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CAD/CAM

international magazine of digital dentistry

case report
Treatment with digital planning and guided surgery

trends & applications
Aesthetic Digital Smile Design: 2-D-/3-D-assisted communication

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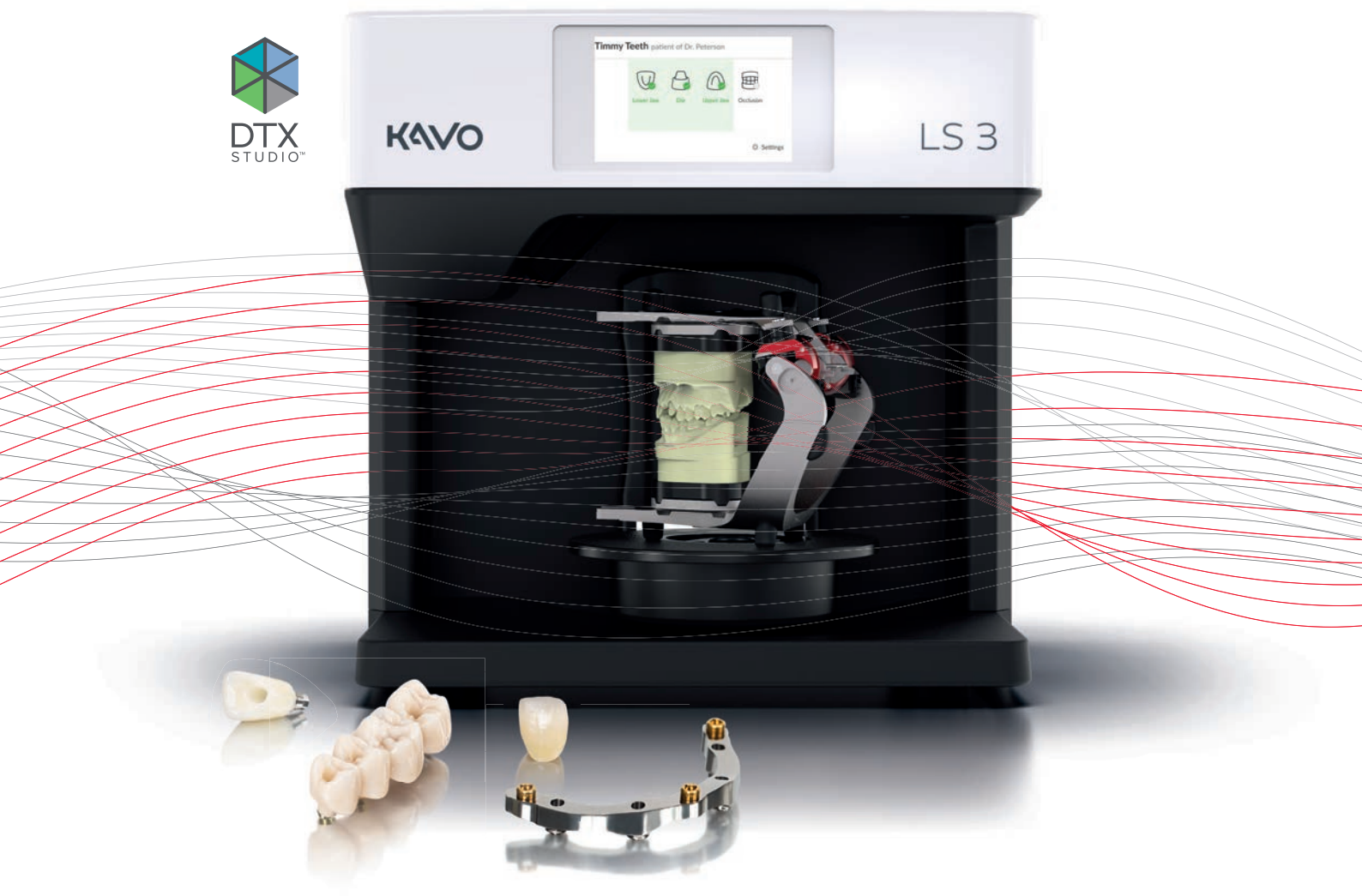

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Dr Scott D. Ganz

Editor-in-Chief

Is there a "magic formula"?

As we approach one of the most attended and important international meetings of the year, EuroPerio9, some thoughts come to mind. Is there a relationship between diagnosis, treatment planning, the use of CBCT, and the final restorative aspect with the long-term maintenance of bone and soft tissue? While there may not be any scientific publication that addresses all of these issues together, one thing that we know for sure is that implants that we place today may be required to stay in function for 20, 30, 40 years and beyond as people are living longer and longer.

Therefore, our profession needs to be constantly searching for the magic formula that will help patients maintain their natural teeth and, if they do lose teeth, maintain implant-supported restorations for their lifespans. Implant restorations require maintenance over time, just like a restoration on a natural tooth. The magic formula may be different for every person, as there are variations in host factors, such as DNA and genetic predispositions, diet, parafunctional habits and environmental issues. However, when teeth are missing, it is important to understand the aetiology before offering future treatment recommendations.

Currently, the use of CBCT provides essential information regarding the individual anatomical presentations and confirms existing bony topography, bone volume, root position within the alveolus, pathological entities, and much more. Combined with computers and interactive treatment planning software, clinicians can now confidently recommend one or more treatment options based on an accurate assessment of the present condition of the oral environment. We can no longer separate the surgical and restorative components of implant reconstruction now that it is possible to merge CBCT data with data sets from intraoral scans or optical scans of an impression or a stone cast. Restoratively driven treatment planning can be achieved when all members of the dental implant team communicate using today's exciting technology, and whether bone grafting or soft-tissue grafting, whether immediate implants or delayed loading protocols are followed, we owe it to our patients to operate from a position of knowledge. Our goal should be to provide the most appropriate treatment for our patients, to maximise the longevity of such treatment, to avoid surgical or prosthetic complications, and to avoid or manage the potential of peri-implantitis as our patient population ages.

As always, through the pages of this current Dental Tribune International publication, it is our goal to educate our readers by providing state-of-the-art concepts and content from around the globe. It is through education and knowledge that we may find that magic formula for each and every patient we are fortunate enough to treat. We hope that you enjoy the articles contained within, and if attending, enjoy the multi-specialty presentations at EuroPerio9. Keep on learning!

Dr Scott D. Ganz
Editor-in-Chief


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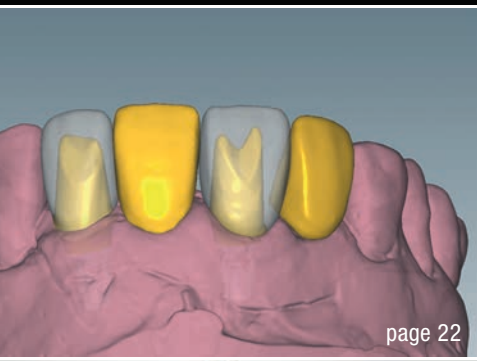
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Importance of 3-D printing in dentistry

Prof. Daniel Wismeijer, Netherlands

This article is from an interview with Prof. Wismeijer on understanding 3-D printing in the digital workflow. He spoke to Dental Tribune at the CAD/CAM & Digital Dentistry Conference held on 4 and 5 May in Dubai in the UAE.

Prof. Daniel Wismeijer

We're here at the 13th CAD/CAM conference in Dubai. This is the second time I'm here; the first time I was here was about three years ago at the tenth edition. The CAD/CAM conference is focusing on the digital workflow in dentistry.

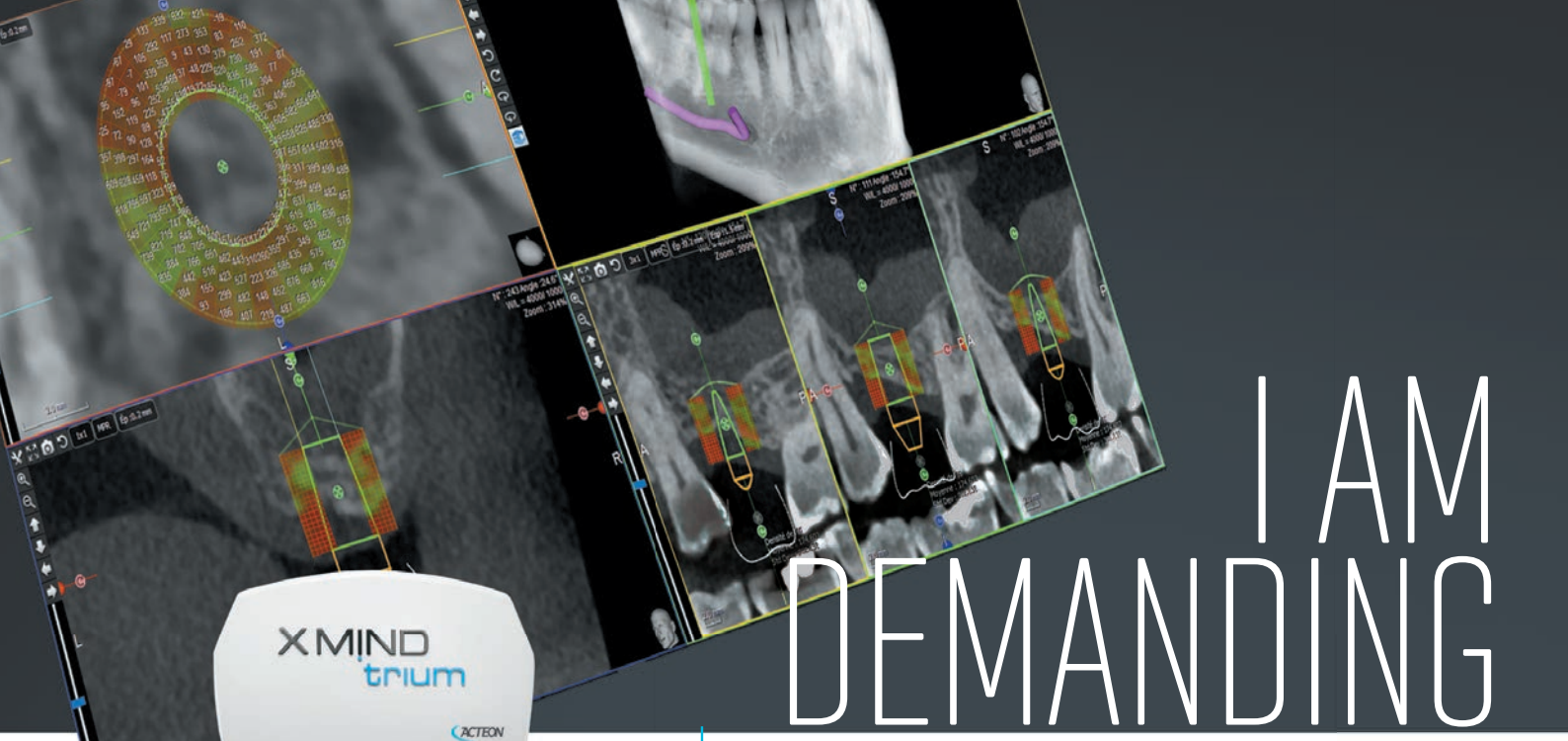
And what is interesting about the digital workflow is, it's showing us how dentistry is going to be changing in the coming years. What we see is that we're getting away from the analogue and going full digital. Digital diagnostics let us look at our patients from a virtual perspective. We do the CAD, the planning; we go into CAM; we have the milling; we have the 3-D printing. And then we can execute the total treatment, as we go to the patients ourselves. So, looking around here at this conference, we see a lot of industry that understands the change that we are up against in dentistry. They're here presenting the technologies that they all have in their portfolios.

One of the problems, however, is that these technologies are all in verticals. The technologies are not horizontally connected together. So, what we're looking for is a horizontal connection between all these vertical technologies to get the digital workflow to really work for dentists.

Questions are directed to me all the time: "How are we going to do this?" "Could you explain how I can integrate this into my workflow?" But, if you don't have the proper software and you haven't learnt how to use it, then you're going to get into trouble when you try to implement it. So, the credo here is that you have to learn, unlearn and relearn to understand what's happening in digital dentistry.

Today, I gave a presentation on 3-D printing in dentistry. Some of the questions that were posed to me after my presentation told me that people do not fully understand yet what 3-D printing actually is; they asked me: "Can I use that printer for printing metals?" No, you can't. "What can I read to learn more about digital dentistry?" Well, my idea would be to get a book on 3-D printing. This could be a very easy and simple book to help you understand the technologies behind 3-D printing. When you understand the technologies, then you can also find a way of implementing these technologies into the workflow. It's not just plug-and-play; it's not "here you have a machine and now you can get to work". No, you have to understand the role the machine plays in the total digital workflow in dentistry. You have to understand which machines you need to make the digital workflow work for you. So, it's not just about reading up on the end solutions; it's also reading up on the basics, the technology itself, and learning about subjects that you need to first understand; that is, what digital dentistry is and what 3-D printing is. If you don't understand the basics, it's going to be very difficult to understand the final execution of all these technologies in your workflow.

My advice is: be humble, be prepared to learn, be prepared to unlearn everything that you have learnt in the past and relearn the new technologies to be able to function properly in the new digital workflow.



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Mastering the implant digital workflow

Dr Ross Cutts, UK


Fig. 1


Fig. 2

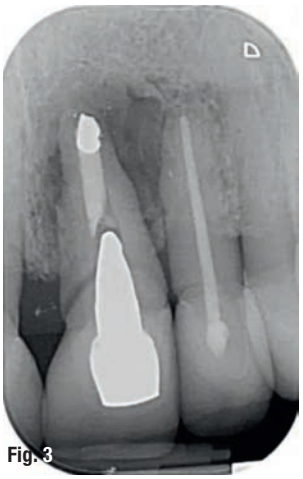
Fig. 3


Fig. 4

Fig. 1: Dental Wings intraoral scanner. **Fig. 2:** Printed models. **Fig. 3:** 2-D X-ray. **Fig. 4:** 3-D X-ray.

Whether we like it or not, we are embracing the digital era in our brave new world. Many dental practices are now becoming paper-free – a digital innovation – and even using tablet computers to record patient details and medical histories. We are continually surprised by the rising age of the technologically savvy patient, particularly those of a certain generation who perhaps we assume would be less so than the perceived iPhone generation.

This change in the patient demographic and attitude towards technology is filtering through to us in the dental profession. The nuts and bolts of implant dentistry tends to lend itself more readily to the digital revolution of dentistry in the UK and now globally. Many practitioners opposed to or reluctant to embrace it are actually being influenced by it through shifting workflows in dental laboratories, even where more traditional clinical practices are followed chairside. Quite often, wet impressions are poured and stone models are scanned to produce STL files for laboratories to process during crown and bridge unit manufacturing.

As an implant clinician, one does not have to invest in a CT scanner or chairside intraoral scanner—there are ways that other centers and laboratories can provide these services. However, having these tools at one's disposal greatly increases one's efficiency and means one is not reliant on external services for one's patients.

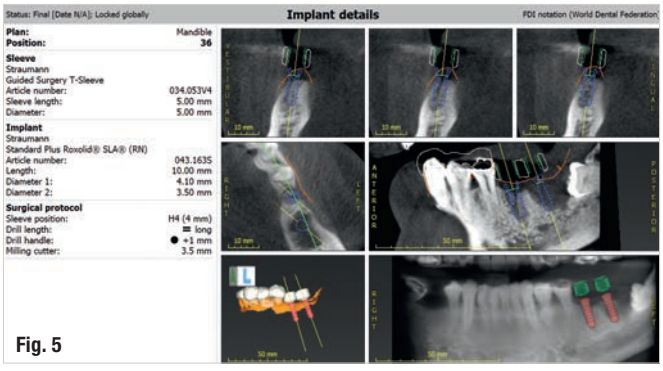

Fig. 5

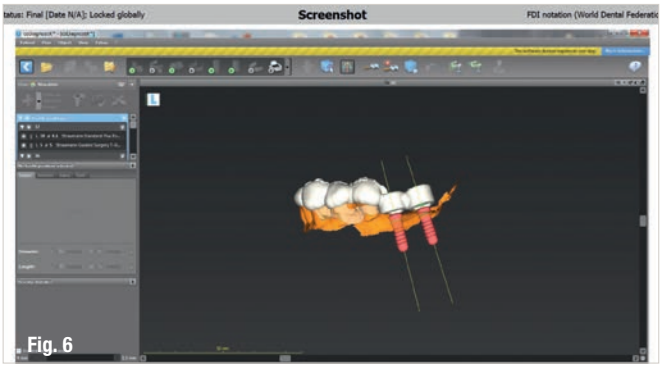

Fig. 6

Fig. 5: CodiagnostiX. **Fig. 6:** CodiagnostiX surgical guide.

So how do we begin the implant digital workflow? Successful implant treatment begins with thorough case assessment and planning of the proposed restoration. This is important for all cases, not just what we deem the complex ones. Even the most experienced implant clinician can miss a potential treatment planning hazard, especially during a busy day. Accurate study model casts are an essential part of this; however, we can now use intraoral scans preoperatively to begin the digital workflow. We take a scan rather than impressions to form digital models. Our laboratory can then use these to create digital wax-ups of proposed treatment outcomes.


Fig. 7

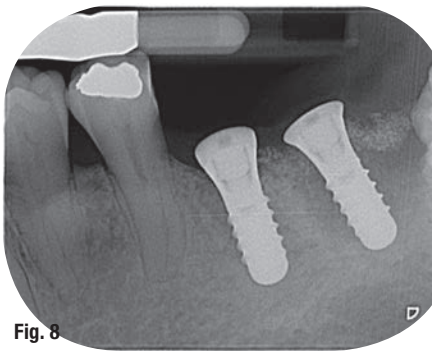
Fig. 8

Fig. 7: Printed guide and sleeves. **Fig. 8:** Postoperative radiograph of implant placement.

"If you fail to plan—then you plan to fail"—Benjamin Franklin

We are routinely used to 2-D radiographic imaging techniques in dentistry, but with the availability and access to CBCT scanning devices now, we are able to assess bone quantity and quality of proposed implant surgical sites. With ever-reducing doses of 3-D imaging and improving accuracy, we are able to use CBCT scans, combined with clever software packages such as coDiagnostiX (Dental Wings), to plan safe and accurate implant placement and restoration. We are able to preoperatively plan precise implant placement with safe surgical margins away from important anatomical structures, such as the inferior alveolar nerve or maxillary sinus. From this, we are then able to design and either mill or print a surgical guide to use for precise implant placement.

Even with assisted surgery or guided surgery, there are sometimes certain restrictions that prevent us from achieving the most ideal implant placement, such as this case shown where posterior access in the second molar region was reduced, so achieving the perfect parallel was extremely difficult.

There are fully guided systems available that allow for absolutely precise implant placement, but these are fraught with complexities and should be reserved for experienced clinicians. The accuracy of surgical guides should not be used to make up for a lack of surgical competency however.

There are many factors to be considered when using surgical guides, including whether the guide is tooth-, soft tissue- or bone-supported. Tooth-supported allows the greatest degree of accuracy.

If tooth-supported,

- are there windows in the guide that direct full seating of the guide?
- are the teeth that support exact positioning of the guide mobile? Any mobility adds a degree of inaccuracy.
- is the guide made from a direct intraoral scan or a scan of a study model? If scanning a study model, is this an accurate stone model representation? Otherwise, there is the risk of poor seating and inaccuracy of the guide.

If soft tissue-supported, mobility completely negates any accuracy of the guide, so it should only be used for a pilot drill and then a more conventional surgical protocol adopted.

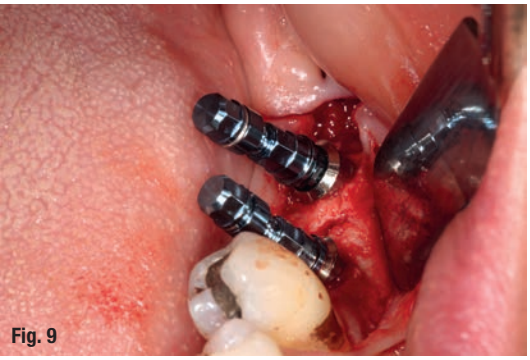
Fig. 9


Fig. 10


Fig. 11

Fig. 9: Surgical placement of LL67 implants. **Fig. 10:** Scanbodies *in situ*. **Fig. 11:** Tissue level implants.