

## DIGITALIZATION OF THE GOLDEN STANDARD OF IMPLANTOLOGY.

*Cortex Fully Digital System Takes Its Place in the Digital Dentistry World.  
By Dr. Masha Fraibert, DMD*

In the last decade, the world has been going through a rapid digitalization upgrading.

Most of the exciting conventional technologies no longer exist and were replaced by smart digital systems, that led them to another level of work-flow, abilities and final results. Those systems allow the users to have more available and accessible updated information, that will provide the most efficient work-flow, accurate and easy planning, and predictable outcomes.

Probably, nowadays, you will not witness people that open a paper map in order to navigate the road. In the present, we use smart GPS navigation systems, that can calculate the optional paths, timelines, inform us about the unexpected nuisances on the way and the final destination status. All of this information gives us the tools to make our best decision in terms of time, cost and simplicity. Moreover, we receive online updating that can make us change our mind and keep efficiency, even though we were challenged by unexpected circumstances.

The innovative systems have taken over the conventional systems and proved themselves as more accurate and efficient. No one will argue with that. The medicine improved its capabilities of pre-diagnostics, surgical abilities, and success range. Additionally, the rate of exacerbations and healing time were extremely reduced.

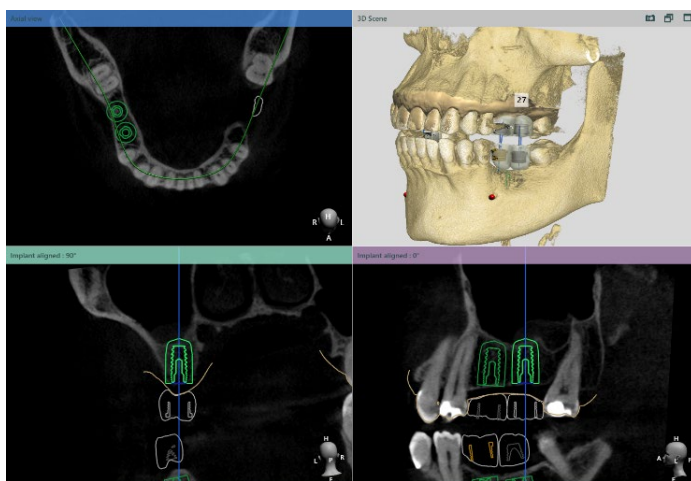
*With all that said, if the entire world had moved on to the digital solutions - why it does not in dentistry?*

The digitalization transformation in dentistry have started more than two decades ago, but it is yet accomplished. We are in the middle of a 'hybrid phase', where digital and conventional procedures are often combined. The exact division of when to use one or the other is highly dependent on individual clinicians' preferences, and no recommendations can be made based on the present consensus. Further crossover studies are needed to evaluate digital workflows utilizing different systems, under various operators' circumstances and appropriately recording patient-related outcome measures, time-efficiency, cost-effectiveness, and clinical results. The use of computer-guided implant surgery was developed to improve the accuracy of surgical implant placement, it is a proven secure procedure, however, it needs to be more developed due to the number of factors that play an important role in the procedure and affect the final result. As for the computer-guided implant surgery, the EAO (European Association for Osseointegration) consensus declares "There is currently insufficient data available to evaluate all factors involved in a digital workflow".

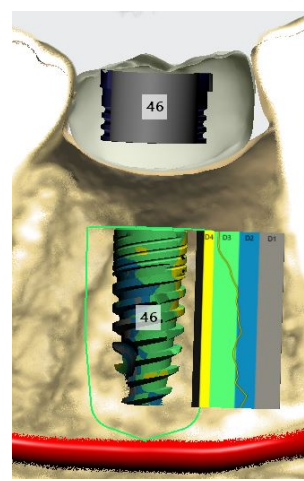
However, virtual implant planning, static guided surgery, dynamic free-hand navigation systems and other CAD/CAM (Computer Aided Design / Computer Aided Manufacturing)

technologies have been going through drastic evolution in the late few years. They became extremely accurate, easy-in-use and affordable. The dental field has been regenerated with many different digital products, that can provide the clinician a simple and short work-flow, minimized chair time, optimal aesthetic and functional results.

Advances in three-dimensional (3D) imaging technology, including computed tomography (CT) scans combined with computer-aided technology, have revolutionized the field of implant dentistry. The computer guided procedure is based on a virtual simulation which by the combination of surface scans and CT data allows the clinician a complete analysis of 3D implant position in relation to vital maxillofacial structures such as nerves, sinuses, adjacent teeth and of course the quantity and quality of bone.



*Virtual 3D implant planning*



*Bone density*

Namely, the digital files uploaded into the virtual software, overlapped with each other, and the virtual wax-up is being designed in relation to antagonist jaw. The software provides a 3D visualization of the full digital data from the supplied files. In addition, you have full control of the implant position in a 2D view which is displayed in three different slices: axial, sagittal and frontal (some softwares provide a panoramic view as well). As for the selected implant, there is no proposal from the software manufacturer in order to use one or another implant brand, and it is up to the clinicians will and discretion. Each implant company that wants to provide digital services to the customers, needs to previously prepare the digital libraries that include the relevant elements like implants, guiding sleeve, CAD/CAM components. The libraries will be certified and integrated into the software. Hence, the planner chooses the implant brand, diameter, and length from the digital library and decides the optimal position in regards to the bone and the future prosthetic solution. Once the implant positioning is over, the surgical guide is being designed over the supplied patients' virtual model.



*Virtual guide design*

The stereolithographic file (STL) is being forwarded to the 3D printer for manufacturing. The quality of the surgical template has a direct relation with the type of 3D printer and its technical parameters, as printing technology, printed layer thickness, axis accuracy, printing material and more. The surgical guide has to be made of a bio-compatible material (for temporary use, Class I in accordance with Rule 5 of Annex IX, Directive 93/42/EEC). Once the template is ready, bio-compatible titanium guide sleeves are being inserted and cemented into dedicated space inside the guide. Those sleeves will guide the drills and insertion tools and determine the osteotomy localization, position, and depth, which are correlated to the virtual implant positioning. Therefore, the surgical kit and instruments have a major importance and will influence the accuracy of the final result.

Moreover, the type of support of the surgical template it is a key factor in terms of accuracy and quality, in a sense that teeth supported templates are more stable and accurate in comparison to the mucosa supported ones (*M. Casseta et al. Int. Journal of Oral Maxillofacial Surgery 2013; 42: 264–275*). In fully edentulous cases, additional fixation pins will be virtually and safely planned to improve the guide stabilization during the surgical procedure.

Since the clinical cases in dentistry are always different from each other and have individual nuances, the digital implantology allows the clinician pre-diagnosis and pre-prepared optimal surgical workflow planning, avoiding unexpected challenges during the surgical execution.

It gives some clear advantages to the clinician as well as the patient. Some clinicians are reducing the time of the procedure and enjoy more secure implant installation in tricky situations. More importantly, it provides a link between the virtual prosthetically driven treatment plan and the actual surgery by transferring the simulated intervention accurately to the surgical site with the use of an individual surgical template, made exclusively for each case. Since the final restoration virtual design is being prepared prior to the virtual implant placement. This approach will provide the planner with a prosthetically driven planning in order to assure an optimal final restorative result.

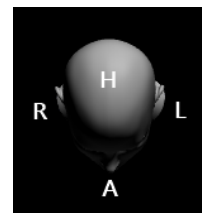
In summary of all that is said above, implantology digitalization process is inevitable and blessed. Therefore, more and more dental companies establish and develop their own digital systems in order to stay up to, attractive and keep place with modern technology.

Cortex Dental Implants Industries Ltd. is a leading Dental Implant Company in the dental implants systems market. Founded in 2008 by dentists for dentists, the company is operated and managed by highly qualified leading experts and professionals in the field of maxillofacial surgery, prosthodontists, and periodontists with 100 years of combined surgical experience.

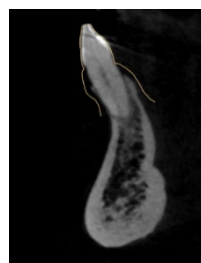
In 2018 Cortex Fully Digital System takes its place in the Digital Dentistry World. The system provides the clinician fully digital work-flow, from virtual implant planning to final restoration.

Guided Surgery procedure is a technique based on the following principles:

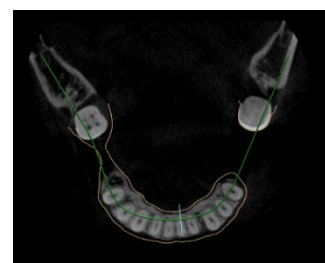
- Accurate 3D information of the patients` anatomy exported from the Cone Beam CT (CBCT) scan as a DICOM file (digital imaging and communications in Medicine). Overlapped with the optical scanning of a plaster model or an intraoral scan (STL files), and finally uploaded into a virtual planning software, that contains the digital implant libraries.



*Frontal view*



*Sagittal view*



*Axial view*

Utilizing certified and validated software programs allows the clinician to develop a complete and precise pre-clinical diagnosis and creates a custom virtual surgical plan.

- The latest CAD/CAM technology is used to prepare a virtual wax-up of the prosthetic solution, allowing to create a prosthetic driven virtual implant planning, as well as surgical guide design and manufacturing.
- Management of any type of implant rehabilitation intervention.
- Open system and completely applicable to Cortex implant platforms, and fully integrated with open software for virtual design with laboratory prosthetic modeling of provisional solutions. Starting with implant planning up to immediate loading, that is supplied in prior to the surgery day.
- Fully guided surgical procedure, from virtual implant planning to clinical execution, by using the surgical guide and an advanced Cortex Guided Surgery Kit.



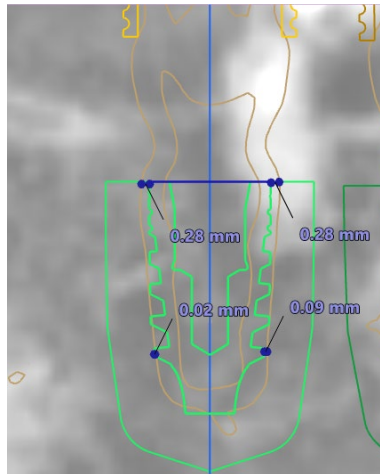
*3D printed surgical guide and diagnostic model*





Bio-compatible guiding titanium sleeve has a special engineering design as well. Its hexagon shape geometry and a support ring in the guide itself, provide an anti-rotational element and height control for better fixation and stability.

This guided surgery system offers the clinicians optimized virtual planning and clinical execution. Assuring optimal accuracy, predictable results, and minimum invasive procedure.



*Comparison between the planned and executed position Accuracy determination*

As a part of digital system development and research supporting, Cortex established a fully equipped in-house dental laboratory, supported by Cortex wide line of CAD/CAM products.

The CAD/CAM products designed and produced from bio-compatible titanium 6Al4V, in accordance with our strict precision and quality.

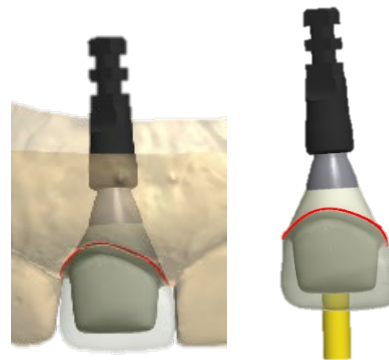
Scan bodies have a micro-roughness surface and asymmetrical geometric shape for enhanced scanning contrast, laser marking for platform identification. Various CAD/CAM systems compatibility can be used intra and extra-orally. The uniqueness of this product is that it has a built-in screw, which is NOT falling out of the Scan body.



High precise titanium bases provide a seamless connection to the crown and ensuring superior aesthetic results. The line includes a vast range of lock and no-lock superstructures, with a different collar and body sizes.



*Ti-base for wide platform implants*



*Virtual abutment and crown design on a Ti-base*

Advanced Multi-Unit system has an intelligent design, along with most advanced manufacturing methods and equipment that brings the ideal product for screw-retained restorations. The Multi-Unit abutments range features angle correction of 0, 18 and 30 degrees and 1-5 of collar heights for all implant platforms including narrow implants.



*Angulated Multi-Unit*

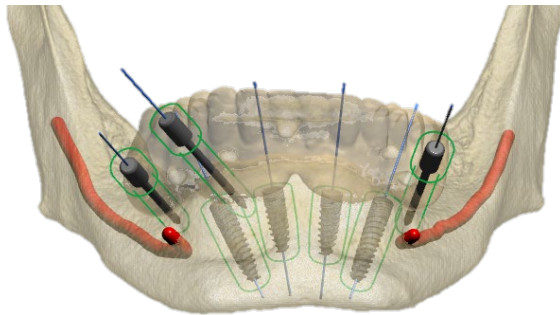


*Digital Model Analog with Multi-Unit System*

In Cortex, we believe that as a dental implants company it is our duty to provide our customers not only the best products but to develop the most innovative, sophisticated and smart abilities, that will support and facilitate the clinicians seamless work-flow and concise time procedures. Therefore, we have developed a **digital ability for an immediate temporization on angulated Multi-Units**. For example, a clinical case report that was performed by Dr. Meir Mamraev in Israel lately this year:

Cortex digital lab was asked to plan a fully edentulous lower case. The dentist required a surgical guide and a total bridge for immediate loading. The patient had an old and not fixed denture with bad stability, due to jaw atrophy. No bone augmentation was planned, so we had to use the remaining bone to fix the implants.

During the first stage of virtual implant planning, we were able to place four Cortex Dynamix implants in between the mental foramens (the bone volume in the posterior zone was not enough). All implants were in angulated position, due to bone deficiency:

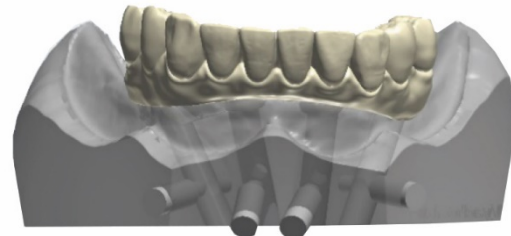
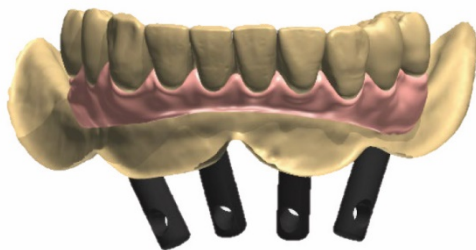


*Frontal view*



*Axial view*

For better guide stabilization we added three virtually planned fixation pins and designed the surgical template. As a second stage, we designed a virtual model analog and used our digital libraries to fix the angulated multi-units and the temporary sleeves. Cortex digital abilities integrated in the software allowed an automatic angle correction for a passive fit of the total bridge. On top of the supersaturations, the prosthetic design was prepared.



*Virtual Model Analog and Bridge Design*



*PMMA Multi-layer Bridge and 3D Printed Model Analog*



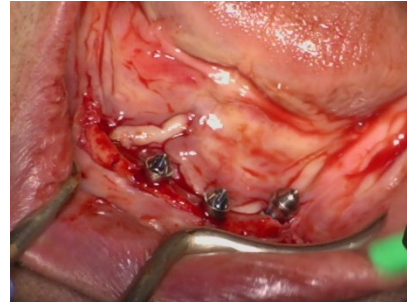
*Temporary Bridge Fixed on Digital Model*



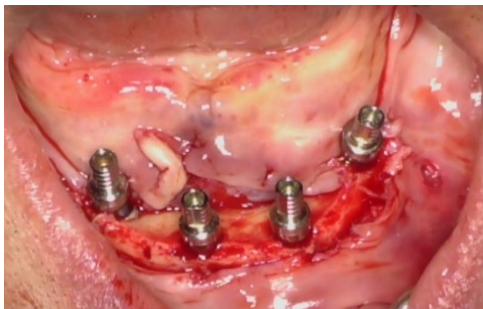
The clinical phase included guided surgery execution and immediate temporization.



*Guided surgery with Cortex surgical kit*



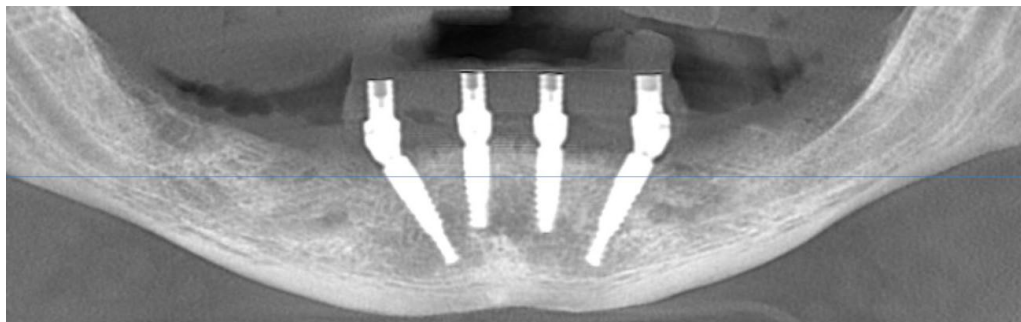
*Multi-units' placement*



*Temporary titanium sleeve fixation*



*Passive fit of the temporary bridge*



*Follow up X-ray*

This case proved that the digital system worked in the most extremal conditions.

For us, it is not the limit, but only the beginning. Cortex R&D Digital team will continue to follow the market and provide the best solutions and major abilities to our customers, hand by hand with the global digitalization, always headed to the future of Implantology.

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