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Basic instincts and the dental metamorphosis



Michael L. Young, DDS

The world of dentistry has undergone profound change during the last 30 years and is steadily evolving toward a digital world.

As dental practitioners, our major concerns are dental anatomy and physiology, materials science and perfecting our preparation and dental operative techniques. It was challenging enough to master the techniques of achieving the perfect margin while simultaneously learning to become physicians of the oral cavity, as well as being small business owners.

Today, however, dentistry has undergone a rapid revolution as it incorporates technology at a dizzying pace. Not only are dentists physicians of the oral cavity, master technicians, materials scientists and business people, they are finding themselves in the position of needing to understand and master advanced aspects of computer engineering and a vast array of available digital technologies.

Digital impressions change the traditional methods and workflow completely. These digital technologies, however, give us complete control over results, with improvements in patient comfort and convenience and the quality of restorative results. Techniques and processes have matured and advanced to the point that they can provide same-day results, predictably and in an extremely cost-effective fashion, and with great acceptance by our patients.

I was an early adopter of digital technology. The integration of the Romexis software with the patient's soft-tissue scans and CBCT image provides valuable information for exceptional treatment planning. The flexibility of the open platform is the core of Planmeca's systems. The modularity and support that I receive allows me to practice better dentistry.

Digital transition doesn't have to mean major upheaval — as a matter of fact, the digital transition simply puts a new spin on what you already know and is often all you need to make huge strides in improving your practice and providing a better patient experience. After all, the basics are the foundation of change.

- Michael L. Young, DDS





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| **on the cover** *Cover image provided by E4D*





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A minimally invasive approach according to biomechanical principles of teeth

Author_Michael L Young, DDS

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_Introduction

Traditionally, the practice of dentistry has been a reparative model. We have waited for disease to express itself, and then repaired it. What if we could predict who would express a disease and prevent it from happening in the first place? How would this approach affect the long-term oral and overall health of the dental patient?

Many of our patients tell us, "If it's not broken, don't fix it." Patients are often unaware of the conditions in their mouths because there isn't an associated disability, and they won't accept a solution to a problem they don't have. Thus teeth at risk may remain untreated until a quality of life issue has occurred, such as pain, infection or a fractured tooth.

According to Geurtsen, Schwarze, & Gunay (2003), root fractures are the third leading cause of tooth loss.

Tooth loss is a quality of life issue. Loss of a tooth ideally requires replacement, which necessitates further expenditures and procedures.

Failure to replace the tooth has consequences, which may lead to further cost and need for treatment or loss of additional teeth. The consequence of the reactive approach to dental care is, at best, a lesser prognosis for the tooth and, at worst, loss of the tooth. This may be avoidable with a paradigm shift to a wellness model of practice. A wellness model is proactive and preventative. If we can identify a dental condition that increases risk to the tooth and patient, and treat the condition prior to its consequence, we're effectively reducing risk. The effect is an improved prognosis. Subsequently, health-care costs will be reduced and quality of life improved. We can do better.

_Biomechanical principles

Tidmarsh said in 1979 that teeth are like prestressed laminates. They flex but can return to their natural state. However, under prolonged loading, teeth can permanently deform.

Grimaldi said in 1979 that there is a relationship between how much tooth structure has been lost and deformation.

Cavity preparation or endodontic access destroys the pre-stress state. Teeth can then deform greater and are more susceptible to fracture. Too much flexing makes them crack.

Larson, Douglas and Geistfield (1981) showed that a restoration that takes up just one-third of the intercuspal distance is less than one-half of the strength of an unrestored tooth. The load required to fracture a tooth was the same if the restoration involved only the occlusal surface or included the mesial and distal surfaces as well.

Geurtsen, Schwarze and Gunay (2003) agreed that the risk of cuspal fracture increases considerably when the isthmus width of a restoration is 50 percent of the intercuspal distance. They stated that amalgam or resin composite restorations should not exceed one-fourth to one-third of the intercuspal distance. The more tooth structure that is removed in cavity preparations, the more the tooth flexes under increasing loads.¹

Teeth with cuspal fractures may still be restored; however, the prognosis will be lower and less than ideal because there is less remaining natural structure to retain a crown and withstand the flexing from functional and non-functional forces. These teeth may last for years. However, they may eventually fracture at the gingival crest or below, because of further cracks and propagation of those cracks.

Teeth with history of endodontic treatment are at an increased risk of subgingival fracture, rendering the tooth non-restorable or with a poor prognosis.² Therefore, it's important to prevent these cracks from forming at all.

How do we prevent too much flexing in these teeth and prevent cracking? Some have wondered whether a bonded in lay restoration would strengthen the tooth and prevent cuspal fracture.

A study of bonded inlay restorations under static load testing in maxillary premolars with large MOD preparations concluded that bonding ceramic or composite will not strengthen the tooth.³ A bonded resin or ceramic inlay will not prevent cuspal deformation and fracture. However, bonded ceramic onlays have been shown to be an effective answer in restoring posterior teeth.^{4,5}

Bakeman and Kois (2009) stated that allporcelain, adhesively retained restorations offered the possibility of limited or no removal of tooth structure on the axial wall, while covering the cusps. The result is a tooth with more remaining original structure, less flexure under force and thus less risk of permanent deformation and fracture.

It is important to preserve as much enamel as possible, as failure rates of adhesively retained restorations increase the more the tooth preparation involves the dentin.⁶ In addition, the size of the remaining enamel ring after occlusal reduction is an important determinant between an adhesively or cohesively retained approach in tooth preparation.

Increased occlusal reduction, or occlusal reduction on a worn tooth, results in a preparation with a reduced enamel ring width. A decrease in the size of the enamel ring thickness from 1.5 mm to 1 mm increased the failure rate dramatically. An enamel ring of less than 1 mm in width would be a contraindication for an adhesively retained restoration, and a cohesively retained restoration would then be required.⁷

A restoration bonded to enamel also provides a margin with reduced or no microleakage.⁸

_Summary

Aminian and Brunton (2003) stated: "The removal of sound tooth structure is an unfortunate biological compromise. The conservation of sound tooth structure, therefore, represents an appropriate strategy to minimize biologic risk."

Adhesively retained restorations offer the possibility to be more minimally invasive while restoring a tooth to natural appearance and function. More conservative removal of tooth structure also means there is less risk to the pulp.

The converse is true in that cohesively retained restorations are more invasive. Removal of more structure increases pulpal risk, decreases strength and increases tooth flexure, which may lead to fracture.

Tooth preparation is also more important as retention and resistance form is essential to retain the crown.

A laboratory can fabricate minimally invasive, adhesively retained restorations. However, chairside CAD/CAM technology can fabricate excellent restorations of the same quality in the same visit. This means the challenge of fabricating a provisional for a tooth preparation that lacks retention and resistance form is eliminated.

In addition, it has been shown that patients prefer a digital impression technique in lieu of the traditional impression method.⁹⁻¹³

Yuzbasioglu, et al (2014), also determined that the digital impression method was faster than the traditional method. This finding was also verified by Patzelt, Lamprinos, Stampft and Att (2014), who indicated that workflow efficiency was improved using a digital impression technique.

_Case report

This patient presented for restorations of teeth #3 and #4 (Fig. 1a). Because of the size of the existing restorations, these teeth were diagnosed as structurally compromised (Figs. 1b, c). The prognosis without treatment was fair.

The restorations were to be completed with PlanScan chairside CAD/CAM technology in the same visit.

Local anesthesia was achieved with 1.7 cc 2 percent Lidocaine with 1:100,000 epi, buffered with Onset sodium bicarbonate inj., 8.4 percent, USP neutralizing additive solution.

Depth guide cuts were made using a 330 bur,





Fig. 1a_Pre-operative photo: Diagnosis of structurally compromised teeth. (Photos/Provided by Michael L. Young, DDS)
Fig. 1b_Pre-op: Measuring intercuspal distance of filling #3.
Fig. 1c_Pre-op: Measuring intercuspal distance of filling #4.
Figs. 2a-c_Depth cut bur #3.
Fig. 3a_Final depth cuts.

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Fig. 3b_Final depth cuts, occlusal view.
Figs. 4, 5_Gross occlusal reduction with KS7 #3.
Figs. 6, 7_Gross occlusal reduction with KS7 #4.
Fig. 8a_Final occlusal reduction frontal view.
Fig. 8b_Final occlusal reduction occlusal view.



which has a 2 mm cutting surface (Figs. 2a–3b). This ensures 2 mm of occlusal reduction to accommodate 2 mm of material thickness on the occlusal surface of the restoration.

Gross occlusal reduction was completed using a KS7 bur to the depth cuts (Figs. 4–8b, 9c). Adequate clearance was verified with a 2 mm prep check from Common Sense Dental Products.

After gross occlusal reduction was completed, the remaining enamel ring was measured (Figs. 9a, b). The enamel rings were noted to be 1.5 mm, and the teeth were prepared for adhesively retained restorations. If the enamel rings were less than 1 mm, the teeth would have been prepared on the axial walls to create retention for cohesively retained crowns.

The remainder of the existing composite resin in #3 and the amalgam in #4 were removed. The occlusal surfaces of the preparations were blended into the interproximal areas using a KS2 bur to create smooth preparations (Figs. 10–15c). There was no retention or resistance form prepared to retain the restorations.

Tissue management was obtained with ViscoStat Clear, gingival hemostatic gel, 25 percent (m/m) aluminum chloride (Figs. 16, 17). Gingival retraction was obtained using a two-cord system. First, a #00 size cord from Ultradent was placed on the mesial and distal of both preparations (Figs. 18, 19).

Additional hemostatic gel was used prior to the second cord. The second cord was #2 size cord from

Fig. 9a_Measuring remaining enamel ring after occlusal reduction #4. Fig. 9b_Measuring remaining enamel ring after occlusal reduction #3. Fig. 9c_Occlusal reduction lateral view. Figs. 10–12_Breaking contacts and removing remainder of existing filling. Fig. 13_Blending occlusal and interproximal #4. Figs. 14a, b_Blending occlusal and interproximal #3. Figs. 15a, b_Final preparations occlusal views. Fig. 15c_Final preparations lateral

Fig. 15c_Final preparations lateral view.





Figs. 16, 17_Tissue management with Viscostat. Fig. 18–21a_Gingival retraction. Fig. 21b_Final gingival retraction, occlusal view. Fig. 22a_Scanning preparations. Fig. 22b_PlanScan screenshot of scanning preparations.

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Ultradent (Figs. 20, 21a). A minimum of four minutes with both cords in place is needed for adequate re-traction of the soft tissue (Fig. 21b).

While waiting four minutes for gingival retraction, the opposing teeth were scanned with the PlanScan wand to create a digital model (Figs. 22a– 24c). The buccal surfaces were then scanned with the teeth fully occluded in maximum intercuspal position. This scan was used along with the scan of the preparations and the opposing teeth to create a model for the occlusion (Figs. 25a–26c).

Prior to scanning the prepared teeth, the second cords were rinsed and removed. The cords were left wet to lower the risk of disturbing the tissue upon removal.

The #00 cords were left in place during the scanning of the preparations, and the teeth were dried to allow accurate scanning.



The preparation model was examined in data density view to verify adequate data was obtained during the scanning of the preparations (Fig. 26c).

Any areas lacking adequate data were scanned further until adequate data was obtained. Next, orientation of the preparation model was performed (Fig. 26d). Orientation is for optimal design, not path of insertion. The margins were then traced and viewed in ICE mode, which provides a rendering of the scanned images for a clear view of the margins, teeth and tissues (Figs. 26e, f).

The initial proposals for the restorations were made using Library A and autogenesis, which is morphogenesis of the library tooth with the neighboring teeth (Figs. 26g–i).

Material thickness of the proposed restorations was checked (Fig. 26j, k). Tools were then utilized to improve the initial proposal to the desired result. The rubber tooth tool was used to make minor adjustments to the anatomy (Figs. 26l–n). The smooth surface tool was used to smooth the surfaces (Figs. 26o, p).

The location and strength of the occlusal contacts were checked and adjusted (Fig. 26q). Interproximal contact strength and location was then verified and adjusted as needed (Fig. 26r).

The final proposals were then verified prior to milling (Figs. 26s, t, w). The slice plane view was used to check the space between the tooth preparation and the restoration (Figs. 26u, v). This is done to check for possible areas that may prevent the final restoration from completely seating on the preparation or for areas that may be overmilled. Over-milling reduces the thickness of the material. This view also illustrates the lack of preparation on the axial wall and the minimally invasive approach taken. The location of the sprues were noted and adjusted as needed in the milling preview (Fig. 26x).

The fit of the restorations was then verified intraorally prior to final seating (Figs. 26y, z). Occlusion can be verified intraorally with e.Max CAD prior to crystallization and any staining and glazing. Checking occlusion with Empress CAD blocks prior to bonding in place is not recommended.

The restoration for #3 was then glazed and crystallized in a Programmat CS2 furnace (lvoclar Vivadent). The restoration was allowed to cool to room temperature upon completion of glazing and crystallization. The restoration was then cleaned with a steam cleaner. Five percent hydrofluoric acid was used to etch the e.max restoration for 60 seconds. The Empress restoration was etched for 20 seconds.

The etchant was rinsed with a steam cleaner. Ivoclean (Ivoclar Vivadent) was applied for 20 seconds on both restorations to clean their internal surfaces. Monobond Plus primer (Ivoclar Vivadent) was applied to the internal surface of the restorations for 60 seconds. The primer was lightly air dried after 60 seconds, taking extra care not to allow primer on the outside surfaces of the restorations. Fig. 23_Scanning preparations.

Fig. 24a_Scanning opposing teeth.

Fig. 24b_PlanScan screenshot of scanning opposing teeth.

Fig. 24c_Opposing model screenshot.



Fig. 25a_Scanning buccal bite.

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- $\label{eq:Fig.25b} Fig. 25b_Screenshot of scanning buccal bite.$
- Fig. 26a_Screenshot of buccal bite.
- Fig. 26b_Screenshot of occluded models.
- Fig. 26c_Screenshot of preparations in density view.
- Fig. 26d_Screenshot of orientation of preparation model.

Fig. 26e_Tracing margins.

- Fig. 26f_Tracing margins in ice view.
- Fig. 26g_Initial proposal of restoration for #4.
- Figs. 26h, i_{lnitial} proposal of restorations for #3 and #4.
- Fig. 26j_Restorations #3 and #4, checking material thickness in occlusal view.



- Fig. 26k_Checking material thickness of #4 in facial view.
- Fig. 26I_Using rubber tooth tool to adjust the anatomy of #4.
- Fig. 26m_Using rubber tooth to adjust the distofacial cusp height of #3.
- $\label{eq:Fig.26n_Using rubber tooth tool to adjust the distal marginal ridge height of \#4.$
- Fig. 260_Using smooth tool to smooth the facial of #3.
- Fig. 26p_Using smooth tool to smooth the facial of #3.
- $\label{eq:Fig.26q_Checking occlusal contacts, location and strength, \#3.$
- Fig. 26r_Checking interproximal contact strength #4.

- $\label{eq:Fig.26s_Final restorations, occlusal view in PlanScan.$
- Fig. 26t_Final restorations, lateral view in PlanScan.
- $\label{eq:Fig.26u} \textbf{Fig. 26u}_Final \ \text{restorations \#3}, \ \text{slice view facial to lingual}.$
- $\label{eq:Fig.26v} \textbf{Fig. 26v}_\textbf{Final restoration \#4, slice view facial to lingual.}$
- Fig. 26w_Final restorations, lingual view.
- Fig. 26x_Milling preview.
- Fig. 26y_Try-in of restorations, occlusal view.
- $\label{eq:Fig.26z} \textbf{Fig. 26z} _ \textbf{Try-in of restorations lateral view}.$





Fig. 27_Isolation for seating of restorations using Isolite.
Figs. 28, 29_Application of Mulitlink Automix Primer.
Figs. 30, 31_Application of Liquid Strip.
Fig. 32_Curing restorations.
Figs. 33a-c_Checking occlusion.

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The teeth were isolated using Isolite (Fig. 27). Multilink Primer A/B was scrubbed onto the entire bonding surfaces using a microbrush for 30 seconds. Excess material was dispersed with blown air until the mobile liquid film was no longer visible, leaving a glossy appearing surface (Figs. 28, 29).

An OptraStick Application Aid (Ivoclar Vivadent) was used to seat the restorations on the teeth because onlays and partial crowns can be difficult to handle. Initial tack curing was completed using a Bluephase

curing light (lvoclar Vivadent) for three seconds at each interproximal area. The resin was then removed easily using a 36/37 scaler from Brasseler. Liquid Strip (lvoclar), a glycerine gel that prevents an oxygen-inhibited layer of the resin cement, was applied to the margins prior to final curing (Figs. 30, 31).

Final curing of the restorations was then completed (Fig. 32). The initial #00 cords were removed after final curing so proper tissue management could be maintained until curing was completed.



Occlusion was checked with the patient chair at a 45-degree angle. Bausch articulating paper, horseshoe shape, 200 microns thick, was used first, and the patient was instructed to chew on the paper as if chewing gum. Next, the patient was instructed to tap straight up and down on red Troll Foil articulating foil. Any marks from the chewing strokes that weren't covered by the red paper were removed to eliminate interferences and reduce the risk of material fracture (Figs. 33a–c).

The restorations were then polished (Fig. 34). For #3 e.max restoration, the burs were NTI Cera Glaze – green, blue and yellow, in order. The green prepolisher was not used on the Empress restoration for #4.

The final result was minimally invasive restorations that appear and function naturally, while decreasing risk of tooth fracture, and minimize further risk to the teeth. (Figs. 35a–36b).__

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Fig. 34_Polishing. Figs. 35a, b_Final restorations occlusal view. Figs. 36a, b_Final restorations,

lateral view.

about the author CAD/CAM



Dr. Michael L. Young graduated from the University of Michigan School of Dentistry in

1994. He has a private general dentistry practice in Sterling Heights, Mich. He has been practicing chairside CAD/CAM dentistry since 2004. Young is a mentor for the Kois Center for Advanced Dental Learning. He is a member of the American Dental Association, Michigan Dental Association and the Detroit District Dental Society.

Phone: (586) 795-5678 mike@digitaldentistry solutions.com



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12.4



Restorativedriven implant

therapy

Author_Curtis Jansen, DDS

_Digital dentistry has changed the way I practice – for the better.

I'm a prosthodontist practicing out of Monterey, Calif. I've got a progressive and successful practice, with a great team assisting me in providing patients with excellence in dentistry every step of the way. I've had the E4D Dentist and NEVO systems (now Planmeca Planscan) for more than three years now, and they have provided my patients with a unique dental experience every time I've used them – digital impressions, restorations in one appointment and quicker turnarounds with larger cases. All without compromise in form, fit, function or esthetics.

I've involved my whole team, from Irma, my chairside assistant who has become a CAD/CAM dental designer (CDD) and a clinical integration specialist (CIS), to Frank, a dental technician with more than 30 years bench experience who is now "gaga" over



(Screenshots/ Provided by Curtis Jansen, DDS)





what he can do with a mouse rather than a hot waxing instrument. I do it all — inlays, onlays, crowns and veneers from single tooth to extensive cases.

Take my word for it — if you haven't looked at this type of system in the last couple of years, you haven't looked at all. And don't believe what you've heard or seen before. This technology works.

But now it's gotten even better and in a way that is more passionate to my interests in dentistry – implants. More specifically, it provides all dental professionals a more predictable way to communicate with patients, specialists and laboratories. It's a way to get exactly what you've planned for – restorativedriven implant the rapy - with Planmeca Planscan and Romexis.

In the implant world, we've always talked a good game and have extensive preoperative plans with the laboratory, the surgeon and the patient. We mock up diagnostic plans, get surgical stents and then hope for the best as we send our patient along the implant placement trail.

But, and we've all had it happen, something goes awry. The surgical stent doesn't make it into the placement procedure or the surgeon puts the implant "where the bone is" and not necessarily where the restoration needs to be. Then what?



These surprise events in the continuum of implant therapy can set the final treatment plan back and dramatically increase the cost of treatment for the patient and the restorative dentist, let alone throw us all into a state of recovery and embarrassment.

_Revolutionizing restorative/implant planning

Digital dentistry is coming to the rescue. With Planmeca Romexis, you're able to combine conebeam data for the 3-D "internal" view of the patient along with intraoral data from the Planmeca intraoral (Planscan) scans.

Only the Planmeca Romexis combines the data chairside from multiple sources and provides the clinician an intuitive planning process. Planmeca Romexis is an open platform that works with Planmeca and any other dental cone-beam manufacturer, such as Imaging Sciences International, Gendex, Instrumentarium Dental and SOREDEX, for a complete solution.

So there is no need to worry about whether you have a certain system.





Although other manufacturers have used a closed loop to simply export a static file into implantplanning software, only Planmeca Romexis brings them all together to revolutionize the entire restorative/implant planning.

I don't want to learn new surgical software – I've already invested time and effort learning my restorative software. Wouldn't it be great if I could have all the data on my restorative system – and be able to play, adjust and design both the restoration and the implant placement all on the same screen?

Well, that's what we can do with Planmeca Romexis – anything we want – at any stage of the game or plan. I can now draw a nerve the same way (using similar tools) as I draw a margin on a preparation. The interface is made for dentistry ... for restorative dentistry.

_Flexibility is the key

Being flexible is important. I know the implant is not always going to be able to be placed exactly where I want it to be. Factors including bone density, dimensions and nerve location all can dictate the final placement. But wouldn't it be nice to know beforehand as you are designing the restoration?

With Planmeca Romexis, I can be flexible because my restoration design and implant placement are both on the same screen, so I can adjust both parameters (restoration and implant) rather than try to heroically save a situation with angled abutments, extensions and other compromises only on the restorative end.

_Optimize, don't compromise

I've been lucky enough to be involved and see the development of this exciting software program. It makes everyone's "wish list" come true. I can draw the nerve(s), view the data from any angle, design the restoration that is right for the edentulous area and then choose one of a myriad of implants to place into the space using just a click and drag of a mouse. Nothing is this easy in dentistry.

Then I can line up the implant with the ideal restorative placement and check the density of the bone and even the angulation of a proposed abutment. Incredible!

This flexibility also allows for efficient and effective communication between the surgeon, the restorative dentist and the laboratory, if needed.

So what's your next step?

First, if you are a restorative dentist, get Planmeca PlanScan system with Romexis into your office. There is no powder, it's easy to use, and it makes any office more profitable by being able to complete same-day dentistry and fabricate nearly all your single-unit restorations.

Get going with that system and start scoping out the myriad of excellent cone-beam systems listed above or locate a scanning center using one of those brands. Why be tied into just one option? And, more importantly, why be tied into a closed system of the same manufacturer's CAD/CAM system and conebeam system?

Be able to choose the best of both worlds and what is right for you.

'The more you grasp technology and use its capabilities to guide you to the ideal, the more efficient and effective you will become.'

_Putting the plan into motion

The more you grasp technology and use its capabilities to guide you to the ideal, the more efficient and effective you will become. So here is your future dialogue with patients missing a tooth who come to see you for restorative therapy.

(Note: Patients don't come to you with the request for "an implant;" they come to you to fill a missing space. It is up to you to offer the ideal restorative plan to fill that space first, then decide how you are going to put the restorative plan in place [bridge, implant; orthodontia]. So let's do that. Design the ideal restoration, then plan the mechanism to hold it in.)

"OK, Mrs. Smith, it is very important for you to replace that missing tooth with a 'tooth' that will maintain the health of your mouth and will provide you function for chewing. We have several options to complete that goal, but let's first scan the area with an advanced 3-D laser scanner so we can plan accordingly."

Take the Planmeca Planscan and capture a true 3-D image of the area — all soft and hard tissue. (Note: No powder or contrast agent is placed. Think about it. This patient has just had the tooth extracted, and there is still an open or healing wound. The last thing you want to do is spray titanium oxide under pressure into an open or healing wound. So don't go the powder route.)

"OK, so here is the 3-D virtual model. We can get a better idea of what the ideal restorative solution would be. The computer will assist us in previewing what would be the best functional and maintainable solution for your individual case. Here is the ideal proposal, which we can optimize for your individual situation prior to doing any treatment.

"It looks like one solution we should consider is a single-tooth implant that would hold the restoration in place and also provide you the most naturalfeeling and natural-looking solution possible. But first we'll need to look under your tissue to see if an implant is possible in that location."

Take Mrs. Smith over to the Planmeca Promax (or any other compatible cone-beam system) and complete a cone-beam scan. Or if you've taken one before on any of the compatible systems, just grab the DICOM data.

_about the author



Dr. Curtis Jansen completed his DDS and his prosthodontic education at the University of Southern California (USC) School of Dentistry. He taught full time at USC and was director of implant dentistry in the Department of Restorative Dentistry. Currently, he has a full-time practice limited to prosthodontics and a dental laboratory in Monterey, Calif.

34 Dormody Court Monterey, Calif. 93940 *cejdds@mac.com www.cejdentistry.com.* (831) 656-9394

"So now we can see the bone available below your tissue. I'm going to combine this data right on this screen and show you what is possible. Here is the implant solution I would recommend, and you can see I'll place this directly under the restoration we've designed and see if you have the type and amount of bone ideal for this procedure.

"We'll identify the location of the nerve that runs down your lower jaw and certainly avoid that. With this software, you and I can get a great view of the overall process before any treatment is started. So, yes, it looks like this would be an ideal treatment.

"If we decide to go with this, I have all the information I need. I can be ready when you are, and in fact, I can prepare a temporary restoration and have it ready to place in that space the same day the implant is placed so you'll never feel that open space again. Your tissues will be able to heal in the ideal form, so when you're ready, the final restoration will be that much more natural and beautiful. Let's get started."

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CAD/CAM

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Going (unintentionally) green: The unexpected bonus of switching to CAD/CAM and same-day dentistry

Author_Dr. Joel Strom

_Introduction

With dentistry as innovative and dynamic as it is, the progress made and the exciting new trends that result are often judged in terms of the technological or financial: We can update our equipment to have a purely digital office, or we can adopt new practices and offer new procedures to our patients that bring in extra revenue.

While these accomplishments are certainly laudable, it is time for dentistry to measure its progress by different standards, ones that affect the profession and the world as a whole. In short, we can examine how our practices and procedures influence the environment and what dentistry as a profession can do to ensure this influence remains positive.

Fortunately, dental professionals no longer have to choose between advances in technology and what is considered "eco-friendly." In fact, practice owners can assure themselves of the best of both worlds by adopting digital technology, such as in-office CAD/CAM systems such as the Planmeca Planscan System (E4D Technologies). While the practical and financial benefits of CAD/CAM technology are well established, the environmental benefits — though discussed less often and perhaps not as well understood — abound.

_CAD/CAM: Why dive into digital?

Though not ubiquitous, digital technologies, particularly in-office CAD/CAM systems, are making their presence known. Dental professionals who integrate these advanced technologies can offer sameday dentistry to their patients; that is, they condense the restorative process of multiple appointments over several weeks down to one appointment lasting a few short hours. Clinicians can digitally scan the patient's teeth and design the restoration(s) right then and there. Once approved, the restoration(s) can be milled and seated immediately. Essentially, in-office CAD/CAM systems are revolutionizing how restorative dentistry is practiced.

This CAD/CAM revolution provides almost innumerable benefits to patients. Multiple appointments for one restoration become nonexistent, so patients no longer need to make multiple trips to the dental office. Digital scans eliminate the need for messy, uncomfortable impressions that make patients gag and are prone to errors. Temporary restorations are no longer necessary, removing that extra step from the restorative process and ensuring that patients are not at risk for increased sensitivity or leakage while wearing sometimes uncomfortable provisionals for weeks. Finally, definitive restorations are fabricated



and placed within hours of scanning and can be adjusted immediately, so patients no longer have to wait for that perfect laboratory restoration.

Clinicians, too, reap several benefits. Digital scans equal easier "impressions" that enable accurate reproductions of patients' dentition. Restorations can be designed in the office without communication or transfer to a dental laboratory, eliminating back-and-forth exchanges that cause delays or less than optimal results. In fact, restorations can now be fabricated with more patient input, since intuitive CAD software enables dentists to easily design restorations on-screen while remaining chairside, providing patients with that "wow" factor as they see what digital technology is allowing dentists to do. Once designed, the restorations can be immediately milled in the office and tried in the patient's mouth, so a perfect fit and high-quality esthetics are affirmed at the same appointment.

_Digital practice equal green practices

Since CAD/CAM technology was first introduced decades ago, early adopters and technology enthusiasts have encouraged integration of these systems for various practical and financial reasons. Though generally a substantial initial investment, practices that upgrade to digital technology find that stream-lined procedures and happier patients lead to a significant return on investment.

But switching to a CAD/CAM system provides an unanticipated bonus, one with a far broader impact. Using an in-office CAD/CAM system is one of the most environmentally conscious upgrades a practice can make, offering both concrete and intangible benefits for dental practices, their patients and the greater community.

CAD/CAM systems add to a practice's green image with the many small changes they allow the office to implement. For example, now that impressions are taken with a digital scanner (Planscan), traditional impressions – and all their associated materials, such as disposable impression trays, impression material and the water with which it is mixed – are no longer necessary. Clinicians who thought they were only saving money (and storage space) can rest easy at night knowing they're no longer contributing to the throwaway, disposable culture in many health-care offices.

Additionally, because digital impressions can be viewed instantly with software that allows users to see potential errors, any mistakes are quickly averted with a second digital scan that requires no extra materials or waste. It is not uncommon for dentists to take a second traditional impression because of errors caused by saliva or air pockets in the impression material or to have a backup on hand in case there are problems down the road. Over time, material waste created using traditional impression methods adds up. Using digital technology not only streamlines the Switching to digital systems is beneficial not only to clinicians and patients but to the environment as well. (Photos/Provided by *freeimages.com*)





An average dental practice uses 360 gallons of water per day. Think how much you can save by getting rid of extra washing cycles.

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process but ensures that materials, time and money aren't wasted.

Moreover, because traditional impressions aren't needed with a digital workflow, equipment previously used to perform these procedures, such as a mixing gun for impression material, are also no longer necessary. While clinicians may think they are only saving themselves hassle or time by purchasing an easier-to-use piece of equipment, they're also saving energy — literally. With digital technology, impression-taking instruments no longer need to be run through a wash cycle and sterilized. This saves time, energy and water.

While it seems like saving resources, particularly water, isn't possible in dental practices, small steps such as these really add up. The Eco-Dentistry Association (EDA) (*www.ecodentistry.org*) estimates that dental practices use 360 gallons of water per day. This totals 57,000 gallons of water per year, per practice. In the United States alone, dental practice water usage totals approximately 9 billion gallons of water per year. This does not even include dental laboratories, which must use substantial amounts of water when mixing and pouring models in stone and cleaning their equipment.

In addition to the above in-office water issues, along with laboratories and their respective procedures that will always require water, these staggering statistics spell out the clear need for water conservation whenever possible, and in-office CAD/CAM supports this effort.

_Greener materials: Using all ceramics instead of amalgam

Amalgam restorations had been the standard of care in restorative dentistry for decades. With

material science advancements, however, there are new contenders for that title. In particular, the use of all-ceramic materials has significantly increased in recent years, and when coupled with in-office CAD/ CAM systems, their advantages are economical and ecological, in addition to esthetic, biocompatible and functional.

The majority of the materials for same day CAD/ CAM dental procedures are generally composite or all-ceramic blocks, so there is no metal involved. These metal-free restorations can often be used without reservation for various indications, including single-unit restorations, inlays and onlays.¹ While the benefits of these materials have been expounded upon (e.g., esthetics, ease of use, wear, optical properties.), they provide tangible environmental benefits as well.

For example, the longevity of all-ceramic restorations such as in-office CAD/CAM designed inlays is well documented.² In addition to a highly esthetic restoration, patients receive restorations that will last for many years, without the concerns associated with amalgam, such as cracks, failures or potential mercury toxicity. This potentially saves patients and clinicians time, money and wasted resources that would be spent traveling to and from the dental practice, taking more impressions and fabricating new restorations.

Perhaps of greater consequence is removing toxic metal from this equation. All-ceramic and metal-free restorations mean that dental practices no longer have to worry about amalgam disposal and its accompanying mercury toxicity.

The Environmental Protection Agency (EPA) estimates that nearly 50 percent of all mercury entering local wastewater treatment facilities originates in dental offices. Using CAD/CAM compatible materials such as all-ceramics lessens or eliminates the contribution of your dental office to environmental mercury. It also means that dental practices needn't worry about using an amalgam separator.

Currently, the American Dental Association (ADA) does not have national regulations in place for amalgam separators, so many dental practices and laboratories aren't compelled to use them. Although designing and milling all-ceramic materials still requires energy and results in some waste materials, can they really compare with the toxic byproducts of metal-based restorations?

_Crunching the numbers: CAD/CAM math

In-office CAD/CAM systems provide more than justa clear conscience about saving the environment. There are real, tangible benefits and savings that can easily be estimated to demonstrate the immense value of this digital technology.

Because same-day in-office CAD/CAM dentistry reduces the number of appointments from two (or possibly more, if the restoration does not fit) to one, it stands to reason that every dentist who incorporates these procedures would positively impact the environment by reducing the number of automobile trips patients make to the practice. This would result in a 50 percent reduction in gasoline and oil product use.

With a carbon content of 2,421 grams, one gallon of gasoline produces approximately 19.4 pounds per gallon of carbon dioxide emissions. This is calculated by multiplying the carbon content (2,241) by the amount of carbon that remains unoxidized (0.99) by the ratio of the molecular weight of CO_2 (44) to the molecular weight of carbon (12).

Using the state of California as an example, where approximately 10 percent of the 100 million laboratory dental restorations are completed in the United States every year, we can calculate an approximate savings. If four gallons of gasoline are used for a round trip to the dentist, a restoration needing two appointments to complete would require eight gallons of gasoline. But if these dental practices adopted same-day in-office CAD/CAM dentistry, that number could be cut in half, saving four gallons of gasoline per restoration. Four gallons of gasoline multiplied by 10 million restorations would equal a savings of 40 million gallons of gasoline for restorative procedures in the state of California alone. This, in turn, would equal a reduction of carbon dioxide emissions by 776 million pounds per gallon each year (assuming the previously calculated 19.4 pounds per gallon measurement).

If we extrapolate to the United States as a whole, we can calculate that this would equal 400 million gallons of gasoline saved and 7,760 million pounds per gallon of carbon dioxide emissions eliminated, per year. This would all be due solely to a reduction in patient automobile trips to and from the dentist for restorative procedures. While same-day dental procedures may not save the world, their potential impact, even estimated, is undeniable.

_Conclusion

In-office CAD/CAM systems' advantages are limitless. In addition to the clear financial and practical benefits they bring, their positive impact on the environment makes the decision to upgrade even better. They remove toxic, wasteful and disposable materials and practices from the equation, replacing them with greener practices that have a tangible influence. While the clinical advantages of CAD/CAM systems and same-day dentistry continue to be rightfully celebrated, their ecological advantages should not be overlooked._

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Dr. Joel Strom is a former president of the California State Dental Board and former course director of "Ethics in the Practice of Dentistry" at USC School of Dentistry. He graduated from UOP School of Dentistry in 1979 and completed an NIH post-doctoral fellowship at Columbia University in 1983. He has owned an E4D milling machine and camera for five years and practices general dentistry in Beverly Hills and provides consultation and litigation support in the dental health area, including corporate clients, governmental agencies and individual dentists.



Planmeca ProMax CBCT with CAD/CAM technology: The perfect combination

Author_Planmeca Staff

_CBCT imaging is becoming the new standard of care for complete patient information. These images provide multi-faceted views of teeth and everything below the gum line, including the mandibular nerve canal, making them an invaluable tool for planning implant cases and other restorative treatments.

Now, consider combining this detailed information below the gum line with images from an intraoral scan, capable of capturing the highest resolution of data above the gum line. This combination of CBCT and STL data from CAD/CAM sources gives doctors the ability to provide the required information and tissue leveling for a crown down to an implant plan.

The Planmeca PlanMill in-office milling unit. (Photos/Provided by Planmeca)

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In most cases, the STL data can also be utilized by the lab to create the final surgical guide for placing the implant with unparalleled accuracy and speed. Temporary and final restorative crowns can be milled



in-office in a matter of minutes or milled by a lab in as little as 24 hours. Planmeca's imaging and CAD/ CAM technology have captured this concept with the ProMax 3D family of imaging units and the PlanScan/ PlanMill systems, offering doctors the ability to acquire a data set with more detail than ever.

_Streamlining the digital workflow

Digital dentistry is streamlining virtually every aspect of the restorative workflow. Traditionally, doctors submit a physical impression to the lab with the prescription and instructions written out on paper. This is gradually ceding ground to an entirely digital process where the patient's information and doctor's instructions are sent to the lab electronically via a digital impression system.

Planmeca PlanScan Restorations can be delivered mere days after the laboratory receives the patient's intraoral scans, while the Planmeca PlanMill 40 inoffice milling unit is making same-day dentistry a reality. The restorations produced by the PlanScan restorative system, along with the combining of the digital impression with CBCT scans, reduce the costs and treatment time associated with replacing a tooth, increasing the demand for digital dentistry exponentially.

For those who want to continue to work with their labs, all of the patient information needed to produce a model-less restoration can be submitted digitally to a dental laboratory. At the same time, clinicians enter the patient's information and prescription



At left, Planmeca's PlanCAD software at work.

Below, the ProOne features an easy-to-use color graphic user interface (GUI) with touch magnification for image verification.

data into their digital impression system's software prior to submitting each case. Because the Planmeca PlanScan system is an open system and the dental team can send the file in a standard DICOM format, exchanging patient data is easy between most systems through Planmeca Romexis software.

_Bringing today's dental practice up to speed with Planmeca Romexis software and cloud service

While digital impression systems are realizing a data standardization solution, the digital X-ray, practice management, cone-beam computed tomography (CBCT) and digital treatment-planning systems found in today's dental practice require the same sort of attention. Because these systems lack interoperability, they are unable to efficiently communicate patient data and reach their true potential, according to Planmeca.

To truly maximize the efficiencies and cost savings offered by these technologies, interoperability is imperative among these dental systems that are becoming increasingly common in today's dental practice. As clinicians demand data standardization, the transfer of the patient's information, X-rays, CBCT scans, digital impressions and prescription data between the dental office and the dental lab with the simple push of a button is now possible with Planmeca Romexis software and Planmeca Romexis Cloud.

_Maximizing practice profitability with open architecture

Data standardization is essential to driving down costs for patients, doctors and laboratories alike by

establishing interoperability between intraoral scanners, CAD/CAM software and other dental systems. Ultimately, having a common standard that allows the disparate systems used in dental care to function as plug-and-play devices rather than requiring pricy IT solutions will reduce the costs of integrating these new technologies into dental practices and maximize the ROI of the equipment.

Planmeca's CBCT and CAD/CAM imaging systems, along with Planmeca Romexis digital treatment planning software, are using this idea to improve the efficiency, predictability and cost-effectiveness of dental restorations, making chairside dentistry a lucrative investment for dentists who wish to grow their practice and offer patients the latest in sameday technology._





The new 3 Ps: Productive, profitable and predictable

Authors_Dr. Mark Morin and Dr. Shanna McGettrick

_The first article I wrote on CAD/CAM 25 years ago was about the three Ps: prep, powder and picture. At that time, all we were worried about was the final product. Was it going to last? Could we do full crowns with it? Will it stay in place with bonding alone? Digital dentistry has come full circle, and now it's how we get to that final restoration that matters the most.

Dentistry is currently facing numerous challenges. It is time we take a long, hard look at how we do things on a daily basis. There are now three new Ps to consider if we are going to rise to meet these new challenges: productivity, profitability and predictability.

So what are these challenges that are threating the profitability of our practices? One of the major issues we are facing is with insurance companies. PPOtype insurance plans have taken over at an alarming rate. They now represent 82–85 percent of insurance plans offered by employers in the United States.

If that isn't enough, during the past couple years, they have taken the bold step of reducing insurance reimbursements by 5–15 percent in many states. They have also tried to dictate the fees that we can charge for services they do not even cover.

The second dilemma is the increase in taxes because of the changes in FICA, medical device tax,

Medicare tax and Obamacare. This means the average dentist will pay somewhere between \$4,000 to \$11,000 more than he or she did last year. Put another way, we will have to produce approximately 10–12 percent more just to break even.

Lastly, the economy is still struggling, which is causing consumer spending to remain stagnant. The American Dental Association projects this spending to stay unchanged for the next 10 years.

One way to combat the threat to our profitability is to increase productivity. Dentists must learn how to do more procedures in less time, without sacrificing quality of care. How can we increase our hourly production while differentiating our practices by offering the patient a fantastic service? The answer is innovative technology.

The right technology makes all the difference. Dentists need technology to free up operative time so they can be more productive, providing more services while lowering their overhead and continuing to deliver high-quality care. Offering patients the opportunity to have their restorations completed in a single visit is a great way to increase case acceptance, thereby increasing productivity.

People are very pressed for time with jobs, children and other responsibilities, and let's be honest, no one

'The right technology makes all the difference. Dentists need technology to free up operative time so they can be more productive, providing more services while lowering their overhead and continuing to deliver high-quality care.'

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'By adding CAD/CAM technology to their practice, doctors can utilize their assistants to free up their own time to accomplish more procedures and greatly increase their productivity.'

really enjoys going to the dentist any more than they have to. So if the dentist can provide a restoration in a single visit by making the restoration with the NEVO/ Planscan, then that eliminates one of the objections we hear in the dental office. Not to mention the technology allows the dentist to conserve more natural tooth as well as manufacture the restoration out of materials that are some of the closest dentistry has ever had to tooth structure, all while being as long lasting as gold.

Another way to increase productivity is to delegate much of the imaging and design portion of onlay/crown appointments to the dental assistant. NEVO/Planscan is one of the easiest ways to do this. If you consider what is accomplished in a prep appointment, the doctor is only needed to anesthetize the patient, prep the teeth and seat the restoration. At the beginning of the appointment, the doctor can add a product called Onset to his or her anesthetic. Onset is a buffering solution that decreases the onset time of anesthesia and makes the injection more comfortable. This allows the procedure to be started within one to two minutes of administration, increasing the efficiency as well as allowing the doctor to stay with the patient, offering comfort and building rapport.

This product lends itself well to the NEVO/ Planscan's ability to increase efficiency and workflow. By adding CAD/CAM technology to their practice, doctors can utilize their assistants to free up their own time to accomplish more procedures and greatly increase their productivity. It also adds to the job satisfaction of the assistant, giving him or her additional skills and responsibilities as well as a sense of autonomy, which most tend to enjoy. The front desk schedules overlapping chair time for these appointments, knowing the doctor will be needed only for the first 20 minutes of the appointment and again for 15 minutes at the end to bond.

After more than two decades of using CAD/CAM technology, I think I can strongly assert that finding the right company and the right technology is the key to success. The NEVO/Planscan system through Henry Schein is the solution to achieving the new three Ps. It can help increase hourly production and profitability by delivering predictable, high-quality restorations. This incredible portable scanner can be easily moved from room to room, which makes the work flow so much faster and more predictable. The

software allows quick design with accuracy and very little "tool work" to get to the final result. This allows the doctor to produce a high-quality restoration efficiently. It also allows the doctor the ability to delegate many of these steps to auxiliary staff and to free up even more time to be productive in other parts of the dental office.

The other advantage of the NEVO/Planscan is it allows us to be very conservative in placing inlays/ onlays and to save tooth structure, which should be every dentist's goal. The other CAD/CAM units on the market are primarily built to perform full crowns and, as such, pressure the dentist to destroy too much of the natural tooth structure, because this is easier for the doctors using these units. These other units also slow the workflow, causing it to take longer and be less productive, thus lowering the hourly production of the general dentist.

In conclusion, the decisions we dentists make today about technology are the decisions that are going to set our offices up for success. Don't make the mistake of choosing the wrong technology. Do your due diligence and make sure you choose the technology that sets you up to achieve productivity, profitability and predictability. My choice today is NEVO/Planscan, without a doubt._

about the author CAD/CAM



Mark R. Morin, DDS, FWCM, lectures globally on the subject of CAD/CAM and various aspects of practice management. productivity and digital dentistry. With his energetic and engaging style, Morin teaches dentists how to utilize technology to differentiate and elevate their practices

to the next level of success. Because of his passion for this area of dentistry and his dynamic delivery, he has earned a place amongst Dentistry Today's "Leaders in Continuing Education" every year since 2002. Morin maintains a private practice that remains in the top 1 percent of dental practices in the United States.



'Take CAD/CAM to the next level'

An interview with Tuomas Lokki, vice president at Planmeca Group and acting CEO of E4D Technologies

Author_Daniel Zimmermann, DTI

_Finnish dental technology manufacturer Planmeca has recently made a significant equity investment in the U.S.-based high-tech medical device company E4D Technologies.

In this interview, vice president at the Planmeca Group and acting CEO for E4D Technologies Tuomas Lokki sheds light on this new venture.

_Mr. Lokki, why did Planmeca choose to invest in E4D Technologies?

We believe in the tremendous possibilities and future growth of CAD/CAM dentistry. As dentistry will be completely digital in the future, we believe it is vital to invest in the development of new and efficient practices.

E4D is a long-term leader in advancing modern CAD/CAM dentistry, so we knew that joining forces with this high-tech medical device company would be a valuable addition to our own leading expertise in 3-D imaging and software solutions. Its special expertise and innovative ideas provide a great foundation for future projects that will combine the know-how of both companies.

_What advantages will this investment offer dental customers worldwide?

The new partnership with E4D Technologies will enable us to offer our customers the most modern CAD/CAM innovations.

Our product distribution in more than 120 countries combined with the cutting-edge E4D innovations will increase global product availability and



Tuomas Lokki, vice president at the Planmeca Group and acting CEO for E4D Technologies.

take computer-aided dentistry to the next level. Our customers will also benefit from the innovative combination and seamless integration of Planmeca's and E4D's products and services.

_How will this improve the daily workflow at clinics?

One great advantage is the integration of X-ray imaging and CAD/CAM into a single software platform, Planmeca Romexis.





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The Planmeca PlanScan intra-oral scanner and Planmeca Romexis software. (Photos/Provided by Planmeca)

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For the first time, customers will have the option of one software interface for both X-ray imaging and CAD/CAM work. All patient data is also saved in the same database, and it can be shared immediately and easily through the clinic's network or with the Planmeca Romexis Cloud service.

Furthermore, the restorations designed in the CAD module can easily be combined with the patient's 3-D X-ray images for implant planning purposes, for example. For the patients, this means convenient same-day dentistry.

_Can you also tell us about the brand new intraoral scanner that you launched recently?

Our new Planmeca PlanScan intra-oral scanner is an ultra-fast, powder-free and open solution for 3-D digital impressions. Its advanced blue laser technology accurately captures hard and soft tissue of various translucencies, dental restorations, models and impressions.

It is the world's first dental unit-integrated intraoral scanner and can be used through a laptop as a standalone version. Together with our Planmeca Romexis software, the system supports an ideal digital treatment workflow. _How will both Planmeca and E4D benefit from this investment?

On the one hand, this investment strengthens Planmeca's position in the fast-growing CAD/CAM business, and Planmeca benefits from E4D's cuttingedge solutions and long-term CAD/CAM expertise. On the other hand, Planmeca's extensive distribution network enables E4D Technologies to grow globally, and our leading dental imaging solutions will be a valuable addition to the E4D CAD/CAM platform.

_Has this venture created any new needs for your company?

Definitely, as we need to provide extensive CAD/ CAM training for our distribution and customer network in more than 120 countries. Therefore, we have recently invested in new training, warehouse and production facilities alongside our Helsinki headquarters. These new 10,000-square-meter facilities will help us address the growing need for training and education in this new field of dentistry.

We are thrilled to be able to take CAD/CAM to the next level. Our innovations will change the concept of same-day dentistry completely and facilitate the workflow of dental professionals worldwide._

Expanded options, new materials from Ivoclar Vivadent

E.max CAD

LT A2/B 32

Author_Ivoclar Vivadent Staff

_IPS e.max CAD, lithium disilicate glass-ceramic block, is now available in additional sizes to expand options and indications, including bridges.

In addition to I12 and C14, the larger C16 size block is available for full-contour, single-unit restorations with large vertical dimensions, such as large canines or crowns over custom abutments.

It is available in the nine most popular A–D shades (A1, A2, A3, A3.5, B1, B2, C1, C2, D2) and one bleach shade (BL2) in the LT translucency.

Additionally, the new IPS e.max B32 block is recommended for the fabrication of three-unit monolithic bridges in the second premolar and forward region.

It is also available in the nine most popular A–D shades (A1, A2, A3, A3.5, B1, B2, C1, C2, D2) and one bleach shade (BL2) in the LT translucency.

The wide array of clinical options combined with high esthetics, in addition to the more than 10 years

of clinical success, makes IPS e.max CAD an ideal choice for permanent, E4D®-fabricated restorations, according to the company.

Telio CAD has been recently launched for E4D to create temporary crowns and bridges. Telio CAD is an acrylate polymer block that features physical properties that exceed traditional provisional materials as well as esthetics comparable to permanent CAD/ CAM restorations.

This provisional CAD/CAM material eliminates the need for traditional impressions and allows for a streamlined process using the digital scans taken by the E4D system.

Telio CAD is available in two block sizes (B40L and B55) and six shades (BL3, A1, A2, A3, A3.5, B1). The combination of physical properties and esthetics make Telio CAD an ideal temporary restorative material for implants and other clinical situations requiring long-term temporary placement._



Programat CS2: A new generation furnace for the dental office

Author_Ivoclar Vivadent Staff

_Programat, the brand trusted by thousands of dental professionals around the world, now offers a new second-generation Programat CS2 for the dental office.

This second-generation PCS2 sets itself apart from the competition by its exceptional user friendliness. Developed especially for the processing of IPS Empress CAD and IPS e.max CAD, glazing and crystallization can be quickly accomplished.

_Programat CS2

The Programat CS2 has many new features, one key feature being the new wide color touch screen.

The furnace is now simply operated by the touch of a button and includes an optical status display (OSD) showing a visual of how much time is left in the firing program. The furnace comprises 20 individually programmable programs and seven pre-defined lvoclar Vivadent programs, including speed crystallization for IPS e.max CAD, which completes single-tooth restorations in less than 15 minutes.

_Additional features

The CS2 ensures high firing precision because of a fully automated calibration process performed at two different temperature points. Additionally, a firing table enhancement distributes the temperature evenly within the firing chamber.

Furthermore, the furnace is equipped with double valve vacuum technology, which reduces the noise of the vacuum pump during operation. The vacuum pump evacuates moisture from the vacuum hose and the firing chamber. Additionally, the furnace includes WLAN and USB connections. If assistance from the service

center is required, the dentist can simply create a diagnostic file and send it to the service center via email.

> The Programat CS2 incorporates state-of-the-art power saving technology, which cuts power consumption in the stand-by mode by up to 40 percent. This reduces energy costs and helps protect the environment._

(Photo/Provided by Ivoclar Vivadent)

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U.S. Headquarters

Dental Tribune America 116 West 23rd Street, Ste. 500 New York, NY 10011 Tel.: (212) 244-7181 Fax: (212) 244-7185 feedback@dental-tribune.com www.dental-tribune.com

Publisher

Torsten R. Oemus t.oemus@dental-tribune.com

President/CEO Eric Seid e.seid@dental-tribune.com

Group Editor Kristine Colker k.colker@dental-tribune.com

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Managing Editor Fred Michmershuizen f.michmershuizen @dental-tribune.com

Managing Editor Sierra Rendon s.rendon@dental-tribune.com

Managing Editor Robert Selleck *r.selleck@dental-tribune.com*

C.E. Director Christiane Ferret c.ferret@dtstudyclub.com

Marketing Director Anna Kataoka a.kataoka@dental-tribune.com Product/Account Manager Humberto Estrada e.estrada@dental-tribune.com

Product/Account Manager Will Kenyon w.kenyon@dental-tribune. comcom

Feedback & General Inquiries feedback@dental-tribune.com

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PRE-SYMPOSIU	M THURSDAY, OCTOBER 23, 2014
SPEAKER.	TITLE
Lee Culp	Achieving Esthetics with Monolithic CAD/CAM Restorations
Walter Renne	CAD/CAM as a Teaching Tool in the Predoctoral Curriculum
Markus Blatz Petra Guess	An Introduction to CAD/CAM Systems: Lab-Based Systems An Introduction to CAD/CAM Systems: Intraoral Systems
3Shape	Advanced Implant Planning with Open CAD/CAM Systems
CMC	Role of the Commercial Milling Center in the Manufacturing Workflow
Marcus Abboud	Digital Dentistry Simplified: How Do I Start?
Nelson Silva, Chair	CAD/CAM Dental Practice Models Round Table

SCIENTIFIC PROGRAM DAY 1

FRIDAY, OCTOBER 24, 2014

SPEAKER	TITLE		
Jonathan Ferencz	Opening Remarks		
Lyndon Cooper, Keynote speaker	Conventional Versus Digital Prosthodontics		
Markus Blatz	Digital Solutions for Today and Tomorrow		
German Gallucci	Digital Implant Treatment Planning		
Petra Guess	All-Ceramic Materials and Treatments for Conservative Digital Dentistry		
Marcelo Calamita	Treatment Planning Using Digital Tools		
Nelson Silva	Understanding Materials Optimized for Digital Dental Applications		
Irena Sailer Vincent Fehmer	Digital Dental Technologies for the Complex Dental Reconstruction		
Eric Van Dooren	Managing Esthetic Challenges in Implant Dentistry Using Digital Techniques		
Peter Wöhrle	Optimizing Esthetic Outcomes Using Digital Applications for Implant Dentistry		
SCIENTIFIC PROGRAM DAY 2 SATURDAY, OCTOBER 25, 2014			

SPEAKER.	TITLE
Paulo Kano	Achieving Esthetics with Digital Dentistry
Galip Gurel	Incorporating Digital Techniques into Conservative Anterior Esthetic Dentistry
Lee Culp	Digital Dentistry and the Commercial Laboratory
Carlo Marinello	CAD/CAM Applications for Complete Edentulism
Lawrence Brecht	Digital Workflow for Maxillofacial Reconstructions

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Speakers	
Marcus Abboud	Galip Gürel
Markus Blatz	Paulo Kano
Lawrence Brecht	Carlo Marinello
Marcelo Calamita	Walter Renne
Lyndon Cooper	Irena Sailer
Lee Culp	Nelson Silva
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