

The digital dental revolution: part one

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In the first part of a new series, Robert Chaffe explores digital dentistry, and explains how adopting it can improve your practice

The digital world is taking over dentistry. From scanners to social media, digital is here with the aim of making our profession simple and more visual, aiding communication between colleagues, the wider dental team (including dental laboratories) and helping patient communication.

As an associate dentist, about five years ago, I felt my dentistry was stale. I was working in a clinic that did not embrace change and was often met with comments such as: 'This is how we've always done it.' My job satisfaction hit an all-time low.

Fast forward five years, and I am loving it. I am surrounded by forward-thinking colleagues at work and on social media, doing dentistry I love on patients who really appreciate all the work that goes on behind the scenes to give the best results we can.

Let's explore digital dentistry. If you are a novice, I can give you an idea of its potential and how it can improve your dentistry and the service you give to your patients. If you are more experienced in the digital world you may learn a few tips.

What is a digital scan?

A digital scan is an alternative to standard alginate or silicone impression techniques. It uses technology called computer-aided design (CAD), and the component made is manufactured with computer-aided manufacture (CAM). Hence why the term CAD/CAM is quite popular to describe these techniques.

There are two types of digital dental impressions – one is image-based, capturing a series of digital photographs, while the other captures a digital video.

The procedure can either involve LASER scanning (ie Itero, Primescan etc.), using concentrated beams of light to capture the teeth and gums in precise detail, without the need for any unpleasant material in the patient's mouth, or digital optical scanners (i.e., some of the old CEREC scanners), which require a special spray on the teeth to capture accurate detail.

Both options are safe and highly accurate. The optical scanners are less popular now with the rise of the LASER scanner and the fact their prices are reducing.

Some of the latest scanners (such as the Itero Element 5) use near-infrared imaging (NIRI) technology that has a wavelength of 0.7-2.0µm in the electromagnetic spectrum which interacts with dental hard tissues to display demineralized tooth structure in the image to help assess for caries without exposing the patient to radiation.

This is useful in pit and fissure caries that is hard to detect.

For pregnant patients who cannot be exposed to ionizing radiation, this can be a great diagnostic tool, and can be used along side conventional radiographs to help justify any treatment planning decisions.

Embracing the digital workflow

So what can I do with digital dentistry? I should phrase this slightly differently; I don't do very much without it now!

There are very few circumstances when an analogue impression is still needed. For example, if I am making an implant bridge and my verification jig does not fit, then I need to section it, so it does fit on all the implants and then I take an impression on this.

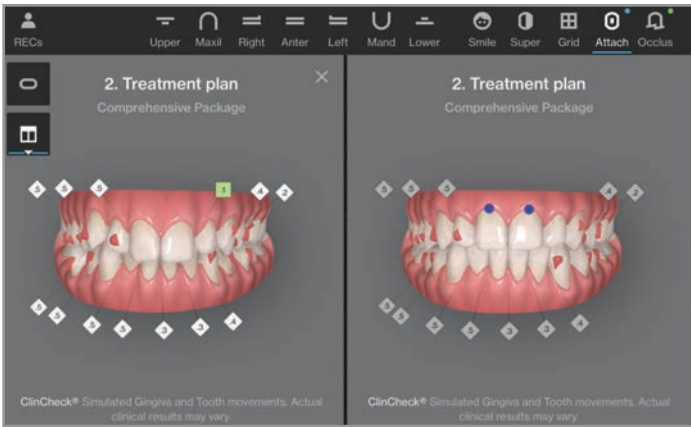


Fig. 1: Front view of before and after alignment

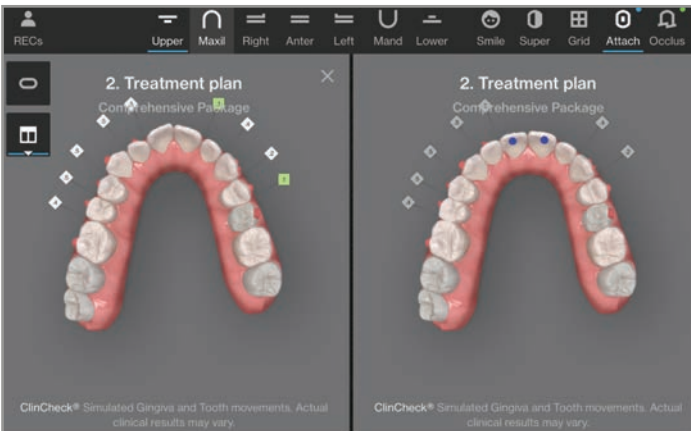


Fig. 2: View of the upper teeth before and after alignment

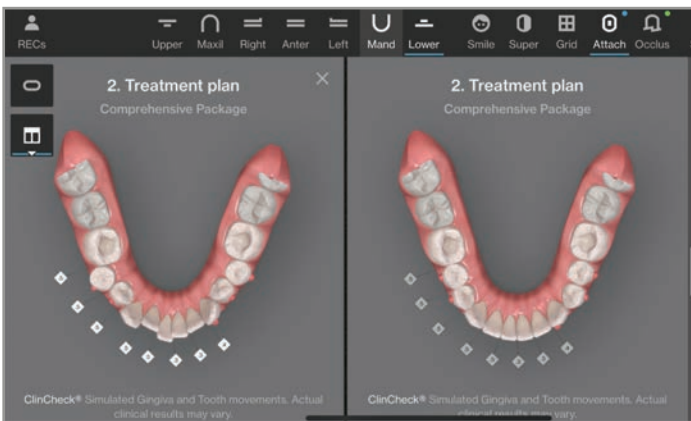


Fig. 3: View of the lower teeth before and after alignment

I also take an impression when doing aesthetic implant work, so I take a digital scan followed by a custom open tray impression, but that's it – the rest of my dental practice is fully digital.

I do a lot of Invisalign®, which comes with or without composite bonding in cases where the teeth are worn as a result of the crowding, overloading certain teeth, so when you align them, one is worn more than the other and therefore is asymmetric.

These are great cases to get a grip on the digital workflow. Your patient can see the end result of the Invisalign and the composite bonding before they even start the treatment. Patients love this, as they can see what they are getting. You get this when you purchase other items, so why not when getting your teeth done?

Case Study

Figures 1 to 7 illustrate digital planning from aligning the teeth, with the patient then wanting to see what their teeth will look like with composite bonding, and then the final result. The model of the end of alignment and wax-up were printed and a Memosil® stent was made so the exact copy of the wax-up can be replicated for the patient.

I plan all my implant cases digitally, too. I take a digital impression of the patient at the assessment and do a digital wax-up. I refer the patient for a CT scan and can import the wax-up into the CT scan, then place the implant on the computer, knowing the bone will support the implant, and I can place the implant in the correct restorative position so a good aesthetic result can be achieved. I will cover this in more detail in a later article in this series.

In summary, you can pretty much do everything with digital dentistry – it is just a question of learning the basics and applying them to your everyday practice.

Why go digital?

There are so many reasons to go digital, including improving patient communication, increasing comfort and speed, boosting patient confidence, reducing cost, and enhancing the accuracy of fit of lab made or printed components.

Patient communication

There is often a disconnect between what dental professionals tell their patients and what they interpret. This can be improved by visual aids such as intraoral scans, so that patients can actually see what is going on with their oral health, rather than just being told.

Patients love to feel that they have been engaged with, and digital aids help to facilitate this. It is also an amazing way to show people they have calculus on their teeth, which patients can often struggle to appreciate.

Patient comfort and speed

Using near-infrared imaging (NIRI) reduces the amount of

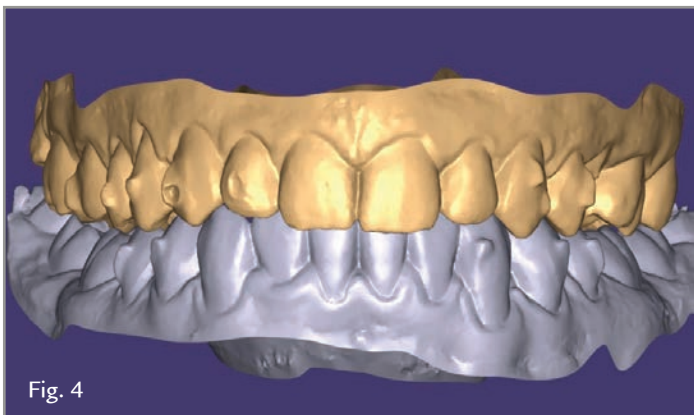


Fig. 4

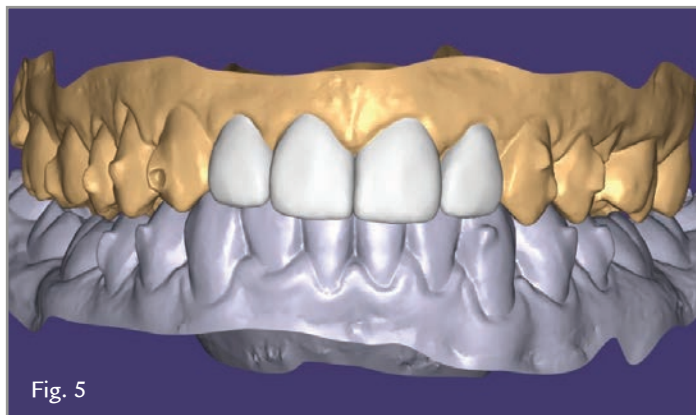


Fig. 5

Figs. 4 - 5: View of the composite bonding plan and stent on the straight teeth



Fig. 6



Fig. 7

Figs. 6 - 7: Final before and after photographs

gagging and discomfort associated with long impression-taking appointments, and means less discomfort than with conventional radiography too. There is also less of a mess associated with conventional impression taking.

I can perform a scan for a study model or bleaching tray in minutes, rather than waiting for the alginate to be mixed and set, then cleaning up the patient before going again.

In 2014, Yuzbasioglu and colleagues showed that the overall treatment time and impression time were lower with the digital impression technique as compared to conventional methods.

The digital impression took approximately 248.48 ± 23.48 seconds and conventional impression took 605.38 ± 23.66 seconds. This was a full arch silicone impression, a little like what is needed for an Invisalign impression. (The researchers did not measure the fit of any restorations.) The faster treatment process gives the clinician more time to spend with their patient, attending to their needs and questions and providing better service.

Patient confidence and cost

When a patient sees a digital scanner, they can see their dental professional is using cutting edge technology, which improves patient confidence and can aid clinical acceptance of treatment and therefore increase treatment uptake.

A survey of practitioners using NIRI technology showed that patient acceptance of interproximal caries lesions increased by 71% along with greater patient satisfaction (Nolting, Poirier and Giblin, 2020). This means a greater uptake in treatment and an overall boost in practice profitability.

However, one must interpret the results from this article with caution, as the study was produced by Itero. In the long-term, the use of scanners will reduce the cost of impression materials, which will therefore increase the profitability of the dental clinic.

Accuracy of fit of lab-made or printed components

Most of the research conducted on lab-made components shows that the fit is equivalent to, if not better, than components made with conventional impression techniques. Research has also found that the two contact points between restorations was more accurate with CAD/CAM components than with conventional impressions (Zarauz et al, 2016; Syrek et al, 2010; Ting-Shu and Jian, 2015). Zarauz et al (2016) conducted an in vivo study to evaluate the marginal fit of crowns based on conventional silicone impressions and digital Itero impressions.

To evaluate the precision of crowns fabricated using conventional and digital impression systems, 26 crowns were made using each technique and cemented onto their corresponding clinical preparations.

Means of the internal misfit and marginal misfit were measured using stereomicroscopy of 2mm thick slices in a buccolingual orientation. Results were more accurate for the digital system. Based on this, a computer-aided impression system and CAD/CAM technology can improve the marginal adaptation of all-ceramic single crowns. Further, Syrek et al (2010) and Ting-Shu and Jian (2015) reported 49µm gap for median marginal crowns fabricated using the Lava COS CAD/CAM system, while the median marginal gap for the conventional two-step impression group was poorer (71µm), although clinically acceptable.

CAD/CAM crowns also had better interproximal contact points. Vennerstrom et al (2014) reported similar marginal and internal fit values for crowns manufactured using digital and conventional impression techniques, using CEREC, Itero or Lava COS CAD/CAM systems.

Digital scanning is more efficient. Align Technology, the company that produces the Itero scanner, claims ClinCheck treatment plans submitted using Itero scans are typically posted 50% faster to the Invisalign Doctor Site (IDS)

than for cases using PVS impressions. Not only that, the company suggests there are 10 times fewer rejections of Itero scans than traditional impressions.

Summary

This article gives an overview of digital dentistry, a list of reasons as to why to get into the digital workflow and how it can help you and your practice give your patients the best experience. In addition, the case study discussed shows how it can be used to aid communication between dentists, dental teams, and patients while giving a very high standard of care. ■



ROBERT CHAFFE BDS graduated from Newcastle University in 2009. He is trained in sedation and implantology and has earned fellowship in the Royal College of Surgeons. He has developed a passion for digital dentistry, Invisalign, dental implants and restorative dentistry, which he loves sharing with patients and colleagues.

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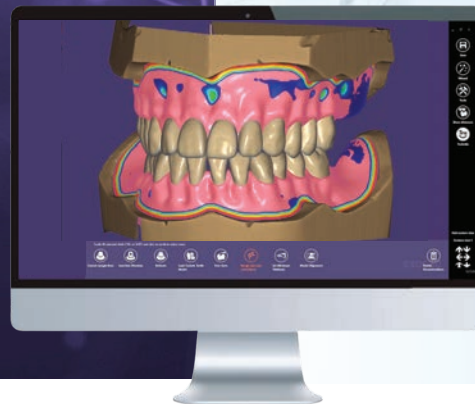
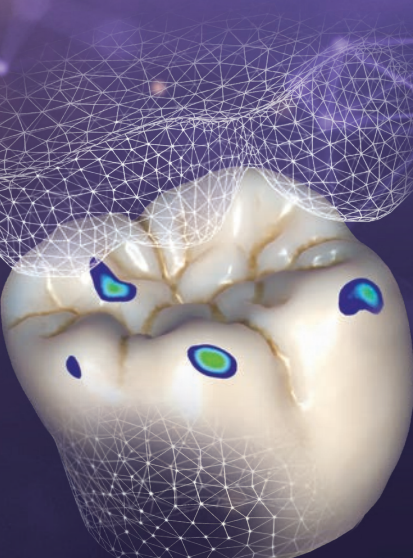
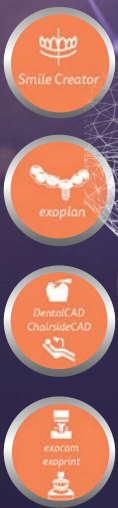
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