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Practice Transformation in the Digital Age with the Integrated Power of iTero[™] and exocad[™] DentalCAD software.

Executive summary of the conversation between Dr. Jan Einfeldt and Oliver Ambridge.

- The digital transformation in dentistry has significantly improved productivity and efficiency within clinical practices. Intraoral scanning and imaging systems can impact the treatment workflow, enabling better accuracy, reduced costs and treatment time, and improved patient experience.
- The iTero-exocad Connector[®] streamlines restorative workflows and communication with your technician. It facilitates the automated transfer of scan data, intraoral camera, iTero[®] NIRI technology (Near Infra-Red Imaging) images, and additional case-related files such as pictures, videos, or X-rays, all transferred directly into the technician's exocad[®] *DentalCAD* software. It also allows technicians to share designs with doctors to review within the MyiTero[®] platform and receive feedback before production. This consolidation of patient data and communication into a single secure channel can reduce potential errors and improve productivity.
- The digital workflow has decreased the need for remakes and minor adjustments in restorative procedures. Tools like iTero[®] Occlusogram allow for real-time adjustments and verification of the preparation, ensuring a proper fit of restorations.
- The digital practice transformation has improved the technical aspects of dental procedures and enhanced communication between dentists, dental lab technicians, and patients. It has led to a more collaborative and efficient treatment process, improving patient experience.



Dr. Jan Einfeldt

Staplehurst, Kent, UK

Dr. Jan Einfeldt is a general dentist with over 24 years as the Clinical Director of his private practice with a special interest in complex restorative treatments and orthodontics. A graduate of the University of Copenhagen School of Dentistry, Dr. Einfeldt has taught intraoral scanning since 2017. He

is also a keynote speaker and a key opinion leader for Align Technology. Dr. Einfeldt is a UK representative for the International Digital Dental Academy (IDDA) and sits on its orthodontic committee.



Oliver Ambridge, RDT Ripon, North Yorkshire, UK

Oliver Ambridge, RDT is a registered dental technician specialising in digital workflows. With over a decade of experience in the dental lab industry, Mr. Ambridge currently serves as a director at Ambridge Ceramics, an award-winning dental laboratory. He earned his qualifications from the University of Leeds and continues contributing to

research studies on optical scanning technologies. In addition to his professional responsibilities, Mr. Ambridge is a speaker for the British Academy of Cosmetic Dentistry (BACD).

Introduction

Dentists frequently face remakes in prosthetic treatments, often resulting in heightened costs, compromised patient experiences, and stress on the entire practice. Remakes often arise due to communication misalignments between doctors and labs and errors in the conventional impression-taking process (McCracken et al., 2017).

With the advent of intraoral scanners, optical impressions can now substitute traditional methods for most restorative applications. Evidence suggests that scanning matches the accuracy of conventional methods, but also decreases operator error, trims treatment time and cost, and enhances the patient experience (Joda & Brägger, 2015; Keul & Güth, 2019; Christopoulou et al., 2021).

Patients stand to gain multiple benefits from this shift, including more comfortable records taking, immediate image review, and easy follow-up scans to track changes in dentition over time. Compared to traditional impressions, scanning is preferred for patients with a sensitive gag reflex (Londono et al., 2015) or a fear of choking.

Yet, the challenges persist. Dental lab technicians and dentists rely on each other in an interdependent relationship and must be in sync to ensure the outcome meets

expectations and patient needs. They commonly use different digital platforms, potentially resulting in compatibility issues and misunderstandings, which can ultimately impact productivity and delivery timelines. McCracken et al. (2018) found that a breakdown in communication between a dental practitioner and a dental laboratory is a cause of up to 50% of remakes.

The iTero-exocad Connector[®] is a solution to these challenges. It forms a bridge between intraoral scanners and CAD software. This bridge facilitates an automated transfer of scan data, intraoral camera, iTero[®] NIRI technology (Near Infra-Red Imaging) images, and additional data, such as clinical pictures, videos, and X-rays, directly into the technician's exocad[®] *DentalCAD* software. The iTero-exocad Connector[®] offers a significant advancement toward consolidating all patient data into a single secure channel. It allows more visual and case-related information to guide technicians in designing and producing the restoration. This paper explores the transformative effect of comprehensive digital workflow and improved doctor-dental technician communication.

Practice Transformation in the Digital Age



Dr. Jan Einfeldt

When I bought the practice in 1999, the most advanced technology was actually in the reception - a typewriter. There were no computers in any equipment, so I brought the first bit of electronic equipment into the dental practice: a laptop.

Digital practice started with practice management software, as previously, we had an appointment book on paper. Then, the next step was incorporating digital radiography. I realised that digital is the way to go because if you take an X-ray and the angle is wrong, you have to take and develop it again. This is inefficient, and I don't like being late for the next patient.



Staplehurst Dental Practice, headed by Dr. Einfeldt

Then, for many years, not much happened. Some smarter technology came along, like instead of mixing silicones by hand, we got a mixing machine that made our life a bit easier. Then, intraoral scanners started coming in the periphery. At the time, I thought that scanners were just digital impression machines that were expensive and required me to work as a technician at my practice – and I did not want that.



iTero Element[™] 2 and iTero Element[™] 5D Plus imaging system mobile used at the practice.

In 2017, we finally made the jump and began using an intraoral scanner. We immediately started utilising it for restorative work, focusing on preps to provide better scans for the technicians. The results were immediately noticeable - accuracy increased, resulting in fewer remakes and adjustments. I purchased the iTero Element[™] 2 scanner in 2019, and in 2021, we added the iTero Element[™] 5D Plus imaging system mobile because of its mobility and advanced features for caries diagnostics and orthodontic simulation.



Oliver Ambridge, RDT

Ambridge Ceramics dental laboratory was founded in 1986 by my father, Mark Ambridge, to service one dental practice in Ripon. Over the years, it has grown into a large-scale operation with many qualified technicians, providing services to hundreds of dentists across the UK.

Over ten years ago, I joined Ambridge Ceramics, starting by pouring impressions and creating casts. Over time, I advanced to waxing frameworks and then onto CAD design. Now, as the lab's director, I oversee all digital operations.



Ollie Ambridge designs the aesthetic case with exocad DentalCAD software.

Our designs are now made easier thanks to the robust and reliable exocad *DentalCAD* software, which performs exceptionally with complicated designs.

Today, our operations are fully digital. We've transitioned from a single milling machine to an advanced setup with nine digital design stations, six 3D printers, three large 5-axis milling machines, and numerous on-site scanning capabilities.

With six constantly running 3D printers, we manufacture everything from provisional restorations to implant surgical guides, master models, soft tissue sections, and whitening trays.



3D printing models for whitening trays fabrication

Using the Scanner as a Communication Tool



Dr. Jan Einfeldt

In my practice, the iTero[™] intraoral scanners have proven not just a treatment instrument but a patient communication tool. My team scans every new patient before I enter the consultation room which provides a detailed visual record and eliminates the need for multiple intraoral photographs.

I set up a large screen in front of the dental chair, which allows us to review scans through the MyiTero" portal and help patients understand their oral health situation. As part of the comprehensive oral health check, we examine tooth wear, dental caries, gum disease, hairline fractures, and risks associated with malocclusions and crowding. Upon evaluating the patient's oral health, we discuss the cosmetic improvements they mentioned in their pre-exam interview.

I set aside an entire hour for the first appointment for every new patient. It allows me to conduct a thorough evaluation and extensively discuss the patient's situation. The scanner has become essential to my patient education and communication strategy, helping patients understand their oral health and allowing me to provide tailored care based on each patient's unique needs and wants.



Caries lesion on a mesial surface of UR5, barely visible on (1) Intraoral camera image and a (2) bitewing X-ray, can be clearly identified on the (3) iTero™ NIRI technology (Near Infra-Red Imaging) images. (4) Caries lesion confirmed clinically. Images are courtesy of Dr. Einfeldt.

Consultation room set up with a large TV screen to review patient scans.

Reviewing scans with an intraoral camera and iTero" NIRI technology (Near Infra-Red Imaging) images that iTero" takes automatically is what I always do. Sometimes, the X-rays are not ideal if the angle is not right or an overlap occurs, so the NIRI in my hands is more sensitive. NIRI has helped me find caries that X-rays didn't show. Despite years of experience, magnification, and good light, interproximal caries are hard to detect. NIRI images from iTero highlight it and help me decide when to treat it.

How Digital Processes Are Shaping Dentist-Technician Communication



Dr. Jan Einfeldt

Traditionally, our technician communication process was quite cumbersome. I would write prescriptions on paper, occasionally accompanied by an email with a photo. This method often led to confusion; emails would precede PVS impressions delivery, and once the prescription sheet was written, there was no easy way to recall specific instructions unless a duplicate was kept.

Everything changed with the digital protocol. I can now detail every aspect of a patient's restoration in the iTero" Rx form and attach varied files directly – from shade guide images to X-ray files or videos of my explanations for the technician. This information is immediately stored in the MyiTero" portal, and the iTero-exocad Connector" seamlessly sends all data, including iTero's intraoral and NIRI technology (Near Infra-Red Imaging) images, to my technician. This digital approach not only streamlines the process but enhances the efficiency of restoration design, reduces remakes, and ultimately results in a superior experience for my patients.



iTero Rx form with detailed instructions and files attached.

How Digital Processes Are Shaping Dentist-Technician Communication (cont.)

Analogue workflow



Doctor & technician steps in the analogue workflow. Note the complexity of communication channels.

Comprehensive digital workflow with the iTero-exocad Connector™



Digital workflow streamlined with iTero" and exocad" DentalCAD software integration.

How Digital Processes Are Shaping Dentist-Technician Communication (cont.)



Oliver Ambridge, RDT

Using the digital protocol with practices equipped with iTero scanners, we can gather all the data needed to understand the doctor's needs. We now receive more information via the iTero-exocad Connector", along with detailed prescriptions. This new integration enables us to access high-definition intraoral and NIRI technology (Near Infra-Red Imaging) images offering us more information than we ever had before.



Automated case import to the exocad[™] DentalCAD software

For instance, problems such as soft tissue covering marginal areas can be readily identified. The enhanced visual clarity empowers us to rectify distortions independently, without direct communication with dentists. Now that we've got it, I would like to request it from all the clients we work with.



Intraoral camera and NIRI technology (Near Infra-Red Imaging) images offer additional data to technicians.

Another significant advantage is the centralisation of all information that streamlines our workflow. Instead of juggling multiple sources like Dropbox and email for intraoral pictures and X-rays, everything we need is now available in the MyiTero~ portal.

These advancements have increased our productivity. The time we save by not having to communicate as much with dentists for clarifications and not having to sift through various data sources allows us to focus more on craftsmanship and precision. Time efficiency translates into greater capacity to handle more cases and optimise output, thereby positively affecting revenue.

Digital Tools Modernize Daily Procedures



Dr. Jan Einfeldt

Most of my day-to-day crown and bridge work required two appointments: initial preparation and the final fitting. I would prepare a tooth, take a silicon impression, and fit a temporary crown. But before we went digital, I wouldn't share pre-op impressions with the technician. Instead, I'd keep them for emergency temporaries. This meant the technician lacked insight into the tooth's original shape and had to guess based on the prepared tooth.

Checking whether I had created enough clearance for the restoration was challenging, especially on molars with steep cusps. I'd take a fast-setting PVS imprint to verify and measure the thinnest part with calipers. Let's say my technician would consider 0.7 mm as a minimum thickness for a given material, but I preferred to add 20% more to avoid breakage. If the crown broke, I'd have to remake it because I can't instruct patients to alter their bite strength.



iTero " Occlusogram tool shows occlusal clearance for preps and adjacent teeth.

Digital Tools Modernize Daily Procedures (cont.)

In digital workflows, we can track down where problems happen, correct them, or even prevent them from happening in the first place. I now take pre-op scans for every unit where possible, allowing technicians to replicate the original tooth shape without guesswork.

Using the iTero[®] Occlusogram tool, I can immediately assess and adjust occlusal clearance, preventing the possibility of thin, fragile crowns. With the iTero-exocad Connector[®], which transfers intraoral camera and NIRI technology (Near Infra-Red Imaging) images directly to my technician's exocad[®] *DentalCAD* software, I'm always confident in the proper fit of restorations they make, and there's less need for additional communication with them.

Although treatment remains a two-visit process for me, the digital workflow has significantly reduced the need for adjustments. **Previously, nearly 40% of all** restorations required refining or adjusting. Now, only about 10% need minor modifications.

Restorations needing adjustments





Oliver Ambridge, RDT

Using the digital protocol with practices equipped with iTero scanners, we can gather all the data needed to understand the doctor's needs. We now receive more information via the iTero-exocad Connector[®], along with detailed prescriptions. This new integration enables us to access high-definition intraoral and NIRI technology (Near Infra-Red Imaging) images offering us more information than we ever had before.

Intraoral scanners allow dentists, regardless of their skill level, to easily see quality issues with their scans, or we can quickly pick up on them. New users often share their first scans with us in real time, allowing immediate adjustments.

It's so much better than analogue impressions because we find out if there are any problems only after we cast it. Digital scans let us pick up on any issues immediately and give instant feedback. For example, If the prep wasn't scanned correctly, contaminated with blood or saliva, or the doctor has not picked up enough information, we can help correct it. This allows us to keep the patient at the least number of appointments possible and make a much smoother treatment journey for the patient.

In our experience, dentists using the digital protocol have a much lower remake number. Based on our numbers, the average remake rate for dentists using the analog process is about 12%, while for digital practices with iTero⁻⁻ intraoral scanners, it is around 3%.

Remake rates



Digital Transformation in Aesthetic and Complex Treatments



Dr. Jan Einfeldt

The treatment process for comprehensive restorative cosmetic cases was often quite complex. Multiple visits were set aside to review and adjust wax-ups and temporaries, ensuring patient satisfaction. However, this elongated the treatment process and carried risks, especially when transporting delicate wax-up models which occasionally sustained damage.

Transferring the desired form from the temporary to the final restorations also presented challenges. In the analog approach, technicians had to manually recreate the shape in ceramic – a process that isn't entirely precise.



Doctors can access webview from their MyiTero.com portal to review and approve designs.

Nowadays, for aesthetic cases, I always ask my technicians at Ambridge Ceramics to create a smile design with exocad" *DentalCAD* software. They generate a digital restoration design calibrated to the patient's facial image. This digital approach allows me to assess the design and its alignment with the patient's facial structure. After my revision, I share the CAD-designed restorations directly with patients. They don't need to come in for another appointment if they like the designs. It saves me time, improves patient experience, and gives me a written record that they've approved their future designs.



Oliver Ambridge, RDT

We appreciate the capabilities of *webview*, exocad[™] *DentalCAD* software 3D viewer in managing our aesthetic cases. The process begins with receiving the prescription from Dr. Einfeldt detailing the patient's needs. Following this, we swiftly create a digital mock-up and transmit it back.

Before the patient sees the design, Dr. Einfeldt provides insights into modifications, desired improvements, and the overall treatment approach. We integrate these suggestions into the design, tailoring it precisely to his specifications, before sending it back for further review and sharing with the patient. This efficient feedback mechanism ensures higher patient satisfaction with aesthetic outcomes. With the new ability to share designs directly with Dr. Einfeldt from within exocad[®] DentalCAD software, it is easier to get feedback from him, as we don't have to copy the web viewer and attach it to an email anymore.



The completed design can be shared with iTero doctors directly from within exocad[™] DentalCAD software.

Conclusion

Designing with more visual information and keeping all files in a single secure channel makes our work easier and ensures consistency of quality. The transition from outdated practices of handwritten prescriptions and multiple communication pathways has significantly improved collaboration with my technicians, making it more seamless and efficient. This efficiency leads to reduced remakes, better aesthetic restoration designs, and an elevated patient experience.

The iTero" intraoral scanner enables more effective communication with patients while optimising restorative workflows. My technicians are empowered to identify and address scanning issues, providing immediate feedback. When it comes to aesthetic treatments, we harness the advanced features of the exocad" Smile Creator software. This tool allows for creating accurate digital mock-ups to be shared online, streamlining the treatment process, and enabling patients to preview and approve their future designs.

Clinical Case Study

Patient: NG Sex: Male

Chief concern: The patient was not satisfied with the aesthetics of old crowns on 1.2 and 2.1 and wanted overall smile improvement.

Diagnostics and treatment plan:



Intraoral pictures of the initial condition



Extraoral pictures of the initial condition. Note the existing crowns on 1.1 and 2.1 and narrow lateral incisors.

Orthodontics diagnosis:

- 1. Class 1 dental relationship with an excessive overbite
- 2. Constricted upper & lower arches.
- 3. Crowding of upper & lower anterior teeth
- 4. Retroclination of upper & lower incisors

Dental diagnosis:

- 1. Crowns on 1.1, 2.1, 4.5 with an unsatisfactory marginal fit, a crown on 2.6
- 2. Composite filling on 2.2, amalgam fillings on 1.6,1.7, 3.6, 3.7, 4.6, 4.7.
- 3. Microdontia of 1.2, 2.2

Treatment plan:

- 1. Orthodontic treatment with Invisalign clear aligners to correct the inclination of anterior teeth and create space for restorations on 1.2 and 2.2.
- 2. Virtual smile design of future restorations
- 3. Temporization and e.max crowns on 1.2, 1.1, 2.1, 2.2.

Phase 1: Pre-restorative alignment



- 1. Initial condition
- 2. Initial position in the Invisalign® ClinCheck software
- 3. Inclination of the incisors after pre-restorative alignment
- 4. Final stage of the ClinCheck treatment plan

The number of aligners used:

- 30 initial U/L aligners
- 14 additional U/L aligners
- Treatment time: 12 months
- No emergency visits.

Phase 2: Restorative phase

Smile design and temporization.





Digital wax-up of the patient shared via exocad[™] DentalCAD software webview

Temporization aids based on the patient-approved design.

The Patient approved the smile design shared via exocad[™] *DentalCAD* software *webview*. Based on the approved design, 3D-printed models with temporisation stents were ordered from the laboratory. We prepped the teeth, took an iTero[™] scan for the final restorations, and placed the provisionals (Luxatemp) with a stent made from the digital wax-up.



Adjusting temporary restorations

After we've reviewed and adjusted the provisionals with a patient, we scanned them again. This allowed my technician to fabricate the final restoration in a shape that the patient approved and which he truly wanted.

Final outcome



Close-up smile photograph of the final restorations in place

| Tooth D | lagram | | | | | | | | | | | | | |
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iTero Rx form with attached shade tab images

Pre-opAfter orthoFinal smileImage: Image: Image:

Extraoral photographs of the treatment stages

9

Discussion

The patient's reaction to his smile transformation was deeply touching. He shared that improving his smile was a dream he had harboured for many years. He initially approached our practice with a request for teeth straightening but soon understood that an integrated ortho-restorative approach would produce a superior result. We illustrated this potential outcome before the treatment started using the Invisalign® Outcome Simulator Pro on our iTero® scanner. Given his narrow upper lateral teeth, our strategy was to make room for restorations from the very beginning.

In this case, the digital workflow allowed us to communicate effectively with our technicians at Ambridge to determine how much tooth preparation was required, the best material for the patient, and the strategy to achieve the optimal restorative outcome.



Invisalign® treatment simulation using the Invisalign® Outcome Simulator Pro software during the initial consultation. Even with the alignment improved in the simulation, it was evident to the patient that the final esthetic outcome would necessitate restorative treatment.

The patient's reaction to his smile transformation was deeply touching. He shared that improving his smile was a dream he had harboured for many years. He initially approached our practice with a request for teeth straightening but soon understood that an integrated ortho-restorative approach would produce a superior result. We illustrated this potential outcome before the treatment started using the Invisalign® Outcome Simulator Pro on our iTero® scanner. Given his narrow upper lateral teeth, our strategy was to make room for restorations from the very beginning.

In this case, the digital workflow allowed us to communicate effectively with our technicians at Ambridge to determine how much tooth preparation was required, the best material for the patient, and the strategy to achieve the optimal restorative outcome.

A complex case like this requires seamless collaboration between the dentist and the laboratory. Utilizing a wide range of digital tools, enhanced by the recent introduction of the iTero-exocad Connector[®], helps establish an effective working relationship. This partnership leads to aesthetically pleasing outcomes and significantly improves the patient's overall experience.

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