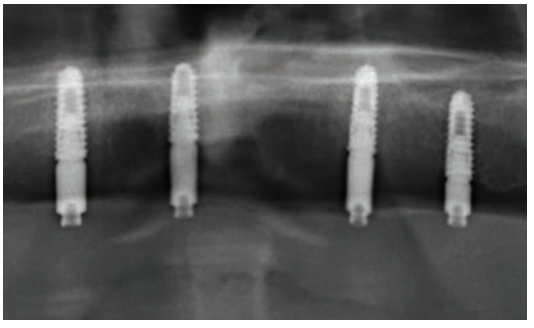

Fig. 25 — Radiography with attachments mounted on implants

Fig. 26 — Smiling patient with new maxillary denture

prosthesis into an overdenture. Meanwhile we could use del FITT on the space covering the healing screws to provide minimum retention and avoid over-contours of the mucous membrane.

Insert the attachments with the dedicated screwdriver and tighten with the torque dynamometer ratchet recommended by the implant line. We place the separator disks and steel housings with matrices and we are almost ready to functionalize the overdenture. We just have to prepare the prosthesis with resin vent holes and knead the pink resin acrylic. We place it in the housings created in the prosthesis by subtraction and insert it in the mouth, first by hand and then by the patient's occlusion. In this phase we can observe that the excesses of resin take the way of the vent holes and do not cause damage in the undercuts beyond the implants. To harden the resin, we polish the excess and remove the separator diskettes. It's all designed for patient comfort. With four attachments, the stability of the prosthesis is excellent especially during function with excellent feedback from the patient (Figs. 21 to 26).

Conclusions

In our daily work, our goal should be to search for reliable protocols where knowledge of technology allows us to make them increasingly streamline for the patient and to optimize the fully digital workflow. It is definitely fascinating but to date, has considerable costs and above all still has large compromises. Traditional ways and analog fit perfectly and can be interfaced with digital - definitely a plus for our clinical practice. In the coming years, digital will dominate with processes and techniques but we should guide the transition with analog experience which has a kind of good sense to take the best of all new roads that are before us.

The author thanks Dentalart by Luigi Secondo and Unilab by Emanuele Rushes for their dental technology and their contribution.

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