

# CAD/CAM

the international magazine of digital dentistry

1 2017



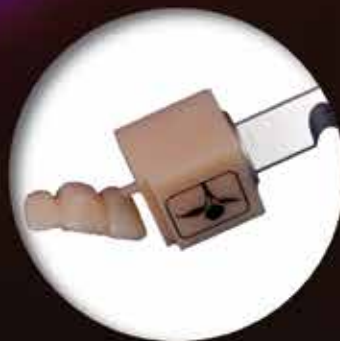
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Integrating digital technology to expand treatment and services

## **\_clinical**

In-office surgical guide fabrication

## **\_technology**

Digital tools in planning and implementing esthetic ceramic restorations

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# Make more than an impression. Make an impact



Gary Severance, DDS

\_ Impressions, implants, ortho aligners and sleep appliances can all make an impact on the lives of our patients. All of these dental procedures and appliances are possible with a great intraoral scanner. The definition of CAD/CAM means the computer-aided design and computer-aided manufacture of a product used to turn designs into physical parts. For the dental profession, we normally think of restorations such as crowns, inlays and onlays. Thinking outside the box and expanding the capabilities of CAD/CAM requires vision and ingenuity.

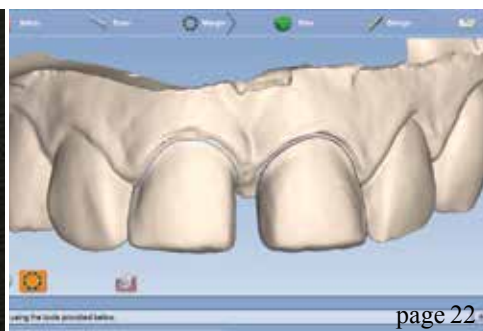
The following articles will provide a perspective of digital dentistry from clinicians who are perfecting their craft not only through computer-aided design and computer-aided manufacture but the main component of all these processes — computer-assisted capture (CAC). CAC is the best combination of ergonomics, efficiency and productivity through an intraoral scanner and, in this instance, the introduction of Planmeca Emerald.

CAD/CAM has been synonymous with designing and milling same-day restorations. We look to our dental schools to see where the future of dentistry lies. Dental educators are teaching the future leaders of our industry to master digital innovations as we once mastered traditional techniques. The pace in which technology advances will reshape dentistry as we know it. This makes it all the more important to create a dialogue with our colleagues and peers.

Collaboration within all facets of dentistry are creating a network of international leaders to assist in diagnosis and evolving treatment to form a digital dentistry "think tank" on Facebook, called PlanmecaFIT users group, spearheaded by Dr. Kiril Kostin of St. Petersburg, Russia. Join the users group and join me in thanking every author in this issue of **CAD/CAM** magazine for elevating the level of dentistry it delivers.

Gary Severance, DDS





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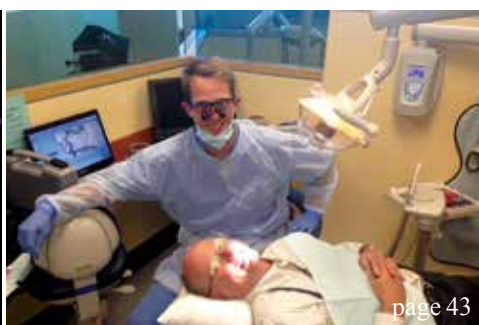
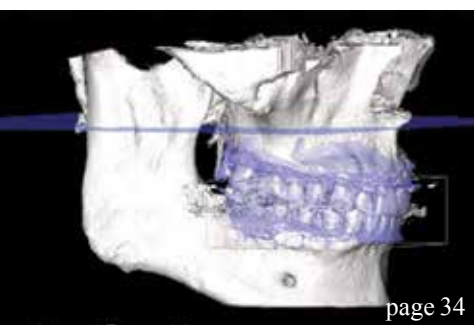
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## on the cover

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# Integrating digital technology to expand treatment and services

In recent years, technology — particularly CAD/CAM — has enabled forward-thinking general practitioners (GPs) to personally offer their patients more services and convenience than ever before right in their familiar dental office.

That trend has continued as technology that has become even more sophisticated is now enabling GPs — many of whom have already expanded into implantology and same-day dentistry — to provide their patients with even more of the services they traditionally “farmed out,” including fabrication of aligners, sleep appliances and sports devices.

Dentists interviewed by CAD/CAM describe how they themselves use this technology or help other GPs use it to take their practices to the next level.

## \_3-D integration

David R. Edelson, DMD, an early adopter of technology in dentistry, says he made a conscious deci-

sion to cross specialist barriers to grow the dental practice originally started by his father, Irving, in Plainville, Conn., never shying away from offering the services his patients wanted or needed. “I do my own root canals including molars, full ortho cases with bracketing, Invisalign and dental implants, for which I took a mini-residency in the 1990s in Boston, when few GPs were placing them,” he says, adding that he generally refers out impacted third molars and cases requiring IV sedation.

Unlike some who purchase technology specifically for a given purpose — e.g., placing implants — Edelson says he didn’t initially have a real agenda when purchasing technology to replace equipment that became outdated. However, he did purchase carefully and strategically, and was among the first in his area to embrace chairside CAD/CAM dentistry and now uses the Planmeca FIT system. When he needed a new 2-D panorex, he foresaw that he would later want 3-D, which required an additional room that he didn’t then have. “Planmeca had an upgradable machine, so I could start with 2-D and upgrade to 3-D later without having to change anything except the sensor. I loved the images and the Ultra-Low Dose radiation exposure option that only Planmeca offers and also preferred its integration with the Planmeca FIT CAD/CAM system.

“Some people buy technology, then start doing new procedures, but I had already been doing them, so what I felt most of all — especially with implants — was greater peace of mind and improved treatment planning as well as an improved patient experience. I could see more before the surgery was actually performed, so I could tell patients ahead of time that a bone graft may be needed, or I could have a surgical guide made for guided surgery to place an implant precisely based on information from my Planmeca Promax X-ray.”

Edelson says his system includes the Planmeca

## \_about the doctor

## CAD/CAM

David R. Edelson, DMD, MAGD, DICOI, has been a chairside CAD/CAM user since 2005 and recently switched to the Planmeca FIT system. He is a master of the Academy of General Dentistry and a diplomate of the International College of Oral Implantologists. Contact him care of David R. Edelson, DMD, PC, 92 E. St., Plainville, CT 06062 or by email at [dmd92east@gmail.com](mailto:dmd92east@gmail.com).





Emerald scanner and Planmeca PlanMill 40S milling machine as well as his Planmeca Promax system with 3-D plus 2-D with the cephalometric option, so he can take both conventional panorex or cephalometric X-rays for orthodontic cases.

"I now use it for everything — implants, endodontics, surgery, diagnosis. If someone has pain and we can't figure out what it is, we can jump on the 3-D to see if there's a fractured root or lesion we can't see on a traditional X-ray."

Then, too, is the same-day dentistry he couldn't do without a complete system with the PlanMill 40S milling unit, also from Planmeca. He says he mills his own crowns, inlays, onlays and veneers in-house and uses a lab or outsourcing center only for bridge framework and custom implant abutments.

Edelson says, like his father always preached, he has become a "super-generalist," a term he first heard from Dr. Carl Gugino, an orthodontic specialist, to meet the needs and expectations of loyal patients who want a one-stop dental care. "My patients appreciate that I can offer all these services so they can stay in an environment they are used to and comfortable with."

## Dental sleep medicine

Joe Magness, DDS, sold his private practices two years ago to pursue his great passion — advocating for public health and his own contribution to it, the RiPPLE® appliances, which are designed to promote restful sleep, which he calls "the foundation of health."

In 2008, he "fell in love" with dental sleep medicine after taking a course and using the education to solve his own issues with poor sleep and pain. He says, "I started playing around with different designs in 2010, but in 2012, I knew I had something." But that something — the first RiPPLE® retainer — had to fit perfectly, and that meant insuring that it be based on an accurate impression.

"If there's distortion in the impression, the basis for the models from which appliances are made, it won't fit correctly. Even 20 microns can be the difference between comfort and pain," Magness explains. He has used an intraoral scanner (IOS) for years and finds it invaluable at reducing the obstacles for both the patients and staff. He is currently using the Planmeca Emerald at his sleep clinic, as well as for research and development and to demonstrate his product at meetings and instructional gatherings.

How he got from running busy traditional private practices to heading a multifaceted business that employs 14 full-time programmers and involves a daunting travel schedule crisscrossing the country to conduct training and otherwise support sleep dentists has everything to do with the technology he

## about the doctor

## CAD/CAM



Joe Magness, DDS, is a general dentist from Orem, Utah. He graduated from New York University College of Dentistry in 2001. He has owned multiple practices but now limits his practice to dental sleep medicine for the past two years. His passion is to help offices implement dental sleep medicine and medical billing. He is a member of the AASM and AADSM. Magness has lectured for Henry Schein and other companies. He is the CEO and founder of imagin® Solutions, a company out to improve interdisciplinary collaboration and understanding to improve health in this country. He is also the inventor of the RiPPLE® appliances.

used back then — and now — to diagnose and treat patients. "This journey could not have taken place without the technology we have had available the last five years," he says.

He says it is possible to use traditional impressions to fabricate a sleep device such as his, but he doesn't recommend it and never has used anything except an IOS himself. "The RiPPLE® appliances are a conservative, cost-effective, non-invasive way to improve sleep, but because doctors should have different options in appliances to use, our company, imagin® Solutions, helps offices learn about and implement all the different appliances and other options."

For all sleep devices, he continues to use and recommend Planmeca's IOS because of its accuracy overall and that it offers the ability to scan the entire arch. He says he also appreciates the ease of the system, as the digital workflow is critical to his business, which not only helps doctors create the device but also to work with the insurance companies — both dental and medical — using software that provides coding for both.

"Treating sleep disorders is one of few specialties where medicine and dentistry work closely together, and today, we have the software and technology to simplify the process and remove the obstacles," Magness says.

Claiming "Dentists have the potential to improve health as much as any other provider of health care in this country," Magness maintains that the technology he recommends will not only help in dental sleep medicine but also help achieve comprehensive care in dental practices. "Intra-oral scanners can improve impressions and speed up communication with a lab; CAD/CAM technology can improve restorative dentistry, and CBCT scans provide dentists and others with the information they need to better understand patients' conditions for improved treatment planning and treatment."

# ‘You can save money and have better control over the final product by making use of your own chosen laboratory or your own technology’

## \_Orthodontic solutions

K. Amanda Wilson, DDS, MDS, too, turned away from individual private practice to focus on supporting colleagues' movement into her own specialty, orthodonture, which she practiced for 10 years. She now advises others — mainly general practitioners and pediatric dentists — on how to leverage their relationship with patients and today's technology to offer patients orthodontic services.

Wilson explains that her company, StraightSmile Solutions, is not affiliated with any specific product or service and can advise on any type or brand of orthodontic appliance or technology. The advice she offers via this subscription service to dentists all over the world focuses on the individual case — cases she can review in accordance with privacy laws, using a HIPAA-compliant portal to transmit patient records.

Describing herself most of all as a coach and educator, Wilson notes the trend toward “de-specialization” in dentistry. “Dentists can do anything and everything, but it can be daunting to find the best solution.” She says a growing number of them are now recognizing they can dramatically lower aligner lab fees — which run between \$1,800 and \$1,900 for a full Invisalign case — or even doing some or all of the work in-house. “Some orthodontic systems and brands require you to use specified labs, but others do not. You can save money and have better control over the final product by making use of your own

chosen laboratory or your own technology — e.g., the Planmeca platform, including the Planmeca Emerald scanner — to print your own models and fabricate your own aligners. The trick is knowing which cases can safely and effectively be completed this way.”

Wilson says there are many good reasons for GPs to offer patients orthodontic solutions in appropriate cases. “Patients like the convenience of staying in their own dentist's office for all these needs, including ortho — especially if it's less expensive. Aligners done in-house are not only less expensive, they can be delivered in a matter of hours, rather than several weeks.”

Wilson says dentists considering ortho should at the minimum invest in an intraoral scanner and doesn't hesitate to recommend the Planmeca Emerald. “It's probably the top-of-the-line scanner in terms of size of technology unit, speed, ease of use. It's a small investment that can pay off in matter of months.”

For dentists, she says, offering an in-house ortho solution is a proven way to differentiate and grow their practices. “The ability to perform orthodontic cases in your office, instead of referring them out each time to a specialist, can greatly increase revenue through case volume, patient retention and new patient acquisition. This creates an opportunity for the patients looking for convenience and the practitioners looking for increased profits. The key to success is case selection.”

## \_about the doctor

## CAD/CAM



Founder and CEO of StraightSmile Solutions, Amanda Wilson, DDS, MDS, is an entrepreneurial, innovative senior dentist and dental consultant who has excelled in telecommuting and in-office roles improving client experiences and company growth trajectories. Wilson is passionate about the future of the profession and consistently stays ahead of key treatment and technology trends in order to provide unparalleled service.



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# In-office surgical guide fabrication

Author\_Michael Flores, DMD

Digital technology has not only enhanced everyday life, but it has given a new life to some everyday dental procedures. From same-day restorations to dental implants, digital dentistry has not only made dentistry easier but also more predictable. Dental implant procedures have been a direct beneficiary to the enhancements in digital dentistry.

Cone beam computer tomography (CBCT) volumes allow the clinician the ability to see vital portions of the patient's unique anatomy in three-dimensions without any additional invasive procedures. Intra-oral scanning (IOS) allows the clinician the ability to digitally "impress" the patient's dentition or mouth and translate those into digital files that can be manipulated for use in restorations, surgery, cosmetic mock ups, etc. Combine the two technologies together, CBCT and IOS can help the clinician and their team achieve predictable surgical guides and lasting clinical results.

## Case study

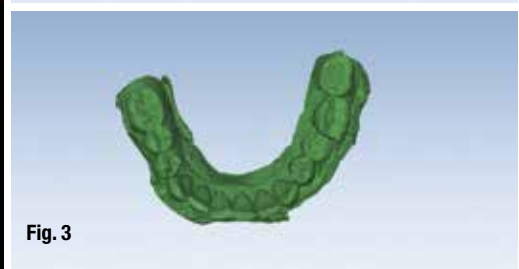
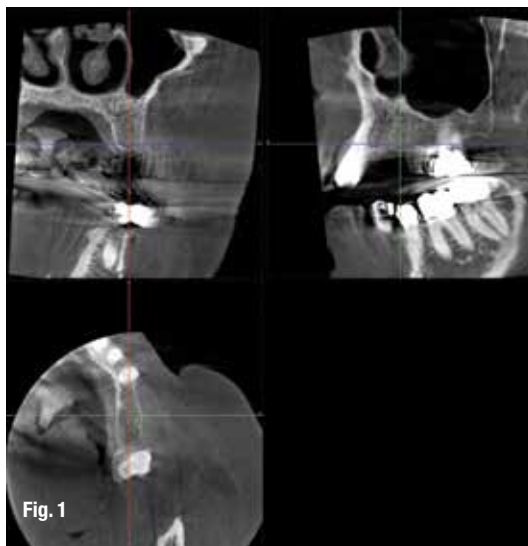
A 73-year-old, Caucasian female presents to the dental office with teeth missing in the upper left quadrant (#12-14). A comprehensive examination and hygiene assessment were completed, and restorative options were provided for the ULQ. She opted for a 3 unit implant supported bridge. She did not like the idea of having a removable prosthesis or the idea of a long-span bridge.

First steps were to capture the patient's hard- and soft-tissue information digitally. The office protocol uses Premier Dental's ComfortView Lip & Cheek Retractor and cotton rolls to disclude the patient while capturing the CBCT volume. Using the Planmeca Promax 3D, we were able to capture a quality volume of the patient's left side (Fig. 1). Next, using the Planmeca Emerald intra oral scanner, we capture the patient's upper and lower arch (Figs. 2, 3).

**Fig. 1** Planmeca Promax 3D volume captured desired implant placement areas, including vital anatomic features required for accurate planning. (Photos/Provided by Michael Flores, DMD)

**Fig. 2** Planmeca Emerald scan of the patient's upper arch.

**Fig. 3** Planmeca Emerald scan of the patient's lower arch.



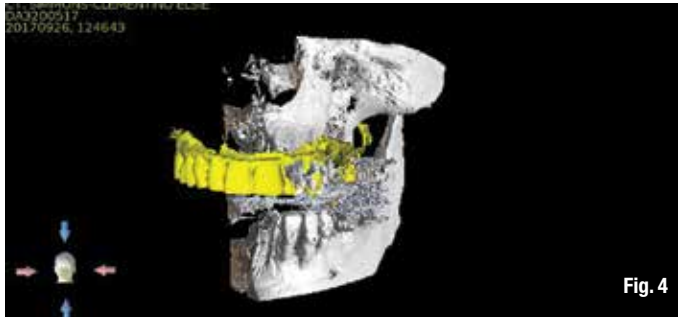


Fig. 4

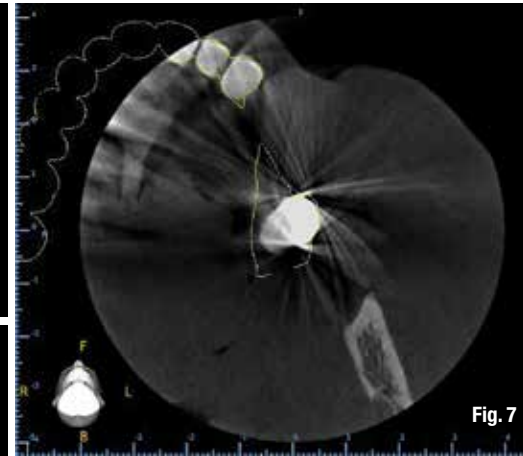


Fig. 4\_ 'Stitching' of the CBCT volume and the STL files.

Fig. 5\_ Stitched sagittal view of CBCT volume and STL files.



Fig. 5

Fig. 6



Fig. 7

Fig. 7\_ Stitched axial view of CBCT volume and STL files.



Fig. 8

Fig. 8\_ Virtual implant placement: surgical guide tubes, implants and generic abutments.

Fig. 9\_ Surgical guide virtually fabricated.

Planmeca Romexis and Planmeca PlanCAD has an advantage of being a completely open software, therefore the volume (\*.DCM file) and IOS scans (\*.STL files) are easily exported to Blue Sky Bio's Blue Sky Plan (BSP). Once the files are opened in BSP, we are able to stitch (combine) the files together to plan implant placement for both soft-tissue and hard-tissue features of the patient (Figs. 4-7). Note the yellow outline in Figs. 5-7. They are representative of the STL file stitched to the DICOM (DCM) file. By using the dentition as the same element in both files, one can combine the two files together, allowing for a cohesive and accurate soft/hard tissue representation.

Using Blue Sky Plan, we were able to measure and plan implant placement based on varying factors, like restorative plan, distance from vital structures, bone quality and the clinician's surgical ability. The clinician decided to place MIS Seven implants in the area. Using the specifications provided by MIS' website and measurements taken by the dentist of MIS' guided surgical kit, the clinician was able to ideally plan two implants for a 3 unit implant supported bridge (Fig. 8).

Once satisfied with the virtual implant placement, a guide is fabricated in the BSP software (Fig. 9).

The STL of the surgical guide is then exported from BSP and opened in Formlabs Preform Software. The Preform software automatically determines the best angle to print for most accuracy, the number of supports needed for a successful print, and based on the number of prints and with the build plate and resin tank, determines the best location for printing (Fig. 10).

Fig. 10\_ Exported surgical guide STL imported into Preform software and prepared for printing.

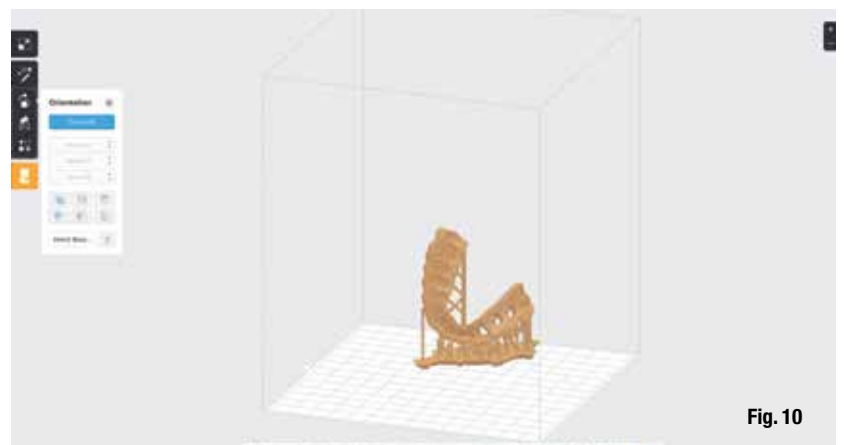


Fig. 10

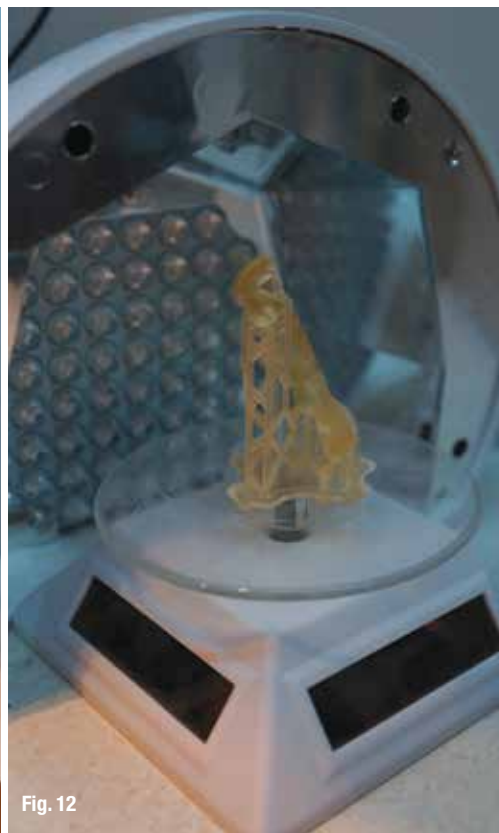


**Fig. 11**\_Post-processing equipment: 91 percent IPA bath with magnetic stirrer to remove uncured resin on print.

**Fig. 12**\_Post-processing equipment: Solar turn table, 405 nm UV LED light to final cure surgical guide and supports.

**Fig. 13**\_Surgical guide and supports completely cured.

**Fig. 14**\_Supports removed and guide polished.



Formlabs Form 2 3D printer with Formlabs Dental SG (surgical guide) resin was used to fabricate the surgical guide. Once printing is completed, post-processing of the guide is required to ensure biocompatibility. The build plate and print are removed from the Form 2. A 90 percent or higher isopropyl alcohol (IPA) bath is used to remove excess, uncured resin (Fig. 11).

After IPA bath, a thorough rinse and dry, a post-cure process is required (Fig. 12). Once completed, the print will have an orange translucent color (Fig. 13).

The print supports are removed and areas polished (Fig. 14). Please note, the virtually planned surgical guide and surgical presented in post processing are not the same; however, the virtual planning and post processing were identical.

Once virtual planning, 3-D printing and post processing are completed, the clinician is able to proceed with the surgery. First we verified fit of the surgical guide. Next, we followed MIS' recommended protocol for implant placement. Procedural radio-

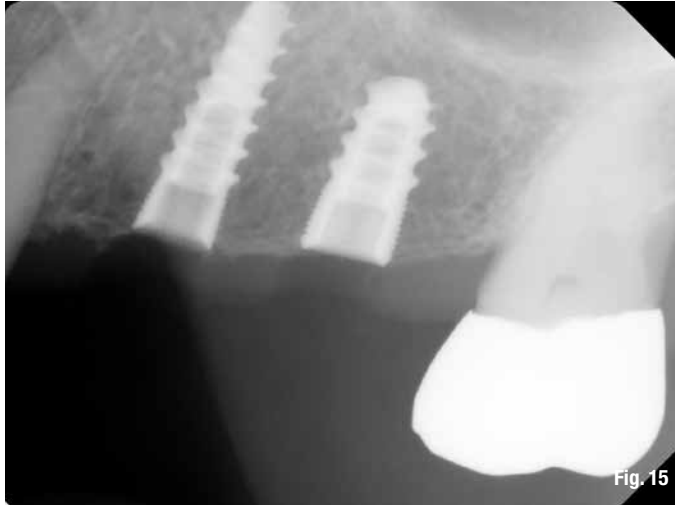


Fig. 15

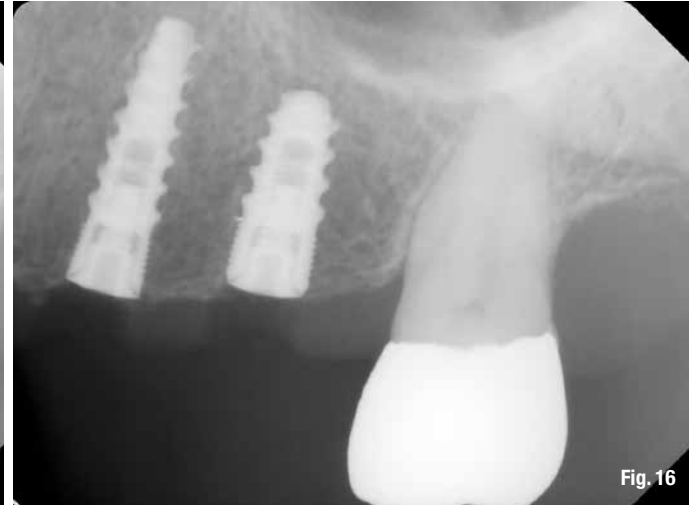


Fig. 16



Fig. 17



Fig. 18



Fig. 19

**Fig. 15** Procedural radiograph showing distance from vital anatomy, depth of implants placed and parallelism of implants placed.

**Fig. 16** Procedural radiograph depicting cover screws placed.

**Fig. 17** Two-week post op intraoral photograph with guide in place, showing the accuracy of the guide and clinical implant placement.

**Fig. 18** Two-week post op intraoral photograph showing the fit of the guide.

**Fig. 19** Two-week post op intraoral photograph showing the soft-tissue healing and implant placement.

graphs were taken to evaluate depth, parallelism and distance(s) from vital structures.

Once satisfied, the clinician took final check films (Figs. 15, 16). The patient was provided postoperative instructions. Two-week postoperative photographs (Figs. 17-19) were obtained, depicting the healing and showing the fit and accuracy of the surgical guide.

## Conclusion

The ability to combine different technologies for implant planning and surgical guide fabrication in-house allows the clinician to minimize costs and turnaround time, maximize benefits and minimize risks for patients.

## about the author

## CAD/CAM



Dr. Michael Flores, originally from San Diego, has made Las Vegas his second home. Being involved in dentistry for more than 15 years has given him the opportunity to create a family practice where adults and children can come to find a dental home. He began his dental career as a dental assistant while obtaining his bachelor's of science in cell and molecular biology from San Diego State University. From there, he received his doctorate of dental medicine from University of Nevada, Las Vegas School of Dental Medicine and graduated cum laude. As a student he received recognition from the Academy of Cranio-Facial Pain. Some areas of focus are CAD/CAM restorations, the placement and restoration of dental implants and cosmetic dentistry. Flores

is an active member of the North Las Vegas community, sponsoring various charities, schools and athletic teams. He also has held a position in the Executive Council of the UNLV: School of Dental Medicine Alumni Association.

# Single-visit restorations using the Planmeca CAD/CAM System: An internationally trained clinician's perspective

**Author\_** Dr. Farzana Paleker

\_What do you want to be when you grow up? A common question we ask of children, teenagers and young adults. Usually when this questions is answered, it means the one career you have for the rest of your life. On rare occasions, some individuals have the opportunity to do what they love and follow their passion from another perspective. Farzana Palekar is the rare occasion in the dental industry.

Dr. Farzana Palekar is the clinical director and lead assistant at Kaye Dentistry and the New York Center for Digital Dentistry (NYCDD) on Madison Avenue in New York City. Prior to becoming the clinical director for NYCDD, she was a practicing dentist for 13 years in South Africa and the Netherlands. During her years as a dentist in South Africa, she specialized in prosthodontic dentistry with several group practices. In 2015, she and her husband decided to move to New York so that he could complete his post-graduate work at Columbia University.

While transitioning from South Africa to the

United States, Farzana completed two post-graduate degrees, one in bioethics and one in endodontics. After relocating to the United States, Farzana realized that becoming re-licensed as a dentist in the state of New York required three years of education from a U.S. institution at a cost of \$110,000 per year. Rather than having two people in one household completing more education, she decided to continue following her passion by becoming the clinical director and lead dental assistant at NYCDD and postpone the re-licensing process in the U.S.

Some clinicians would have viewed this opportunity as a "step down." However, Farzana saw a chance to learn and use innovative CAD/CAM technology, which was a technology not frequently used in South Africa. As the lead dental assistant, Farzana currently scans and designs a significant number of the single-visit crowns produced in the New York Center for Digital Dentistry.

When she trains other dental offices on





**Fig. 1**\_Pre-operative photo of #18 and #19 showing large amalgam restorations. (Photos/Provided by Dr. Farzana Palekar)

**Fig. 1**

CAD/CAM technology, she emphasizes that any office not transitioning to digital dentistry will become obsolete. Not only has she become proficient in digital dentistry, she finds there are surprising benefits to her role as a lead dental assistant.

"I have a unique perspective of dentistry from the other side of the patient. In my role as an assistant, I find that I have more of a connection with my patients than I did when I was a practicing dentist. From this perspective, patients will reveal more telling information about how they are feeling, which can be more important."

For Farzana, her experiences with scanning digital impressions and designing restorations have deepened her passion for dentistry. She feels that she has improved her bedside manner, which allows her to empathize with her patients, and she genuinely enjoys scanning. Her next project in the dental industry is to delve into the manufacturing process of restorations through the New York Center for Digital Restorative Solutions, a state-of-the-art dental lab affiliated with NYCDD. Dr. Farzana Palekar is one clinician whose passion for dentistry truly provides her patients with a holistic approach to dental care as seen in the following case study.

## **\_Introduction**

Computer-aided design/computer-aided manu-

facture (CAD/CAM) has been used in dentistry for the last two decades. Traditionally, CAD/CAM technology has been employed by dentists and laboratories to use computer software to design and fabricate esthetic and durable restorations. However, continuously evolving technologies in the field of "chair-side single-visit dentistry" has resulted in increased involvement by dental assistants in the digital workflow.

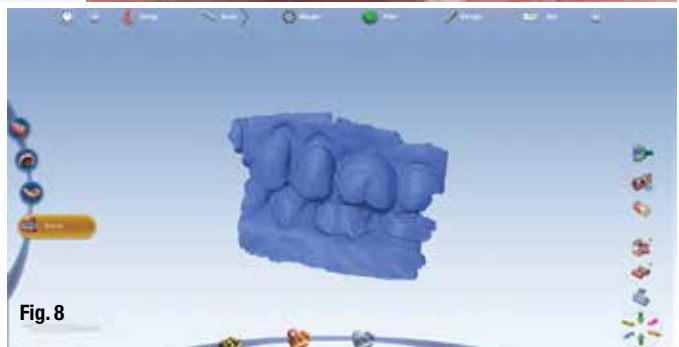
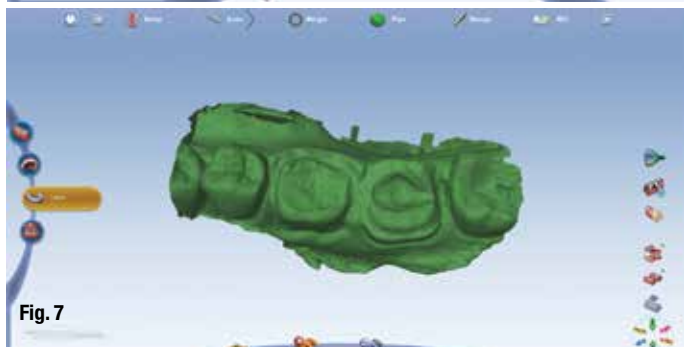
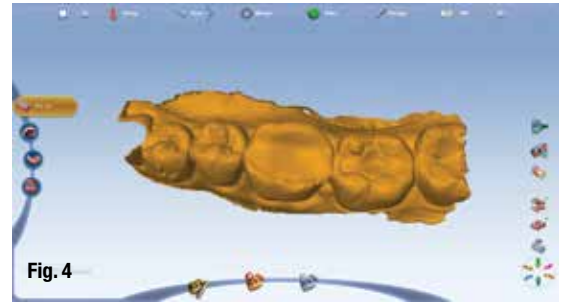
## **\_Case**

The latest Planmeca CAD/CAM system, like its predecessor, follows a process chain of scanning, designing and milling phases. The purpose of this case study is to demonstrate the benefits of the Planmeca CAD/CAM system for dental assistants involved in the scanning and manufacture of chair-side single-unit dental restorations.

The patient, a 35-year-old female, presented with defective amalgam restorations on #18 and 19 (Fig. 1).

After an intra-oral and X-ray evaluation, the dentist discussed restorative options with the patient. These included both single- and multiple-visit restorations.

The patient opted to have a chair-side e.max crown and onlay prepared and completed during the same appointment.



**Fig. 2\_** Completed digital prescription for the proposed work on #18 and #19.

**Fig. 3\_** The Planmeca Emerald scanner.

**Fig. 4\_** Pre-operative scan of #17-21.

**Fig. 5\_** Scan of the opposing teeth.

**Fig. 6\_** Photo depicting the preparations after removal of the amalgam and decay.

**Fig. 7\_** Preparation scan of #18 and #19.

**Fig. 8\_** Buccal bite scan.

## \_Step 1: Scanning

After the dentist anesthetized the tooth, the dental assistant entered the relevant prescription information into the Planmeca PlanCAD Design Software (Fig. 2) and proceeded to take digital impressions using the Planmeca Emerald Intraoral Scanner. This ultra-lightweight, ergonomically designed digital scanner is compact, easy to use and control, and rapidly delivers highly accurate and detailed images with superior accuracy and detail (Fig. 3).

At this stage, a pre-operative scan of the relevant teeth was taken that included at least one tooth on either side (Fig. 4).

The teeth occluding with these were scanned for the opposing scan (Fig. 5). These scans were completed in three to five minutes.

After removal of the existing restorations and preparation of the teeth by the dentist (Fig. 6), a preparation scan was taken using a copy of the pre-operative scan (Fig. 7), followed by a buccal-bite scan (Fig. 8).

## \_Step 2: Design

A digitally trained assistant used the Planmeca PlanCAD Design Software on a laptop to map the preparation margins (Fig. 9) and design the crown and onlay in under 15 minutes. This guided software, with an easy-to-follow navigation, automatically positions and shapes the selected tooth templates to match the central grooves, cusp heights and marginal ridges of the actual proximal dentition. After verifying the bite and aligning the preparation, the PlanCAD Design Software generated proposals for the crown and onlay to be manufactured (Fig. 10).

During this stage of the workflow, modifications can be made to the design according to the dentist's specifications or it can simply be copied from the pre-operative scan. This stage gives the doctor time to examine other patients and gives the patient an opportunity to take a break. Typically, patients enjoy watching the design process and are notably impressed with the technology used during every step of the workflow.



Fig. 9

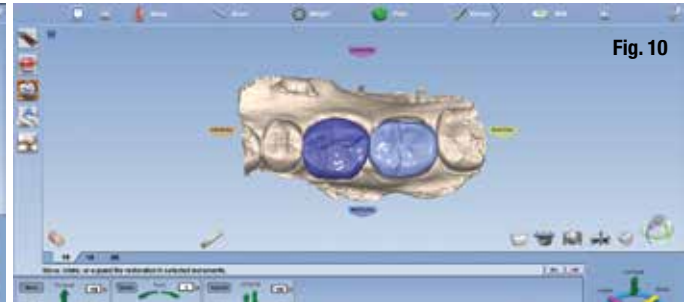


Fig. 10



Fig. 11



Fig. 12



Fig. 13

### \_Step 3: Manufacture

The design was sent wirelessly from the Planmeca PlanCAD Design Software to the Planmeca PlanMill 40S that features SmartMill touch-screen operation. The assistant then placed a pre-selected e.max block into the mill where the dual spindles simultaneously milled the crown on both sides of the block in 11 minutes. A second pre-selected e.max block was placed into the Planmeca PlanMill 40S to mill the onlay in nine minutes.

From here, the restorations were tried in to verify the bite and inter-proximal contacts (Fig. 11). No chairside modifications were necessary for this case. The restorations were then stained, glazed, and sintered in an oven for 20 minutes.

### \_Step 4: Insert

The restorations were seated by the dentist using a bonded technique (Figs. 12, 13). The patient was seen from start to completion within 90 minutes.

### \_Discussion

The positive responses we get from our patients every time they observe the design and manufacture and experience the benefits of chairside CAD/CAM restorations is extremely satisfying. All team members involved in the workflow optimized their time during this appointment.

The design, milling and sintering time allows the patient to catch up on calls, emails and even grab a cup of coffee. What the patients love most is that they don't have to return for the insert at a second appointment, which involves time and likely more

local anesthetic. The dentist was also able to leave the operatory intermittently to continue with other procedures.

And finally, the digitally trained assistant no longer has to take analog impressions that have a long setting time and are uncomfortable for the patients, or pour these to make stone models. These steps involve various materials that require specific handling and are messy to use and clean up.

An additional benefit of using a CAD/CAM system, like the one by Planmeca, is the favourable environmental impact. Analog impressions and stone models have to be saved and stored for a set time period and they ultimately end up polluting landfill spaces when they are discarded. The digital impression can be stored electronically indefinitely, which saves space, contributes to efficient recordkeeping and supports a paper-free environment.

**Fig. 9** Margin lines mapped on both preparations.

**Fig. 10** Design proposals generated by the Planmeca PlanCAD Design Software.

**Fig. 11** Chair-side try in of the restorations in the purple pre-sintered phase.

**Figs. 12, 13** Post-operative photo taken after insertion of the restorations.

### \_about the author

### CAD/CAM



Clinical Director and Lead Assistant for the New York Center for Digital Dentistry Dr. Farzana Paleker's experience as a foreign-trained dentist gives her extraordinary knowledge and understanding when she assists dentists in the delivery of dental procedures. She draws from her years of experience to enable the introduction and integration of new and upgraded systems and equipment at Kaye Dentistry. She is a certified trainer in various digital technologies and is involved in the scanning, designing, milling and finishing of digital crowns. Her goal is to create a supportive, friendly atmosphere and to ensure that patients understand the procedures involved with their dental treatments. She is passionate about traveling and engaging with people from other cultures and backgrounds.



# Taking routine cases and making them easier and quicker

**Authors\_** Michael Kelliher, DMD

\_When evaluating new technology for our office, I'll look at several factors to decide if it's something I will invest in. Will this technology help me do things I do now better or faster?

Can this technology allow me to do any additional procedures? And how will this technology improve the patient experience?

We have incorporated two significant advances to our office recently that help in all three regards: the Planmeca Emerald scanner and Planmeca PlanCAD Easy version 5.9 (Planmeca). The Planmeca Emerald is the next-generation intraoral scanner that features a much faster scan time, native color through the use of a 3 laser acquisition and is a very light, ergonomic device (Fig. 1).

The improved scan speed has allowed us to much more easily scan routine restorative cases, which have helped us complete cases in a more efficient

manner. Also because of the fast scan speed, we have found that scanning full arches is extremely practical, so we are now using the Planmeca Emerald to scan for things such as night guards rather than taking a physical impression, which is a nice benefit for our patients (Figs. 2, 3).

Crucial to any scanner is, of course, software. Version 5.9 has many useful features, two of which we have been finding extremely helpful. First, the buccal bite has been revamped for this version, allowing the user to scan two bite registrations to more accurately align the models. This combined with the ability to refine the bite automatically has made accurate articulation of full-arch models simple and predictable (Figs. 4, 5).

A second addition to version 5.9 that we are finding very useful is the ability to see what the clearance between prep and opposing is. One of the things I see



**Fig. 1\_** The Planmeca Emerald intraoral scanner. (Photo/Provided by Planmeca)

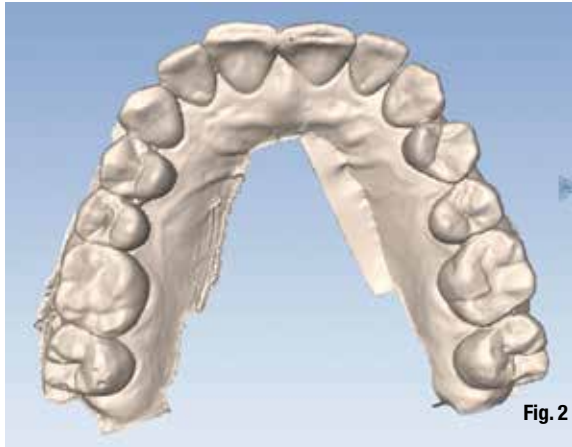


Fig. 2

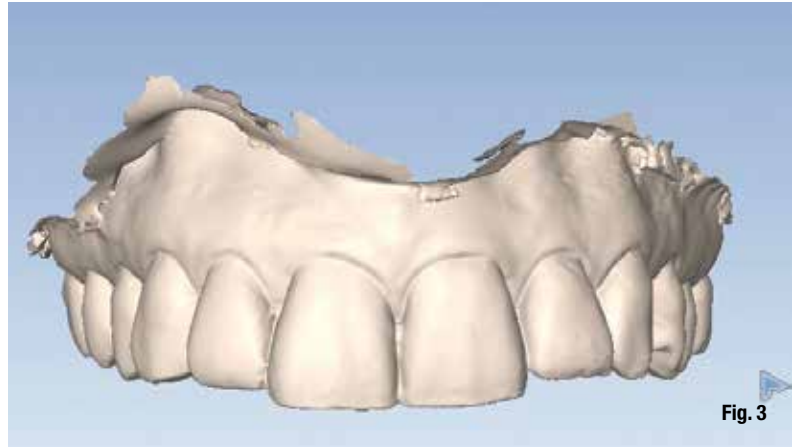


Fig. 3

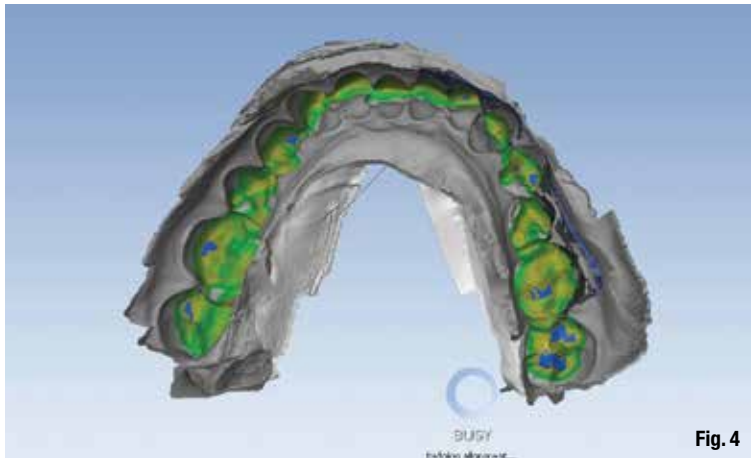


Fig. 4

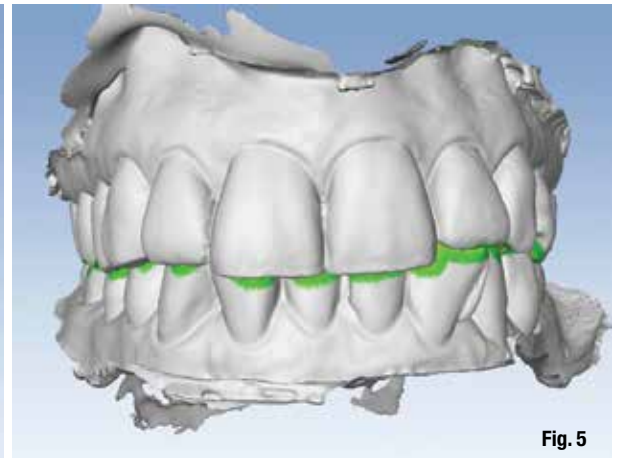


Fig. 5

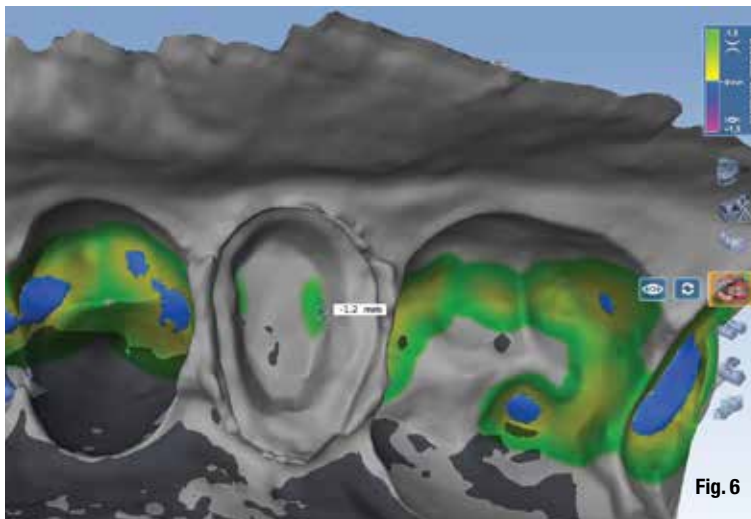


Fig. 6



Fig. 7

users struggle with is design when they don't have proper reduction.

When the clearance is tight, design becomes a bigger challenge because you need to balance material thickness and proper occlusion, which can be time consuming. This feature makes it very easy to see if there are clearance issues, allowing the user to make a prep modification prior to proceeding to the restoration (Fig. 6).

Routine restorative is what the vast majority of

dentists primarily use in office CAD/CAM systems. The combination of the Planmeca Emerald scanner and the updates in version 5.9 have made our bread-and-butter cases easier, faster, and more predictable. Here is a recent case completed in our office.

A patient presented with a chief complaint of a fractured tooth on the lower left. Exam revealed a cusp fracture of tooth #18 with a large existing resin filling. Treatment of choice was to crown the tooth (Fig. 7).

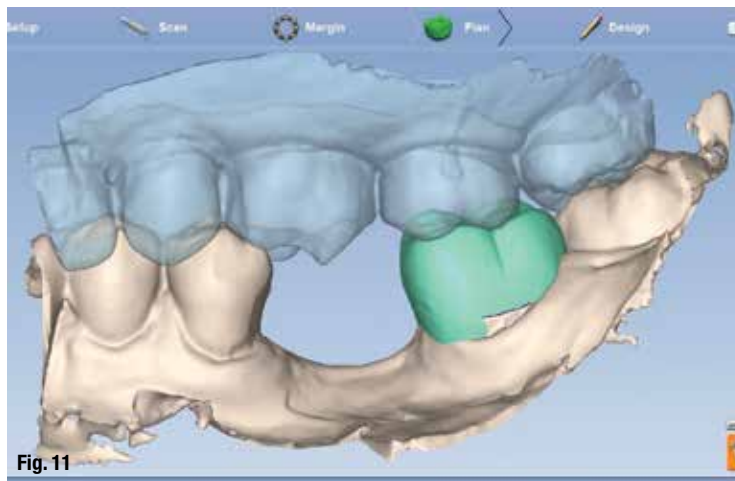
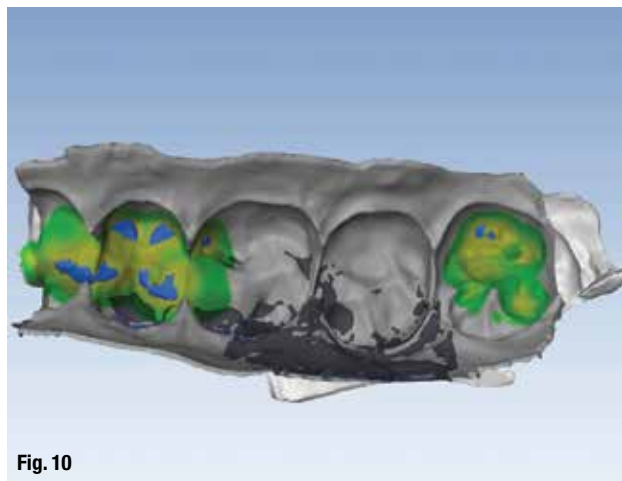
**Figs. 2, 3** Full-arch models. (Photos/ Provided by Dr. Kelliher)

**Fig. 4** Bite refinement.

**Fig. 5** Properly aligned models.

**Fig. 6** Clearance indicator.

**Fig. 7** Initial presentation.



**Fig. 8\_Initial prep.**

**Fig. 9\_Planmeca Emerald scan and prep.**

**Fig. 10\_Heat map of bite.**

**Fig. 11\_Plan with bite in place.**

After local anesthesia (Septocaine, Septodont), a rubber dam was placed. I find use of a rubber dam for the initial preparation is very helpful, especially on lower molars, allowing me to more easily and quickly complete the bulk of the prep (Fig. 8). Once the majority of the prep is completed, the dam is removed and first size 0 retraction cord is placed (Ultradent). Preparation is refined and a second size 2 retraction cord is placed. Cord is left in place for at least five minutes to allow for adequate tissue retraction.

The opposing arch is scanned while the cord is in place to help expedite the workflow. After five minutes, the size 2 cord is removed and the prep side arch is scanned with the Planmeca Emerald scanner (Fig. 9). We will leave the size 0 cord in place until the crown is cemented. This helps to keep the fluid from seeping from the sulcus during cementation as well as preventing any cement from being pushed deep subgingival.

Next the buccal bite is scanned. In version 5.9, you begin by scanning the upper arch and scanning until the upper model pops onto the bite. Normally for the upper you will only need to scan the upper molar. We proceed to the lower scanning units until the lower arch pops, which does require scanning several teeth. As always, we will confirm the models have articulated correctly by opening the bite window and examining the articulation. We now have a heat map

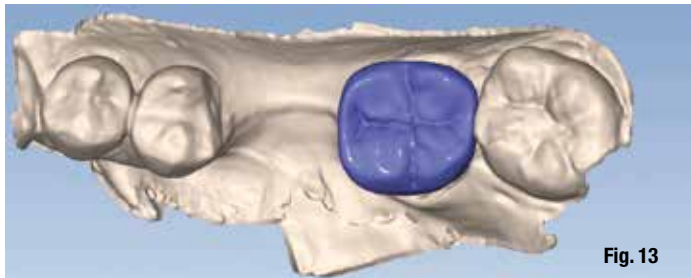
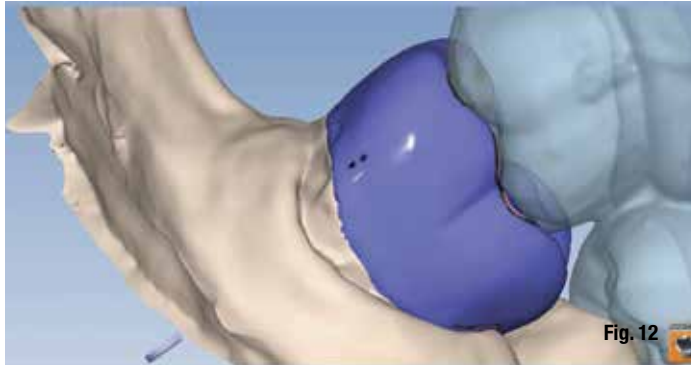
bite representation that allows the user to easily see if the articulation is accurate (Fig. 10). If it appears the bite is over closed, refinement of the bite can be accomplished by going to the buccal bite scan and clicking the bite refinement button, which will fine-tune the articulation of the models.

It's a good idea also to check the clearance at this point. If the software detects close clearance, you will see a colored indicator in the area where the software is detecting potential issue. Moving the cursor around inside the prep will give a measurement of the clearance. This can be very helpful, and if there is a tight spot on the prep, the user will see exactly where the concern is and may then go back and adjust the prep if needed.

The model is oriented and margins are marked in the usual manner. The color model produced by the Planmeca Emerald is helpful in identifying the margins. Utilizing the Plan Tab, the proposal is resized, rotated and placed on the model (Fig. 11). This helps autogenesis provide a more accurate initial restoration design.

My goal is to minimize the amount of time spent on design. Basic idea: The less you have to modify the library tooth, the better. If the plan step is done well normally, we find you will not need to use the incremental change tools at all and can make any needed modification with the freeform change tools (Fig. 12).





**Fig. 12**\_Initial design proposal.

**Fig. 13**\_Completed design.

**Fig. 14**\_The final restoration.

When I design a case, I will first use rubber tooth to fill out any contours on the facial and lingual, adjust the bite and marginal ridges and broaden the proximal contacts as needed. Last step in design is to check the proximal contacts and adjust as needed using the smoother or dropper tool. Minimizing the tool set I use helps me to complete a design quickly and efficiently (Fig. 13).

The design was sent to the Planmeca PlanMill 40 (Planmeca), and an IPS e.max MT block shade A2 (Ivoclar) was milled. The restoration was tried in after milling and found to need no adjustments to the occlusion or contact. I like to try the restoration in prior to crystallization for two reasons. First, it is easier to adjust the material if needed in the purple stage, and second, there will be no need to republish the restoration if the final contacts are perfected prior to crystallization.

Stain was placed on the buccal and occlusal surfaces and a spray glaze was applied (InSync Jensen Dental). The restoration was crystallized on the speed crystal cycle using a Programat CS oven (Ivoclar). Once the restoration was cooled, the internal aspects of the ceramic were etched with 5 percent hydrofluoric acid for 20 seconds, and monobond (Ivoclar) was applied for one minute prior to air drying.

The tooth was isolated and oil and debris cleaned from the prep using Clean and Boost (Apex Dental Materials). Tooth was rinsed and dried prior to application of all three components of Surpass dental adhesive (Apex Dental Materials) per manufacturer's directions. The restoration was loaded with Variolink Esthetic neutral and seated. The restoration was exposed at each corner for one second with a Valo light (Ultradent) to gel the excess.

Variolink esthetic has a very nice gel set stage, which makes cleaning up the excess very easy. Excess resin was removed with an explorer and floss. The restoration was then cured for a total of 30 seconds using the Valo light on high power setting. The initial retraction cord was then removed and the restoration checked for any remaining cement. A final check on the occlusion was done and the patient was dismissed (Fig. 14).

This case presented some unique challenges because of the edentulous space immediately anterior to the restoration as well as the presence of a rotated #17. Being able to scan quickly made it very simple to scan additional teeth anterior to the edentulous area as well as acquire more of the upper quadrant to allow the software to align the bite. This was more time consuming in the past.

In cases like these, the Plan Tab is also a very helpful feature, allowing the user to easily resize and place the library tooth in the proper orientation, which yielded an initial proposal that required very little modification. Prior to the introduction of the Plan Tab being available, a restoration like this tended to take quite a bit of time to design.

The combination of the Planmeca Emerald and Planmeca PlanCAD easy version 5.9 have helped our office do the routine cases more quickly and easily. We also are now able to routinely scan full arches, which have allowed us to do more and more procedures with digital impressions.

In the future, we are looking forward to pairing the abilities of the Planmeca Emerald scanner with 3-D printing to allow us to print models and a variety of appliances in the office. Digital dentistry is no longer the future — it is the present! \_

#### \_about the author CAD/CAM



Dr. Michael Kelliher is a 1993 graduate of Tufts University School of Dental Medicine. He operates a general dental practice in Longmeadow, Mass., with an emphasis on CAD/CAM restorative dentistry.

# Digital tools in planning and implementing esthetic ceramic restorations: The SKYN concept

Author\_Dr. Kirill Kostin

## \_Clinical case report

Until recently, indirect dental restorations in the esthetic area required a high degree of cooperation between dentists and dental labs. The planning process spanned several stages and entailed several appointments for the patient. Yet, the final result was often significantly different from the original plan. Fortunately, new digital tools have since changed the nature of esthetic treatments and enabled improved levels of care.

The development of digital tools has greatly simplified planning and creating restorations in the esthetic area for contemporary dentists. Moreover,

these tools enable us to communicate efficiently with our patients, increasing the predictability of treatment outcomes for everyone involved. Still another advantage is that the new techniques allow for shorter treatment times compared to conventional methods.

This article presents a clinical case where the SKYN concept was used alongside various digital tools to plan and create full-ceramic CAD/CAM restorations.

The article features a female patient presented with the main complaint of incisal edge wear of the upper central incisors. The patient also expressed a desire to have her diastema closed as it made her feel her smile was not harmonious. (Figs. 1, 2)

Fig. 1\_The patient's upper teeth before treatment. (Photos/Provided by Dr. Kirill Kostin)



Fig. 1



Fig. 2

Fig. 2\_The initial smile view.



Fig. 3



Fig. 4

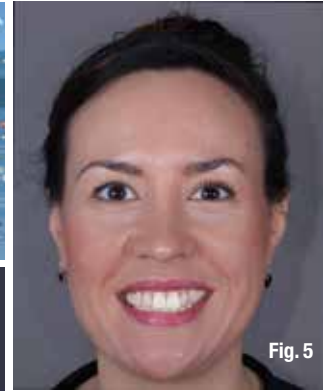


Fig. 5

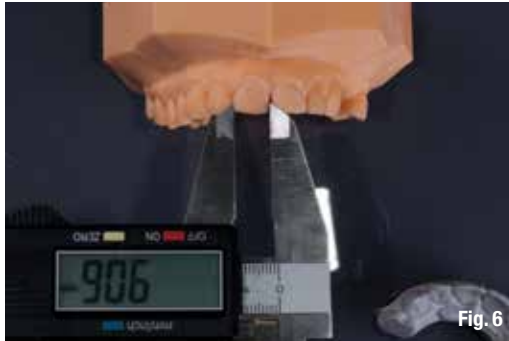


Fig. 6



Fig. 7



Fig. 8



Fig. 9

**Fig. 3** \_ A 3-D-printed model showing the initial situation, as obtained at the orthodontic diagnostic stage.

**Fig. 4** \_ Digital design: Shaping the central incisors in Planmeca Romexis Smile Design.

**Fig. 5** \_ A portrait photograph with a digital mock-up of the future smile. A photograph like this allows the patient to better visualise the potential outcomes of an esthetic treatment and makes the final result more predictable for everyone involved — from dentist to patient to dental technician.

**Fig. 6** \_ Measuring the width of tooth #11 on the diagnostic model.

**Fig. 7** \_ Measuring the width of tooth #11 on the A1 model from the Anteriores set by Jan Hajtő.

**Fig. 8** \_ The A1 model used as a sample for the digital rendering of the shape and size of the central incisors, as part of the SKYN concept.

**Fig. 9** \_ Taking a silicone impression of the central incisor buccal surfaces on the Jan Hajtő anatomical model.

The patient was offered to undergo an orthodontic preparation prior to her restorative treatment but declined. Moreover, the patient requested to have as minimal intervention as possible done without involving other teeth.

## \_Treatment plan

To improve the appearance of the smile according to the patient's wishes, the decision was made to restore the upper central incisors with full-ceramic CAD/CAM restorations. Given that color correction was necessary, we selected IPS Empress CAD Multi A1 (Ivoclar Vivadent) as the material. To discuss and determine the shape of the future teeth, we further suggested preliminary esthetic diagnostics with the Planmeca Romexis Smile Design software.

## \_Treatment protocol

At the preliminary stage, we performed an intraoral scan to obtain a virtual diagnostic model for further evaluation. Then we converted the digital models into physical ones by way of 3-D printing (Fig. 3).

As the patient could not undergo a long-term orthodontic preparation, we needed to model the out-

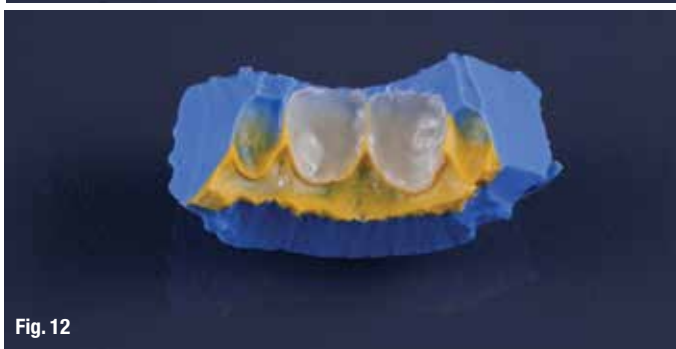
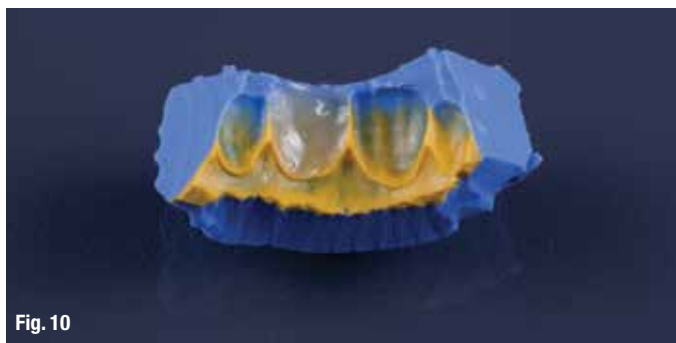
come based on the patient's wishes and restrictions. Working with portrait photographs of the patient, we used the Planmeca Romexis Smile Design software to visualise the shape and proportions of the future teeth (Figs. 4, 5).

A design like this takes no more than two to three minutes and allows creating a virtual mock-up chairside. Seeing the result of the proposed smile modification significantly improves dentist-patient communication and increases the efficiency of consultations.

After the patient approved the computer-aided smile design, she participated in selecting the shape of her future centrals from the Anteriores catalogue by Jan Hajtő. Attention was paid to both the desired shape and actual size of the planned restorations. This was achieved by measuring the width of tooth #11 and then selecting a matching sample from the Anteriores models. (Figs. 6-8)

This was the outcome of the first appointment, when the patient visited the clinic for diagnostics and planning. By the following visit, we prepared individual anatomical composite skyns based on the 3-D-printed diagnostic model. Composite skyns can also be prepared and adjusted intraorally without any models. First, we obtained a silicone impression of the buccal surfaces of the Anteriores set model (Fig. 9).





**Fig. 10**\_Introducing the light-cured composite into the silicone index.

**Fig. 11**\_The silicone index was lubricated with modelling resin (Bisco) prior to injecting the composite, in order to achieve a smoother surface on the anatomical composite skyn.

**Fig. 12**\_When creating skyns, the composite was spread in the silicone index into a thin, homogenous layer.

**Fig. 13**\_The individual anatomical skyns and the original model from the Anteriores set.

**Fig. 14**\_Try-in of the composite skyns and marginal adaptation on the diagnostic model. A similar try-in procedure can also be performed in the patient's mouth.

**Fig. 15**\_The individualised composite skyns are ready for fitting and cementation in the mouth.

Then, using a light-cured composite, we created individual anatomical skyns, reproducing exactly the shape and micro-texture of natural teeth (Figs. 10-13).

The skyns were then fitted and finished, with margins corrected, on the diagnostic model. The marginal correction was performed with rotary instruments (Figs. 14, 15).

All of the work can be performed during the very first visit directly on the patient's teeth. In our case, however, we created the skyns between appointments, so that during the second visit all that was left to do was to fit and adjust the individual anatomical composite skyns in the mouth. (Figs. 16-21)

As we fitted the individual composite skyns in the patient's mouth, we noticed a small black triangle forming between the central incisors when the shapes were copied into future restorations. To avoid this effect, it was necessary to prepare the medial surfaces slightly, taking the preparation slightly into the sulcus. Moreover, the contours of the restorations were modified for a more rectangular shape.

As the patient wished to preserve the shapes we tried in, it was important for us to prevent poten-

tial disappointment with the final esthetic result. Visualising the final outcome helps to achieve mutual understanding with the patient still at the planning stage and helps the dentist choose the required preparation design.

Furthermore, at this stage, the patient was also able to inform us that the macro-texture and the "uneven" incisal edge of the original composite skyn were not desirable.

Thus, after discussing all the details with the patient, we were able to transfer all the details agreed upon into the final restoration. This was achieved by way of preliminary intraoral scanning and obtaining a virtual model with "digitised" anatomical composite skyns (Fig. 22).

Next, teeth #11 and #21 were prepared for ceramic veneering. As is known, adhesion to enamel is highly superior to adhesion to dentin. Consequently, at this stage it is crucial to preserve the healthy tissues within the enamel. (Figs. 23, 24)

Upon preparation, Ultrapak 00 cord (Ultradent) was inserted into the sulcus and an intraoral scan was performed with the Planmeca PlanScan intraoral scanner (Fig. 25).



Fig. 16



Fig. 17



Fig. 18



Fig. 19



Fig. 20



Fig. 21

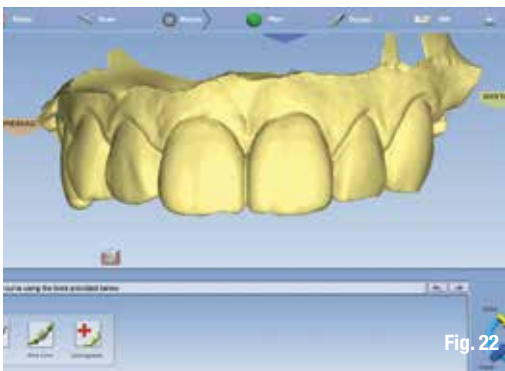


Fig. 22



Fig. 23



Fig. 24

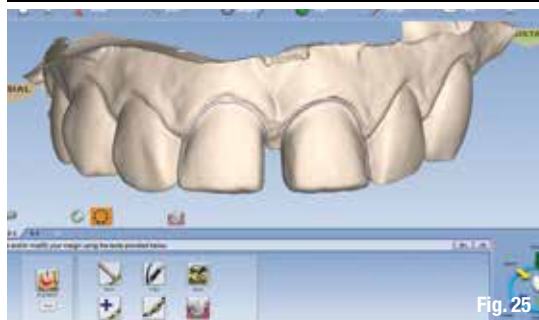


Fig. 25

**Fig. 16\_** The initial situation intraorally prior to the adaptation of the composite skyns on the patient's teeth.

**Fig. 17\_** For best positioning and adaptation of the skyns, a preliminary occlusal adjustment was made on teeth #11 and #21.

**Fig. 18\_** On the buccal, All-Bond 3 (Bisco) was applied without prior enamel etching.

**Fig. 19\_** The individual composite skyns adapted on the teeth with small amounts of a flowable light-cured composite.

**Fig. 20\_** Composite cementation allows you to visually demonstrate to the patient the potential final outcome.

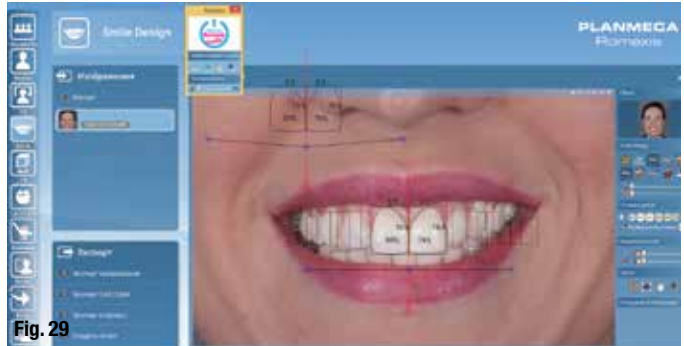
**Fig. 21\_** One of the advantages of the SKYN concept is the immediate visualisation of the final outcome without the need for impressions or laboratory manufacturing of a diagnostic wax-up.

**Fig. 22\_** The composite skyns on the surfaces of teeth #11 and #21 scanned for further digital copying at the restoration modelling stage.

**Fig. 23\_** Preparing teeth #21 and #11 through the composite skyn to control the thickness of the future restoration.

**Fig. 24\_** The patient's teeth after preparation before taking a digital impression.

**Fig. 25\_** The digital model obtained by intraoral scanning.



**Fig. 26**\_Partial silicone impression: the upper segment from #13 to #23.

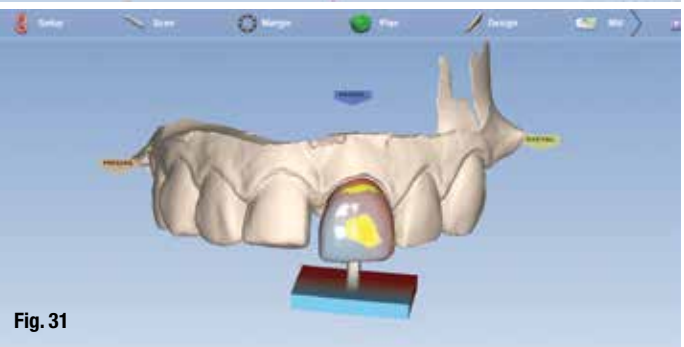
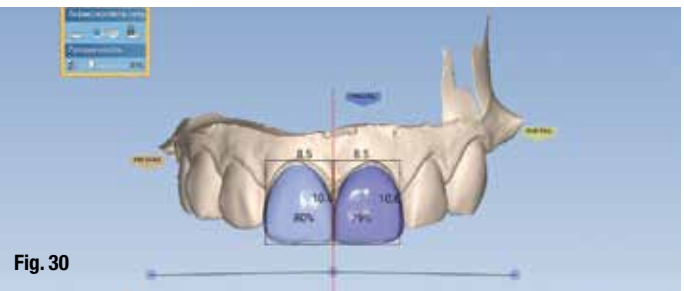
**Fig. 27**\_The control model made of composite, as obtained from the silicone impression. A similar model can also be obtained digitally by milling or 3-D printing.

**Fig. 28**\_Digital design of the restorations by way of digitally transferring the shape and macro-texture of the anatomical composite skyns. In the digital environment, the contours of the scanned anatomical composite skyns were superimposed on the restorations being created.

**Fig. 29**\_When designing the restorations, we exported the silhouettes of teeth #11 and #21 from the Planmeca Romexis Smile Design software to control the shape and proportions of the restorations.

**Fig. 30**\_Superimposing the exported silhouettes on the restorations allows correcting the proportions of the restorations according to what was agreed upon with the patient at the planning stage. This is how digital planning with the Planmeca Romexis Smile Design software enables efficient communication with the patient as well as the predictable transformation of the planned outcome into the final restoration.

**Fig. 31**\_Checking the restoration before milling. Because IPS Empress CAD Multi blocks have a fluorescence transition, the operator can change the position of the restoration in the block and thus control the degree of translucency/opacity in the final restoration.



As an adjunct, we obtained a partial silicone impression of the upper teeth from #13 to #23 in order to produce a control composite model. This is not an obligatory step in creating digital restorations but can be useful when micro-contouring and dyeing ready veneers or crowns. (Figs. 26, 27)

After the digital impression was obtained, the restorations were designed with the Planmeca PlanCAD Easy software, which is part of the Planmeca FIT open CAD/CAM system. Using the capabilities of the system, we essentially copied the shapes of the anatomical composite skyns. During the design process, we also used the teeth silhouettes, which were cre-

ated at the initial diagnostic stage with the Planmeca Romexis Smile Design software. All in all, creating the virtual restorations took about 30 minutes for two units. (Figs. 28-30)

The next stage was manufacturing the restorations with the Planmeca PlanMill 40 milling unit. The material of choice in this case was IPS Empress CAD Multi, shade A1. This material has a high translucency, which allows transmitting the colour of the stump. (Figs. 31-33)

The milled veneers are separated from the block, with the macro- and micro-texture added later (Figs. 34, 35).





Fig. 32



Fig. 33



Fig. 34a



Fig. 34b



Fig. 34c



Fig. 34d



Fig. 35

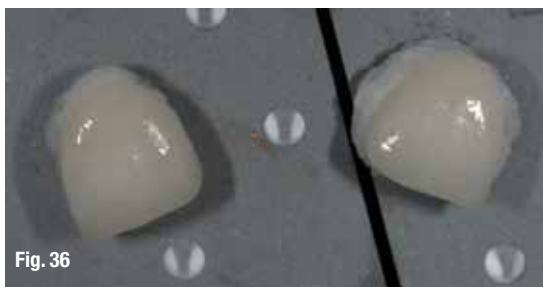
**Fig. 32\_** The compact Planmeca PlanMill 40 milling unit.

**Fig. 33\_** The ceramic restorations immediately after milling. Milling one unit takes about 15 to 20 minutes.

**Fig. 34a-d\_** Stages of micro-contouring, which aims to imitate the natural texture of teeth.

**Fig. 35\_** The final look of the restoration after macro- and micro-contouring.

**Fig. 36**\_Dyeing and glazing the ceramic surfaces.



**Fig. 36**

**Fig. 37a-c**\_Final outcome three days after the completion of the treatment.



**Fig. 37a**

**Fig. 38a, b**\_Final outcome two months after cementing the veneers.



**Fig. 37b**



**Fig. 37c**



**Fig. 38a**



**Fig. 38b**

## join in

CAD/CAM

### Join the PlanmecaFIT users group

If you are a PlanmecaFIT user and interested in the new wave of digital dentistry, join Dr. Kirill Kostin at the Facebook PlanmecaFit users group. Post your cases and share and see the latest in what you can achieve with PlanmecaFIT.

Because of their thinness (between 0.5 and 0.8 mm), ceramic veneers made of IPS Empress CAD Multi blocks transmit the color of the underlying tissues nicely.

To make the restorations look even more natural, the cervical and incisal areas were also dyed. Finally, the ceramic surface was glazed and polished (Fig. 36).

Finally, the restorations were adhesively fixed with a light-cured composite cement, Choice 2 (Bisco), shade A1, according to the manufacturer's instruction (Figs. 37, 38).

## Conclusion

Contemporary digital tools facilitate communication between dentist and patient, enabling the high predictability of esthetic treatments. The ability to visualise potential outcomes boosts the efficiency of consultations at the initial stages as well as helps to avoid conflicts upon completion of treatment. The SKYN concept, along with the capabilities of modern CAD/CAM systems, allows performing esthetic treatments in the shortest times possible and creating highly esthetic restorations immediately and chairside without the need to work with a third-party dental lab.

## \_about the author

CAD/CAM



restorative procedures with direct and indirect restorations.

Dr. Kirill Kostin graduated from Saint Petersburg State Medical University (Russia) in 2004. He became the co-founder of the PerfectSmile dental clinic and dental study center in 2014. At his clinic in Saint Petersburg, Dr. Kostin runs a private practice concentrating on the esthetic and functional rehabilitation of natural dentition and implants, applying various digital instruments as part of restorative procedures (digital smile design, intraoral scanning, CAD/CAM milling, 3-D printing and guided surgical procedures). Using a dental microscope on a daily basis, Dr. Kostin focuses on minimally invasive

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# Digital workflows and implant dentistry: Efficiently creating better patient outcomes

Author \_ Dr. Clint Stevens

The field of implant dentistry has experienced exponential growth and changes over the last two decades. Developments in 3-D imaging and CAD/CAM manufacturing have taken the planning, placement and restoration of dental implants to exciting new places. Replacing missing teeth with dental implants has never been easier or more predictable than it is today.

With CBCT imaging and the ability to overlay an intraoral scan, we can now ideally restore an edentulous space with a virtual restoration and plan the placement of a dental implant to ideally support that proposed restoration. We can then place that implant, with either a static guide or a dynamic guidance system, and be confident that the implant will be appropriately positioned for the final restorative outcome.

A patient-specific abutment can then be fabricated with CAD/CAM technology, giving the final restoration ideal support regardless of the restorative material chosen, while at the same time facilitating a predictable delivery of that restoration, whether it be cemented or screw-retained.

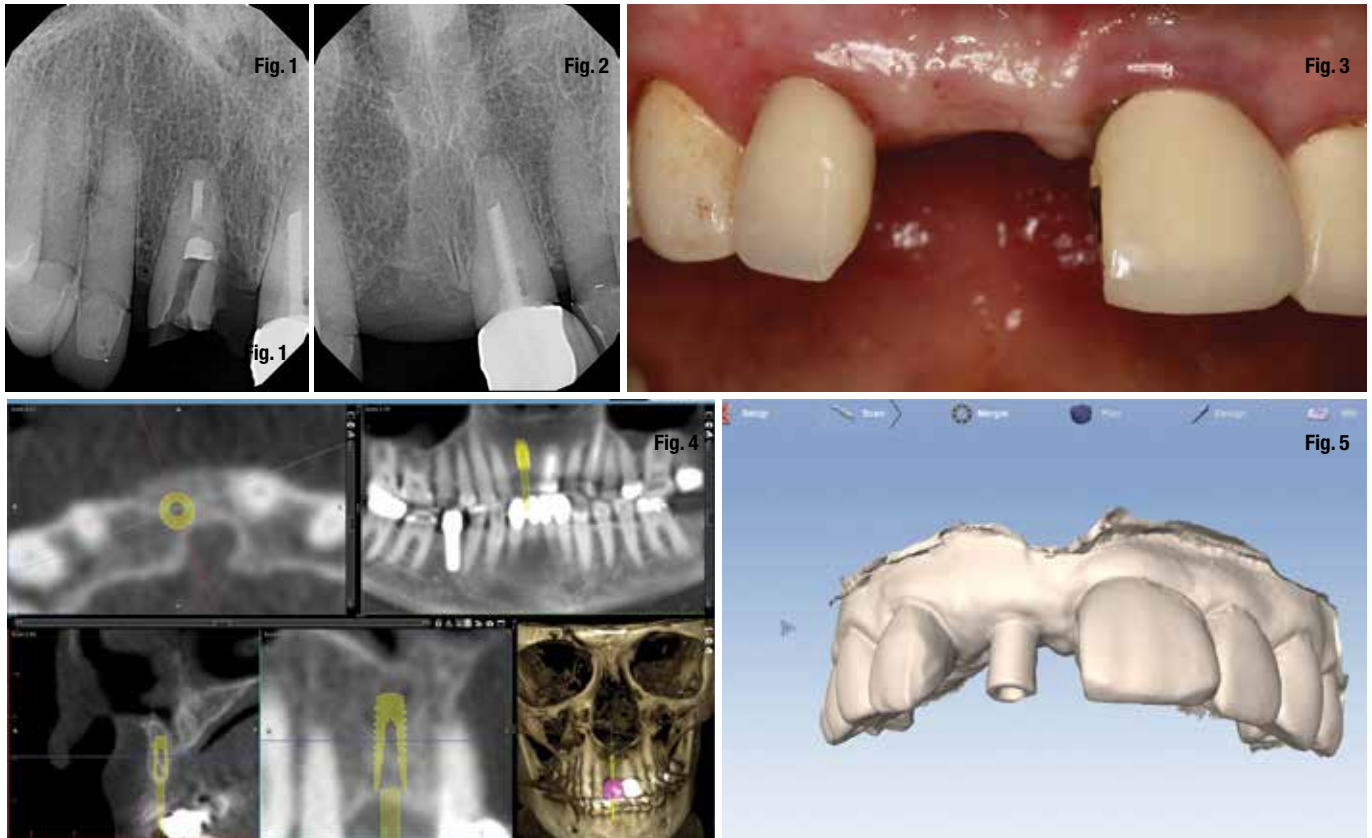
It is interesting to note that while all of these changes have taken place, our restorative management of dental implants has largely stayed the same. Most patients have their dental implant placed with a generic healing abutment delivered at the time of surgery or two to three months later. Then the patient has at least two more visits to impress and restore the implant.

In esthetic situations in the anterior and select scenarios in the posterior, a modified provisional abutment or custom healing abutment might be used, which is most often fabricated chairside at the time of implant placement or after the implant integration period has passed. This translates into three or more visits for a patient over a three- to six-month period to successfully replace a missing tooth with a dental implant, with a significant amount of time spent by both the clinician and the patient in the operatory to facilitate the outcome.

Many of the historical impediments to faster, more predictable, patient-centered outcomes have been removed by today's technology. Advances in CBCT technology to significantly lower radiation doses have totally changed discussions of pre-operative scanning of potential implant patients, largely minimizing patient risk and making the benefits of scanning a patient before implant placement to far outweigh the risks, even for "slam dunk" cases.

The development of manufacturing custom abutments with CAD/CAM technology has led to practically every implant system available on the market today being able to offer a patient-specific abutment solution at a similar cost or even cheaper than a pre-fabricated abutment. The ability to acquire data digitally with CBCT and intraoral scanners, restoratively and surgically plan cases, and fabricate surgical guides and restorative solutions digitally without ever having to cross back over into a conventional laboratory workflow gives us more accuracy and pre-

## Case No. 1



dictability than we have ever had, eliminating many of the potential sources of error that have hindered implant surgical and restorative workflows in the past. It also facilitates the fabrication of patient-specific solutions pre-operatively that can minimize operator chair time and reduce the number of patient visits, while potentially eliminating the need for the use of provisional abutments or custom healing abutments.

The following cases are meant to show various clinical scenarios commonly encountered in implant dentistry and illustrate how they can be much more efficiently managed leveraging the integration of CBCT and digital impression technology within an open architecture software framework.

### Case study No. 1

The patient presented with the chief complaint of pain when chewing with her front teeth. Radiographic and clinical examination revealed teeth #8 and #9 to have been previously treated endodontically and restored with splinted metal-ceramic crowns. Probing depths on the mesial of tooth #8 exceeded 10 mm, and an obvious root fracture was noted radiographically. Treatment options, risks and benefits were discussed. The patient elected to re-

place tooth #8 with a dental implant, while attempting to leave the crown restoration on tooth #9 intact.

To maximize predictability in this particular clinical situation, a delayed approach was chosen for implant placement. At the first visit, the splinted restoration was sectioned and removed (Fig. 1). The extraction site was grafted with allograft and allowed to heal for three months. The patient used an Essix retainer for the first two weeks following surgery to replace #8, followed by the delivery of an interim removable partial denture.

At three months (Figs. 2, 3), a CBCT and intraoral scans were taken to finalize treatment planning for an implant #8 (Fig. 4). The patient presented with a relatively narrow ridge but adequate for a 3.3 mm diameter implant. Given the patient's deep bite and expected lack of dense bone quality, it was decided to place the implant and allow for submerged healing before attempting to develop appropriate gingival contours and place a restoration.

A surgical guide was printed following planning of the placement of the implant. On the day of surgery, a small tissue punch was used to gain access to the implant site, and the osteotomy was prepared using the surgical guide. Following placement of the implant, a scan body was placed and the arch was scanned (Fig. 5). A cover screw was then placed on

**Fig. 1** Remaining root structure following sectioning and removal of splinted crown #8, #9. (Photos/ Provided by Dr. Clint Stevens)

**Fig. 2** Healed extraction site at three months.

**Fig. 3** Clinical presentation of healed site at three months.

**Fig. 4** Prosthetically driven treatment planning for implant #8 in Romexis.

**Fig. 5** STL model of maxilla with implant #8 and scan body in place on the day of surgery.

## Case No. 2

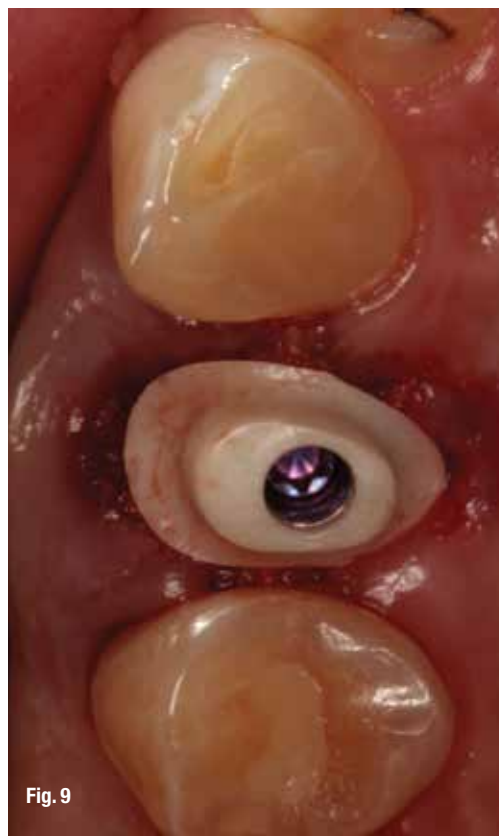
**Fig. 6** Clinical presentation of patient with broken off tooth #5.

**Fig. 7** Pre-operative treatment planning for immediate implant #5 in Romexis.

**Fig. 8** Implant #5 successfully placed.

**Fig. 9** Final custom hybrid abutment #5 tried in on day of surgery.

**Fig. 10** Provisional restoration #5 in place on hybrid abutment, day of surgery.



### \_about the author CAD/CAM



Dr. Clint Stevens graduated from the University of Texas Health Sciences Center San Antonio and completed a one year Advanced Education in General Dentistry residency at the University of Michigan. Stevens is engaged in ongoing laboratory and clinical research dealing with adhesive restorative materials, digital dentistry workflows, endodontics and dental implants. He serves as a key opinion leader and consultant for product development and evaluation to several dental manufacturers. He has utilized chairside CAD/CAM for 10 years and has extensive experience with Planmeca FIT. Stevens maintains a full-time private practice in Tulsa, Okla., that emphasizes the use of modern, evidence-based materials in providing the highest level of comprehensive dental care.

the implant, and a collagen plug was secured in place with a figure 8 suture.

Thanks to the non-invasive nature of the guided surgery, a very accurate scan of the implant position and soft-tissue architecture could be obtained, which will allow for the predictable fabrication of the final custom abutment to be delivered when the implant is uncovered. This will optimize subsequent soft-tissue healing and outcome stability by minimizing changes that could occur with multiple prosthetic interventions.

### \_Case study No. 2

A patient presented with her crown for tooth #5 in her pocket. Clinical and radiographic examination revealed #5 to have been previously treated endodontically and with no remaining tooth structure left supragingivally to retain a new crown (Fig. 6).

After discussing treatment options, risks and benefits, the patient elected to replace tooth #5 with a dental implant.

Prosthetically driven treatment planning was completed as described for case study No. 2 (Fig. 7). Prior to the surgical appointment, a surgical guide, hybrid abutment and provisional restoration were fabricated.

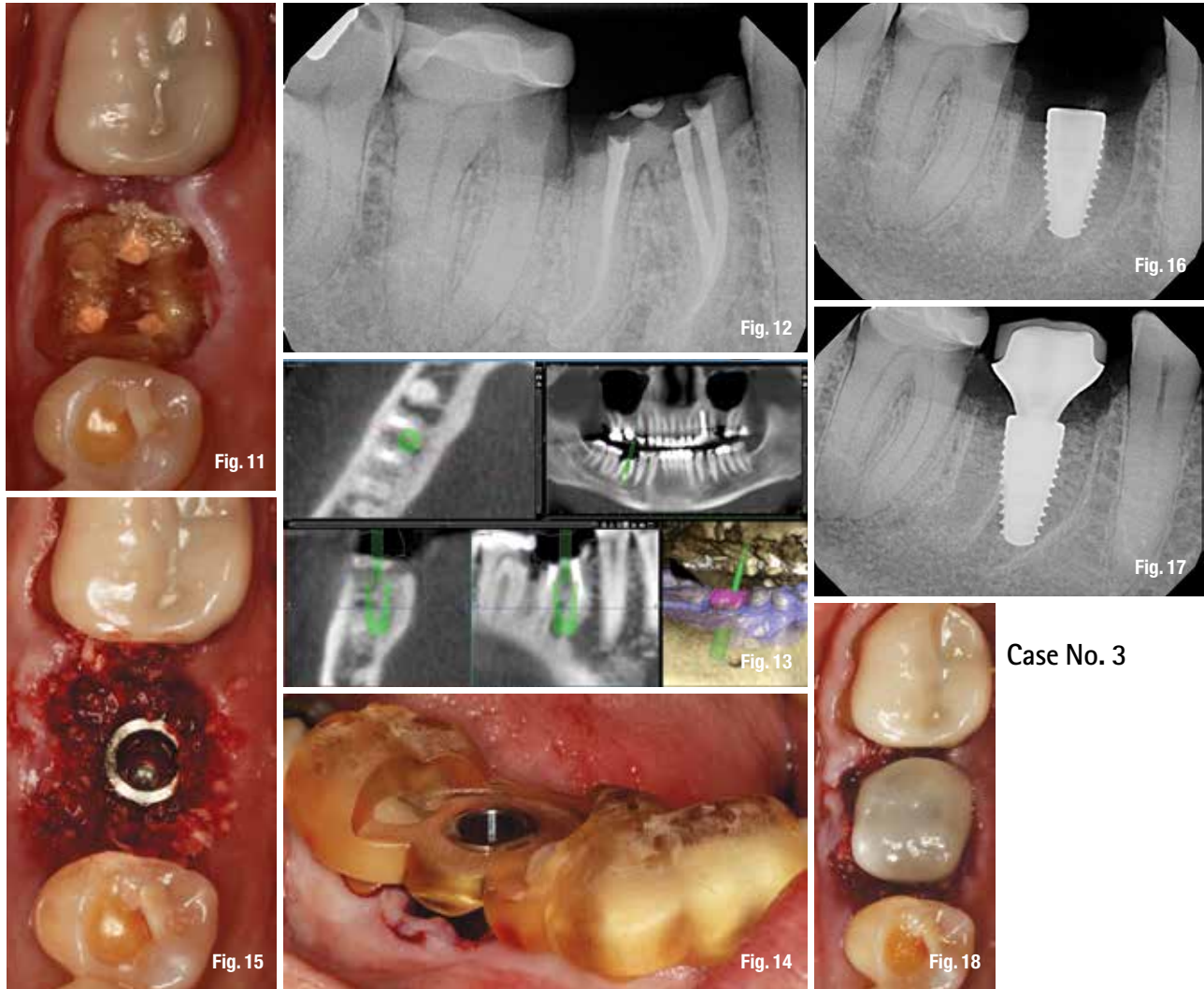
On the day of surgery, the remaining root structure of #5 was removed.

Following guided osteotomy preparation and implant placement, the implant-socket gap was grafted with allograft (Fig. 8). The final custom hybrid abutment (Fig. 9) was delivered as a screw-retained provisional (Fig. 10).

The gingival tissue was traumatized and pushed apically during the extraction, hence the visibility of the buccal margin of the abutment on the day of surgery. The tissue is expected to migrate coronally during healing to cover the margin.

Occlusion was verified to ensure the provisional was not in function. Space was left proximally between #5 and #6 to allow for planned orthodontic movement to correct rotations and crowding of teeth #6 and #7.





Case No. 3

### Case study No. 3

The final patient presented with his existing crown for #19 in hand (Fig. 11). The tooth had previously received endodontic therapy. Radiographic and clinical examination revealed tooth #19 to have no remaining supragingival tooth structure or a pulpal chamber space to provide retention/resistance form for an "Endocrown" approach (Fig. 12). After discussing the poor restorative prognosis for tooth #19, along with alternative treatment options, risks and benefits, the patient elected to replace #19 with an implant.

Following CBCT and intraoral scans, a virtual restoration was ideally planned in the space of #19. The intraoral scan model and proposed restoration were then stitched to the CBCT data to optimally plan the placement of an immediate implant (Fig. 13). A surgical guide was then fabricated from this plan, and the data was also exported to a lab for fabrication of a custom titanium abutment.

On the day of surgery, the remaining roots of tooth #19 were extracted, and a dental implant was

placed using the surgical guide (Fig. 14). After grafting of the root sockets with allograft (Figs. 15, 16), the final custom titanium abutment was delivered (Fig. 17). A final full contour e.max restoration was tried in to verify accurate placement of the dental implant and abutment. A provisional cover was provisionally cemented over the abutment to facilitate easier hygiene maintenance during healing and to keep gingival tissues from healing over the abutment margins (Fig. #18).

The final restoration will then be cemented in three months once the implant is integrated and the soft tissue has healed, with caries control to be completed on adjacent teeth during the healing phase.

Implant dentistry can present a variety of clinical situations that require different approaches to obtain optimum results. Modern digital workflows in an open-architecture framework facilitate the flexibility to ideally adapt to those varying situations, while providing precision and predictability far superior to that of conventional surgical and restorative implant workflows.

**Fig. 11**\_ Patient presented with no coronal tooth structure #30.

**Fig. 12**\_ Pre-operative radiographic presentation #30.

**Fig. 13**\_ Prosthetically driven treatment planning for implant #30 in Romexis.

**Fig. 14**\_ Printed surgical guide in place following extraction of #30.

**Fig. 15**\_ Implant in place with allograft in the adjacent sockets.

**Fig. 16**\_ Radiograph visualizing implant in place #30.

**Fig. 17**\_ Radiograph showing final custom abutment in place with provisional cover.

**Fig. 18**\_ Clinical presentation of final custom abutment and provisional cover #30.

# Comprehensive care and improved health achieved by understanding dentistry's role in the treatment of sleep disorders

Author\_Joe Magness, DDS

The dentist's role in health and how using intraoral scanning, imagin<sup>®</sup> software and other technology will automate the process of dental sleep medicine

It is a well-known fact that sleep affects the entire body and that sleep is the foundation for health (Fig. 1). For the population to achieve wellness or health, they will have to sleep, diet and exercise well. The chronic illness that is so prevalent is a reflection of our choices<sup>1</sup>. With the poor trending of health in this country<sup>2</sup>, it's important that the dental and medical professions work together.

Dentists play a critical role in health, through the screening, prevention and treatment of sleep disorders, like bruxism, TMD and obstructive sleep apnea (OSA) — referred to as dental sleep medicine.

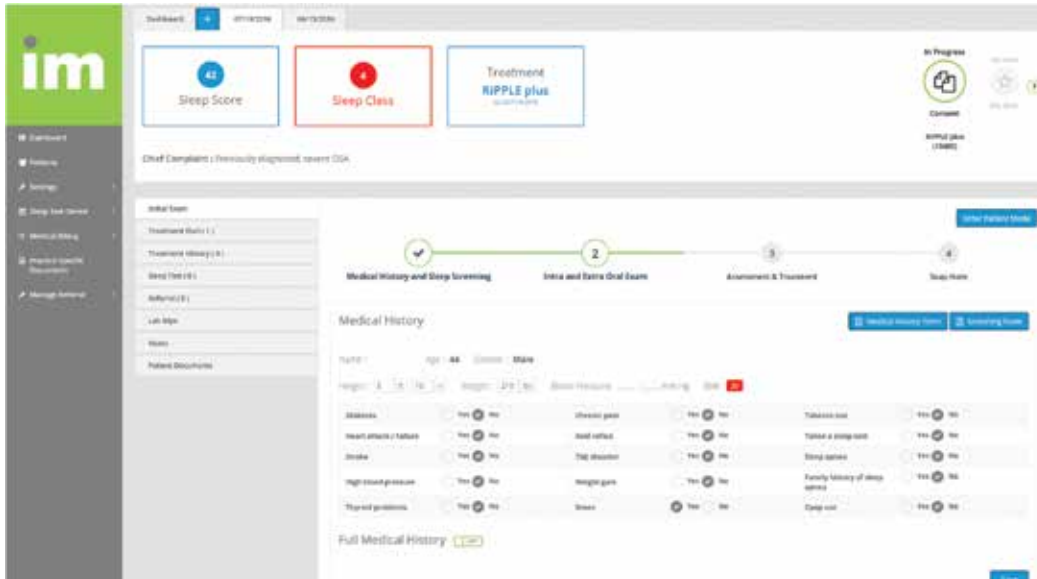
By asking a few screening questions and being more comprehensive, dentists can identify sleep disorders in patients. Without dentists, and this "preventative" mindset, these patients could be left unscreened, untested and untreated for years.

## The reality

The population is facing staggering statistics of poor health and poor sleep. These numbers will translate into patients being seen every day in dental offices. Offices feel the burden of keeping up with the



Fig. 1\_Sleep is the foundation of health. (Photos/Provided by Joe Magness, DDS)



**Fig.2\_** The patient used imagin®, a cloud-based software automating the process of DSM.

needs of patients yet staying financially strong. About 65.7 percent of the population saw a dentist last year<sup>3</sup>. People are spending billions trying to sleep better. Dentistry has conservative, cost-effective options. The medical side needs dentistry's help.

There are many different factors that disrupt sleep<sup>4</sup>. Dentists need to understand how a poor airway and pain disrupt sleep. Dentistry makes appliances that improve the size of the airway and treat bruxism to decrease pain. If a patient continues to have sleep disrupted for years or decades, then sleep disorders will become more severe<sup>5</sup>. The medical profession agrees that oral appliances have their place, and almost every patient will transition through the phases that we should be screening, testing, and treating. Be confident and get educated.

There are multiple ways that sleep disorders can be treated and have successful outcomes<sup>6</sup>. Treating sleep disorders has a dental and medical component. This case is an example of medical problems with dental solutions and was appropriate to treat with oral appliance therapy. The technology used made it easier for staff and the dentist to achieve success.

## Case presentation

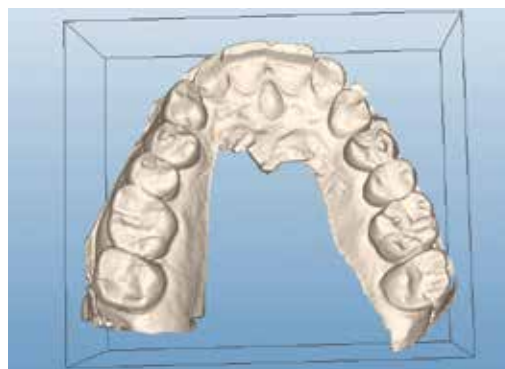
A complete medical history and imagin® sleep screening was completed, as well as a comprehensive exam and appropriate imaging. Because we are entering the medical side, I am going to present the case in a SOAP note format. I will also be discussing how technology is used to remove obstacles in creating this medical insurance approved format, as well as how technology is used throughout the treatment and monitoring process. The comprehensive evaluation identified the following findings.

## Subjective

A 44-year-old male with a BMI of 30 presented with the chief complaint of daytime tiredness. The patient reported a history of snoring and head, neck and jaw pain with clicking (Fig.2). Also, sometimes feels tired and most days feels good when waking up. The patient had been tested and diagnosed with severe OSA and was treated with a continuous positive airway pressure (CPAP) machine but is a non-compliant CPAP user. The patient has been non-compliant because of the lack of comfort and effectiveness. He has had these symptoms for more than five years and sleeps on average more than 7 hours.

## Objective

The patient presents with generalized, severe wear facets with severe pitting on the occlusal surfaces, abfractions and a significant amount of dentistry from excessive force to the teeth (Fig. 3). Large, lingual tori are present with localized periodontitis. The patient has Grade 1 tonsils and scored a Class 3



**Fig. 3\_** Wear from nocturnal bruxism.



**Figs. 4,5**\_CBCT builds value for the patient.

**Fig. 6**\_Bringing TMJ and airway health in one appliance.

**Fig. 7**\_The Emerald scans the challenging open bites in DSM.

**Fig. 8**\_The new, flexible ios to provide the scans for your treatment needs.

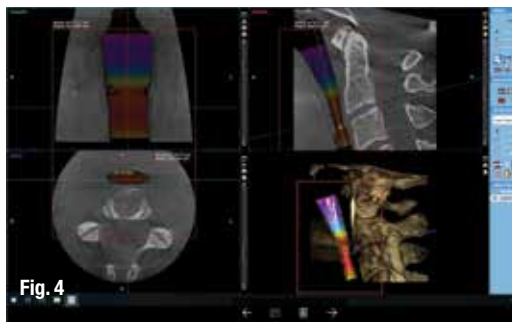


Fig. 4

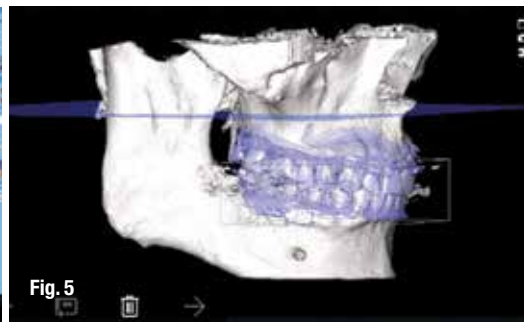


Fig. 5



Fig. 6

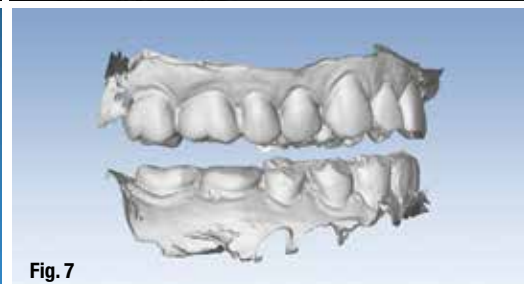


Fig. 7



Fig. 8

Mallampati score, as well as a scalloped tongue.

The extra-oral exam revealed tenderness to palpation to the masseter, temporalis, SCM, scalene and sub occipital muscles. There is a 2 mm deviation to the right with limited movement in a left excursive movement with a 35 mm opening. Nothing else was remarkable regarding the TMJ, and the patient had a skeletal Class I jaw relationship and bite with a history of orthodontics as a 14-year-old.

A CBCT (Planmeca ProMax) was taken, and the airway analysis shows a narrowest Cross Sectional Area (CSA) of 90 mm<sup>2</sup> (Fig. 4). This predictor shows an intermediate risk of OSA. The average group of non-OSA subjects will have about twice the square area at the narrowest CSA as a group with OSA. CBCT gives dentists the complete picture of what is happening in the patient's mouths (Fig. 5). This will lead to higher case acceptance and better clinical care. This also provides comfort to feel confident that we are providing the best care for all aspects of dentistry.

### Assessment

Because this patient had been previously diagnosed with Severe OSA, this assessment is straightforward. Most patients will not be tested before this

visit and so the assessment would be possible OSA. OSA can't be diagnosed except from a sleep test and it must be interpreted by a board-certified sleep physician. The patient suffers from nocturnal bruxism.

### Plan

The plan for this patient is to be treated with oral appliance therapy (OAT). The American Academy of Sleep Medicine (AASM) says, "No treatment is not an option." So this patient, even though a severe OSA patient, should be treated with OAT. A CPAP affidavit is signed by the patient for consent for this procedure.

### The treatment process

The most important part of any sleep appliance will be compliance. The aspects of appliances that can lead to compliance are comfort, improved sleep and joint health. Because the RiPPLE® plus achieves these aspects, it was the appliance of choice for this case. This is a device not based on constantly protruding, so therefore dislocating the TMJ, all night long, every night (Fig. 6). Because this device has a bite position with an "open" CR position and an elastic that can hold the mandible in a healthy position for

**Sleep Study Report**

Fig. 9

**Sleep Summary**

Start Study Time:	11:07:55PM
End Study Time:	8:00:13AM
Total Study Time:	8 hrs, 52 min
<b>Sleep Time</b>	<b>7 hrs, 59 min</b>
% REM of Sleep Time:	33.7

**Respiratory Indices**

	REM	NREM	All Night
pRDI:	25.8	46.4	39.5
pAHI:	23.9	46.4	38.9
ODI:	21.7	43.3	36.1

**Sleep Study Report**

Fig. 10

**Sleep Summary**

Start Study Time:	11:35:57PM
End Study Time:	6:40:51AM
Total Study Time:	7 hrs, 4 min
<b>Sleep Time</b>	<b>6 hrs, 23 min</b>
% REM of Sleep Time:	26.6

**Respiratory Indices**

	REM	NREM	All Night
pRDI:	3.5	9.6	8.0
pAHI:	1.8	7.5	6.0
ODI:	1.8	5.3	4.4

**Figs. 9, 10\_**Efficacy testing showing the reduction of RDI and AHI.

a better airway at night, it can provide the best of both worlds. One of many CR definitions that make sense from a sleep perspective has been described as "the most stable and comfortable position of the mandible in which the joints can be loaded without discomfort." Poor breathing will disrupt sleep, but pain can also, so don't create it.

Intraoral scanning technology was used and the appliance was created (Figs. 7, 8). At delivery, the patient tried in the appliance to check fit and the bite position. This type of appliance has elastic that needs to be titrated to support and maintain a position of the phonetic, deep "aaahhh" sound. The patient was checked two days after, seven days after and then a 30-day "efficacy" test to verify the effectiveness of the appliance. There was adequate reduction in apneas and hypopneas. The patient reported no complaints and the efficacy test was satisfactory (Figs. 9, 10).

### **\_\_Sleep changes everything®**

The patient reported relief from the pre-existing symptoms and complaints. The patient now reports, "The results have been life changing. The mouthpiece fits my teeth perfectly. The elastic, which can easily be replaced, keeps my jaw in place and also protects my teeth from grinding. My wife has commented about how quiet I am while sleeping ... I am able to fall asleep normally without any medication. I'm also able to maintain a restful sleep without waking up gasping for air. My headaches are gone and I have energy throughout the day without nodding off during the day. Getting a good night's sleep, along with having energy to exercise and eat right, have aided in increasing my health and I've dropped about 30 pounds over the last year ... I lived with a burden of

fear in the past because all of the health horror stories from sleep apnea effects. I now sleep in peace and live in peace. Thanks!"

### **\_\_Summary**

Dental sleep medicine has the ability to improve patient care and strengthen practices. As screening is improved, patients will be identified earlier in the process and prevent bigger health issues from starting. TMJ and sleep treatment go together, meaning you cannot treat one and not affect the other. We have the technology today to automate and simplify the process of DSM so dentistry and medicine can work together. \_

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**\_about the author** CAD/CAM



Joe Magness, DDS, is a general dentist from Orem, Utah. He graduated from New York University College of Dentistry in 2001. He has owned multiple practices but now limits his practice to dental sleep medicine for the past two years. His passion is to help offices implement dental sleep medicine and medical billing. He is a member of the AASM and AADSM. Magness has lectured for Henry Schein and other companies. He is the CEO and founder of **imagn®** Solutions, a company out to improve interdisciplinary collaboration and understanding to improve health in this country. He is also the inventor of the **RiPPLE®** appliances.

# Collaboration in the digital age between the dentist and the laboratory technician

**Author** Gary Kaye DDS, FAGD, & Mark Hartsliel, BSc, RDT

The collaboration between the dentist and the laboratory is a crucial component in delivering successful restorative dental treatment. Historically, laboratory technicians have relied on physical impressions, models, photographs and written or verbal prescriptions to fabricate prostheses. As we move into the digital age, finding a digital laboratory has become even more critical in establishing a digital workflow with a solidified line of communication.

## Capturing the digital file

The digital workflow begins with capturing the dentition and surrounding structures with an intraoral scanner. This scan results in an STL file that is electronically transmitted to the dental technician. This replaces the physical impression that has to be shipped, poured up, articulated and then evaluated a number of days later. In comparison, the digital scan can be evaluated in real time. The dentist and laboratory technician can then have a dialogue while the patient is still seated in the operatory, which makes for a truly seamless impression.

## Digital design

The technician begins to design the restoration as prescribed by the dentist, and this is where the

advantages of the digital workflow are truly amplified. The dentist has access to the digital design, which improves the workflow in a multitude of ways. Design proposals can be emailed and viewed on any device, online platforms can be utilized to manage case progression, and modifications to the design can be added prior to fabrication. Ultimately, the digital design becomes a true collaboration between the dentist and technician from start to finish.

## Restoration fabrication

The restoration can be milled in a number of materials, including zirconia, lithium disilicate, modified resins (PMMA), titanium or metal alloys. In complex cases, it is possible for the lab technician to fabricate a PMMA prosthesis in which the dentist can insert, easily adjust and have the patient wear for a short time. After the dentist determines that the prosthesis meets esthetic and functional requirements, the prosthesis can be scanned in the mouth and that scan sent back to the lab and duplicated.

## Case report

A 23-year-old female was referred for the restoration phase of the reconstruction of her mandible. Previously, the patient had a lower right mandibular





Fig. 1



Fig. 2



Fig. 3



Fig. 4



Fig. 5

**Fig. 1** Pre- and post-operative extraoral photographs of removal of lower right mandibular osseous lesion. (Photos/ Provided by Gary Kaye DDS, FAGD)

**Fig. 2** Post-operative panoramic radiograph following total resection of mandible using an autogenous tibial bone graft and placement of four Nobel Biocare endosseous implants.

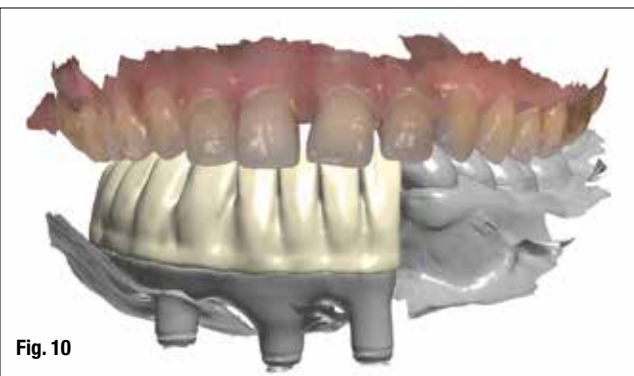
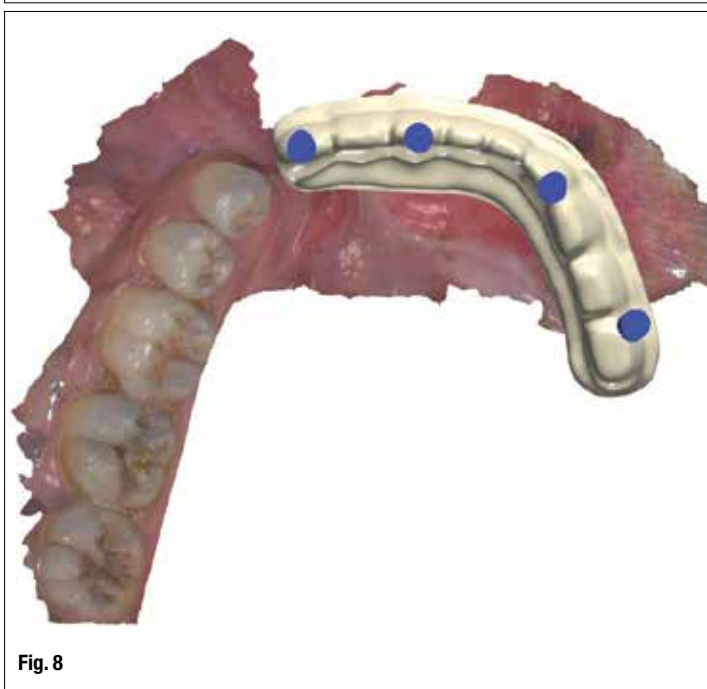
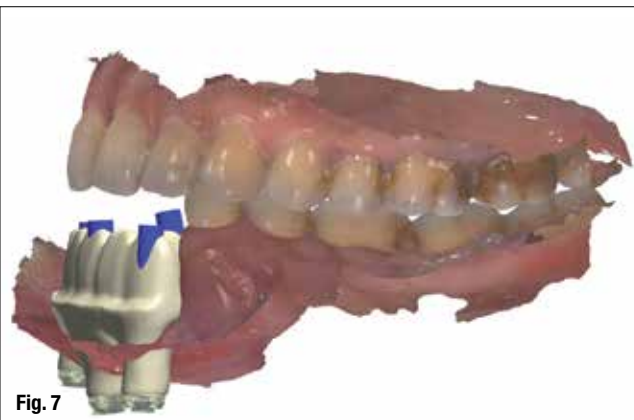
**Figs. 3-5** Scan view of implant cylinders capturing the position and orientation of implants on mandibular arch.

osseous lesion removed, which required a total resection of the mandible. Reconstruction of the mandible was attained using an autogenous tibial bone graft. Four Nobel Biocare endosseous implants were placed in the bone graft, which a prosthesis would be constructed on. (Figs. 1, 2)

The present case requires a high level of collaboration with the laboratory technician, both in the planning phase as well as the execution. In any digital case, it is essential that the laboratory technician be able to recognize the scan bodies used to capture the implant position and orientation. Prior to scan-

ning, the dentist must confirm with the technician that they have the compatible software for both the scan bodies and implant manufacturer. In this case, the soft-tissue limitations required the technician to provide modified scan bodies that had sufficient length supra gingivally for accurate capturing.

At the initial visit, intraoral scans of both arches, as well as a buccal scan with the patient in centric occlusion, were taken. The scans were transmitted to the laboratory where the technician confirmed that they were acceptable before the patient was dismissed. (Figs. 3-5)



**Figs. 6-8**\_CAD design of implant borne framework.

**Figs. 9, 10**\_CAD design of overdenture.

**Figs. 11, 12**\_Insertion of PMMA framework.

One of the challenges presented in this case was how to manage the excessive vertical discrepancy from the top of the implant platform in the mandible to the occlusal place (.30 mm). This was accomplished by fabricating a fixed screw retained substructure, which allowed for the fabrication of an overdenture.

The communication between the dentist and laboratory in the design phase was critical to the success of this case. The design was approved, and a try-in of the PMMA framework was milled to be used as a verification jig as well as a temporary prosthesis. The PMMA framework ensured that the final prosthesis could fit passively. (Figs. 6-12)





Fig. 13



Fig. 14



Fig. 15



Fig. 16



Fig. 17

Fig. 13\_Zirconia overdenture.

Fig. 14\_Zirconia overdenture and framework.

Figs. 15, 16\_Insertion of zirconia overdenture.

Fig. 17\_Post-operative extraoral photograph.

At the following visit, the overdenture, fabricated in zirconia, was tried in and required minimal occlusal adjustments. After polishing, the prosthesis was inserted to the patient's satisfaction. (Figs. 13-17)

The collaboration between the dentist and laboratory played an essential role in the success of the aforementioned case. Through the utilization of the digital workflow and an open line of communication with the laboratory, we can provide our patients with a healthy and beautiful smile.

### \_about the author

### CAD/CAM



Gary Kaye, DDS, FAGD, has practiced comprehensive dentistry in New York City since 1993. He graduated from Columbia University of Dental Medicine in 1993, where he received awards in endodontics, prosthodontics and geriatric dentistry. He has built an extremely successful practice by acquiring an existing practice, modernizing the facility and developing superior clinical and practice management skills. In addition to his private practice, he has consulted with other dentists, dental manufacturers, lectured on topics including ceramics, occlusion and digital dentistry and performed live patient demonstrations to dentist audiences. He is on the guest faculty of E4D University in Dallas, Texas.



Mark Hartsliel, BSc, RDT, is the chief executive officer of the New York Center for Digital Restorative Solutions. He is a leading, internationally recognized dental technician with more than 30 years of experience. He attended dental school in the University of Durban, Natal in South Africa. While attending dental school he worked alongside Victor Hartsliel and Martin Loewenstein, who direct two of the top 10 dental labs in the Southern Hemisphere. He has lectured, published, conducted hands-on courses, led training programs for prosthodontic schools such as North Shore and NYU, mentored MDT, CDT technicians and has extensive chairside assistance with special empathy in terms of "hands in the mouth" subtleties. He is now at the forefront of the revolutions in digital dentistry, material science and helping dentists transition from traditional, analog modus operandi, to digital.



# A dentist's perspective on the changing landscape of dentistry



Don Murry III, DMD, founder of Are You Numb Yet? LLC

When you think of dental education, you probably remember at least eight years of late-night study sessions and stomach-wrenching exams. It tends to be a time that most dentists and clinicians find to be riddled with mind-numbing experiences. In a recent interview with Don Murry III, DMD, founder of Are You Numb Yet? LLC, a dental education resource company, he redefines the adage "Everything old is new again" with experiential educational events for the new era of digital dentistry.

## **CAD/CAM** magazine: How long have you been in practice?

Murry: I've been a practicing dentist for approximately seven years but joined my father's dental practice, an established office of 35 years.

## What initially inspired you to pursue dentistry?

Initially, I majored in business in college but worked part-time in the family business pouring dental models. After my father was involved in a major car accident that took over a year of recovery, I decided to pursue dental school. Helping out with the family business was something that we all did; even my mom, who was a pharmacist, changed her career to become the office manager. Working in the office made me realize that there had to be a way to make the practice better, more efficient.

## Why did you decide to branch out of regular day-to-day dentistry into digital dentistry education?

As a dental PPO office, I see the struggle in dentistry of insurance companies increasingly trying to have dentists maximize patient care within a limited timeframe. The daily routines can be monotonous, and I wanted to bring more excitement and passion back to dentistry. I feel that digital dental technology can do that for dentists.

## Why did you choose educational formats such

## as podcasts (available on iTunes) and Tee It Up Events?

Growing up in a digital era, I knew that younger clinicians would be drawn to podcasts. When I would attend educational seminars, they were usually formatted as a lecture presentation in a hotel conference room. After six to seven hours of listening to a presenter, your mind goes numb from the monotony, and learning isn't really facilitated. That's how I came up with the name of my company, Are You Numb Yet?, LLC, and it's also a play on words, especially for dentists. The idea of having an experiential educational event was sparked after a conference where we could go play a few rounds of golf. When we were on the course and enjoying our time bonding, I found myself in engaging conversations with other clinicians. I realized these formats were the best ways to have dentists share their experiences rather than staring at a PowerPoint in a hotel conference room.

## Who is your target audience for your events?

When I was thinking about the best way to reach my audience of dentists, I realized there were three main groups of people — young dentists who have grown up in a digital society, dentists who purchased digital technology but didn't know how to best utilize it and older dentists who hadn't used digital technology nor understand the power of using it in-office.

## What do you see as the changing landscape for dentistry?

Digital dentistry is the trend, and dentists have no choice but to follow it. Digital technology makes a dental office cost-effective and time-efficient. If you are a PPO insurance-driven office, volume dentistry and fee schedules are the way you practice. Digital dentistry is the best way to separate your office from the competition and the best way to build your practice. In our office, PPO insurance drives our business and same-day dentistry helps us stay profitable.

## \_contact

## CAD/CAM

To find out more information on events and courses by Are You Numb Yet? LLC, visit [www.areyounumbyet.com](http://www.areyounumbyet.com).

# Tech-savvy students entering the profession in a new era of dentistry

There's no doubt that today's American dental students — like most young Americans — are different than their predecessors in terms of their relationship with technology.

Dean P. Bradford Smith, DDS, and Associate Dean for Clinical Education Harold J. Haering, DMD, both at Midwestern University College of Dental Medicine in Glendale, Ariz., observe that the youngest students are remarkably more advanced technologically than students even just a few years ahead of them. "Generally, the latest crop of dental students knows more about technology, computer systems and imaging than the faculty instructing them," says Smith, adding, "They don't necessarily know the dentistry portion, but they are often better than their instructors at dealing with system issues."

This facility, they observe, is likely an outgrowth of their own experiences as children growing up with a wide array of electronics — computers, tablets, cell-phones, video games, etc. But the deans stress that these students' comfort with and ease of adapting to the latest technological innovations, including in dentistry, comes from a basic learning concept that has little to do with technology itself — repetition.

"How they become proficient with technology then is through repetition; they use it constantly, learning nuances from their friends and semi experts like blogs and YouTube, all the while developing the psychomotor skills that make it second nature to them," says Smith.

Haering maintains that the school's success in teaching technology is rooted in harnessing that drive to doggedly master the skills through repetition and peer mentoring.

To illustrate this point, Smith contrasts the ease with which a child given a new iPhone quickly becomes proficient in understanding and using its previously unfamiliar capabilities by constant use, with the difficulty experienced by the dental school's own faculty in mastering new technology at weekend trainings



separated by months during which the information taught is not applied. "When our own faculty training was not progressing from these intermittent trainings, we instead decided to make super users of our students right from the start by providing them with the best equipment and mentors from among tech-savvy faculty and their own classmates."

Smith says the school is highly identified with being on the leading edge of technology. "We look to be on the forefront of technology — whatever it is — that's our niche."

Observing that the faculty may lag behind "technologically native" students, Haering says, the school recognizes the advantages of CAD/CAM dentistry and depends on all who embrace technology — both students and faculty — to deliver on the school's promise to support it.

For this reason, says Smith, the school has invested



(Photos/Provided by Midwestern University)

## A tool for training a new generation of dental students

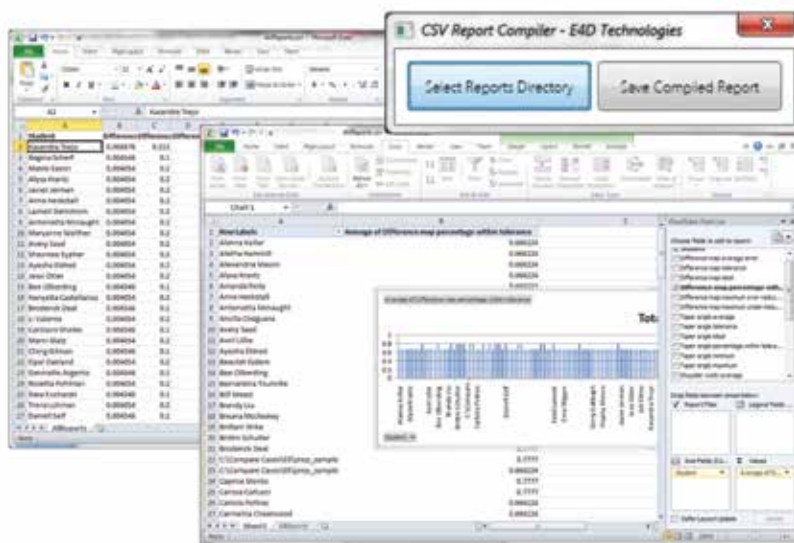
“Digital natives” — that is, those born into the world of computers, cellphones, tablets and video games — are generally making an easy transition to digital dentistry. But, as students, they still need to learn the basics of dentistry — e.g., tooth preparation, restoration design and occlusal articulation.

In keeping with the learning style of tech-savvy students who are already accustomed to interactive games and video tutorials, Planmeca has introduced Compare® software, an innovative adaptive learning technology tool for dental teaching institutions.

Compare provides students with self-evaluation tools for precise measurement and feedback about their sample preparations and restorations and how they compare to the institution's standards. Students can work at their own pace, while compiling digital portfolios that demonstrate their accomplishments. The software also provides evidence-based assessment tools that document progress.

This comparative assessment tool is for non-clinical applications only. It enables individual institutions to define their standards and uses evidence-based tools to provide performance assessment and reinforcement toward continual improvement in meeting those standards.

Its adaptive learning approach engages students and adapts to different learning abilities, improves understanding and frees up time for one-on-one instruction.



(Screenshots/Provided by Planmeca)

heavily — not with last generation hand-me-down technology from manufacturers but the latest equipment, and lots of it, so students get the experience they need to walk into a CAD/CAM practice. This, he explains, starts in year one — and in some cases before. “Our preclinical area now has 10 Planmeca FIT acquisition units with laptops dedicated to CAD/CAM, plus four Planmeca PlanMill 40s. Then in the clinic area, where third- and fourth-year students see patients, there are 10 group practice areas called suites — each of which has three, or a total of 30 Planmeca FIT units. Add to that 10 more mills and eight ceramic ovens.”

As a result of the school's focus on CAD/CAM dentistry and the hands-on experience it provides, students have a significant amount of scanning experience, which is done on live patients in their last two years. Smith says the average student last year

did 14 CAD restorations and their most proficient CAD student did about 75 CAD restorations.

Haering notes that while most dental students today take naturally to technology and relish their dental school's focus on it, they nonetheless need to learn traditional methods as well — for the time being — to meet the school's focus on preparing them for the job market they will face upon graduation.

On this, Smith says, “We tell students who apply that our goal is to create a clinically competent graduate who can step right into private practice. So although, for example, working with impression materials is not second nature to them, in many parts of the country, the use of CAD is not yet widespread, so we still need to teach traditional methods. If we don't layer like that in this transitional period, it decreases their competitive advantage. We want students to



have a competitive advantage in the marketplace, not just in dental school."

However, Smith notes a growing desire among employers for students with CAD/CAM experience. "Even as recently as of 2012-2013, use of CAD/CAM was rare. But now, with the seventh class approaching graduating, in our 10 years in operation, I can tell you there's been an exponential increase in the number of employers that demand that students know CAD," he says, adding that this is the case in the military, public health, and corporate offices, as well as the offices of private practitioners.

So although the deans say the school continues to teach traditional methods, they note changing times are likely to phase them out, particularly as the advantages become clear to patients as well as practitioners.

Haering points out "the inherent inaccuracies" in traditional impressions compared to an IOS, "which produces a video of an actual prep," and remarks that in a free market system, customer demand may rule the day. "Consumers will ultimately drive what health-care providers do in medicine and dentistry — at least if there's a choice. Patients love same-day CAD restorations, much as they loved — and ultimately demanded — tooth colored fillings. Same-day dentistry means patients — many of whom drive one and a half hours or more — don't have to take off extra time from work or have a temporary restoration that may come off."

Smith agrees, saying the ultimate goal of all health-care professionals — including those involved in the education of its future practitioners — is to



P. Bradford Smith, DDS, dean of Midwestern University College of Dental Medicine.



Harold J. Haering, DMD, associate dean for clinical education of Midwestern University College of Dental Medicine.

serve their patients' best interests. "We're actively thinking of what's best for all patients, for their satisfaction and well-being, taking into consideration their time constraints, lifestyle and cosmetic requirements. Eventually, they will be the ones who drive widespread use of technology delivered by doctors committed to their care."

Both Smith and Haering note the daunting challenges faced by today's dental students.

"They have had to learn more in the same amount of time than past generations of students," notes Haering. "Keeping up with technology, like all change in the profession and life in general, requires most of all a commitment to lifelong learning," he concludes.

## Networking to keep technology secure and accessible in the university setting

Balancing HIPAA compliance with access to data can be a big challenge in any setting involving multiple users of that data. This is especially the case in the university setting, where dozens of students are accessing that data via laptops, which — unless the network is properly designed — can wreak havoc on the whole system when used to download unauthorized updates or software.

Midwestern University College of Dental Medicine strives to maximize data access and security using an open-architecture Planmeca network that overcomes challenges of other dental systems and meets the often-conflicting desires of users vs. those charged with protecting the privacy and optimal functioning of the system. Key advantages of a networked system for dental schools:

1. Compatibility with other third-party systems.
2. Integrates with other dental technology, such as digital Xrays, CBCT and intra-oral cameras, which, in turn, improves equipment reliability.
3. The universal DICOM and STL files easily export /import into treatment planning software
4. Network protections and security allow for automatic backup of patient data without the need to update drivers.
5. Optimized software speeds increase user productivity.
6. Images saved on a centralized network allows for easy access within any network workstation.

# Start the new year with benefits



Take advantage of the Section 179 tax benefit to upgrade your practice to digital dentistry. (Photo/Provided by Planmeca)

If you are a health-care professional who is thinking of starting, growing, going digital or remodeling an office, you may be able to do so more affordably in 2017 than ever before. What makes this a highly desirable environment? Section 179 benefits.

IRS Section 179 encourages business owners to invest in equipment or technology by allowing them to deduct a substantial amount of the asset's value the first year. Taxpayers who acquire new equipment may be able to deduct up to \$500,000, as well as 50 percent bonus depreciation of qualifying expenses during the first year of ownership. You can see that there is a benefit to taking the full deduction for the cost of the item immediately, rather than being required to spread out the deduction over the item's useful life (see table).

## Section 179 fundamentals

It is never too late or too early to do business tax

planning. There are many ways to conduct tax planning, and the best time to do tax planning is now. The Section 179 tax deduction allows businesses to deduct all or part of the purchase price of certain qualifying business purchases, such as equipment, technology and off-the-shelf software. (Please check with your own financial advisors as we do not offer tax advice).

As more and more practitioners embrace equipment and technology, the Section 179 benefit can be applied to lower the office's taxable income, making a practice more efficient, productive and profitable. But don't wait too long to acquire technology or upgrade your office.

Although it is true that you can have equipment placed in service until Dec. 31, waiting too far into the year may mean you will settle on your selections because of diminished quantities. You owe it to your practice and yourself to evaluate your opportunities. Think of the incremental profitability when you are able to focus on delivering an even higher level of quality care to your patient base. There is no better time to invest in your practice.

Tips for taking advantage of Section 179:

1. Plan ahead: Tax planning is key for maximizing the Section 179 deduction.
2. Avoid last-minute purchases: Purchasing at the very end of the year can be risky because items only count toward Section 179 if they were put into use that same year.
3. Keep detailed records: You MUST keep records that show the specific identification of each piece of equipment, as well as how you acquired it, who you acquired it from and when you placed it in service.
4. Consider leasing equipment: Leased equipment can sometimes qualify for the Section 179 deduction.

Disclaimer: Planmeca/E4D Technologies and its owners, affiliates, suppliers and partners are not tax advisors, and the information is not intended to offer any tax advice. Please consult with qualified professionals concerning your specific situation.

2017 Section 179 Tax Deduction Calculator™	
Enter Cost of Equipment Here	\$ 36000
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Normal 1st Year Depreciation:	\$ 0.00
Total First Year Deduction:	\$ 36,000.00
Cash Savings on your Purchase: (assuming a 35% tax bracket)	\$ 12,600.00
<b>Lowered Cost of Equipment: (after Tax Savings)</b>	<b>\$ 23,400.00</b>

# Introducing Zirconium Oxide Block for IPS e.max

Author\_ Ivoclar Vivadent Staff

**Monolithic crowns  
and 3-unit bridges  
now possible in a single  
appointment**

Ivoclar Vivadent announces the introduction of the new IPS e.max® ZirCAD® LT, a low translucency zirconium oxide block for digitally fabricating monolithic crowns and 3-unit bridges in a single appointment. Available in eight A through D shades and two block sizes — C17 and B45 — IPS e.max ZirCAD demonstrates high fracture toughness and a flexural strength of 1,200 MPa.

With IPS e.max ZirCAD, dentists can fabricate monolithic restorations for cases in which there is considerably lower wall thickness, such as posterior crowns with a minimum of 0.6 mm or anterior crowns with a minimum of 0.4 mm.

Once the IPS e.max ZirCAD blocks are wet milled, the restorations can be sintered in the newly introduced Ivoclar Vivadent Programat® CS4 furnace, which is capable of speed sintering zirconia restorations.

After sintering, IPS e.max ZirCAD restorations can be glazed and/or characterized using IPS e.max CAD Crystall materials. They can then be conventionally cemented using a self-adhesive resin cement, such as SpeedCem® Plus.



IPS e.max ZirCAD LT. (Photo/  
Provided by Ivoclar Vivadent)



# New Programat CS4 furnace performs crystallization, sintering and glazing

Author\_ Ivoclar Vivadent Staff



Ivoclar Vivadent announces the introduction of the new Programat® CS4, a combination furnace for dental practices suitable for sintering zirconium oxide restorations – including IPS e.max® ZirCAD®.

The compact furnace is also ideal for crystallizing and glazing CAD-processed lithium disilicate and other restorations, such as IPS e.max CAD and IPS Empress CAD.

Easy to use with a clearly arranged membrane-sealed keypad and a graphic display to ensure easy operation, the Programat CS4 furnace is capable of speed sintering zirconia and lithium disilicate materials.

Based on the long-standing success and high-quality of other Ivoclar Vivadent firing and press furnaces that have been used by dental professionals for decades, the Programat CS4 features 30 programs, eight pre-installed programs that are optimized for Ivoclar Vivadent materials and 22 open programs that are free and available for individual, customized programming.

(Photo/Provided by Ivoclar Vivadent)

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# CAD/CAM

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