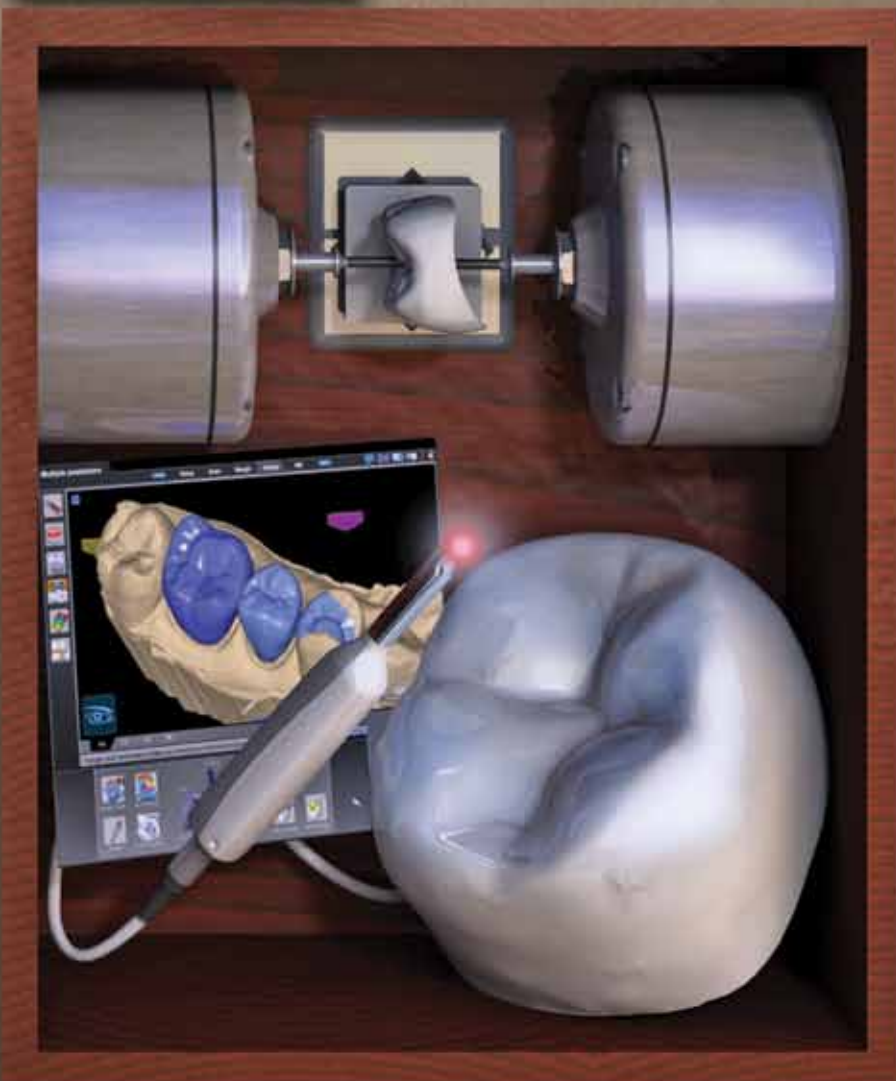


CAD/CAM

the international magazine of digital dentistry

3²⁰¹¹



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Conservative dentistry achieved through a multi-disciplinary approach

technique

A convenient cement for CAD block inlays

opinion

In-office CAD/CAM isn't for me ... or is it?

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CAD/CAM in dentistry

_The concept of CAD/CAM has roots in antiquity. However, in the 1950s, CAD/CAM technology started to have some of the characteristics of what we now know as CAD/CAM. In the 1970s, computer drafting was popular, and by the 1980s, engineering applications of the concept became useful. Currently, CAD/CAM is used in almost every industry with great success.

Dentistry has been relatively slow to adapt to the concept, even though other industries have transformed most of their manufacturing processes to CAD/CAM because of its improved efficiency, repeatability and predictability. It was only about 25 years ago the CAD/CAM concept for milling restorations was introduced into dentistry with devices that were time consuming and difficult to manipulate. Many thought the concept would never replace the time honored "lost wax" casting technique and the commonly used direct restorative techniques.

_How wrong they were ...

Currently, CAD/CAM in dentistry is not only used, it is preferred by a growing and enthusiastic group of dental practitioners who have discovered its value and who have learned how to integrate the concept into mainstream dental practice. CAD/CAM in dentistry is beyond the phase of early adopters and those who buy everything new – it's now moving into the "early majority."

The dental CAD/CAM technologies now available, and the clinical results that are available to the profession and the patients they serve, would have seemed impossible only a few years ago. A realistic appraisal of some of them includes:

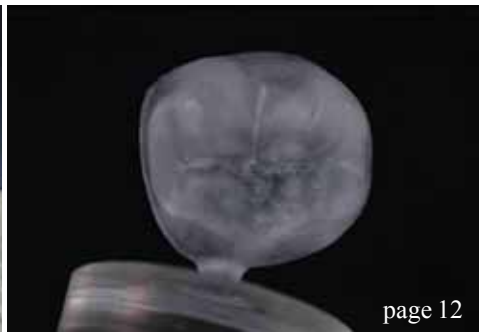
- After a conservative learning period, imaging and milling of crowns and onlays with accuracy and clinical longevity prove to be superior to conventional restorations.
- With experience, fabrication of inlays and veneers rival traditional techniques.
- Expanded use of competent, well-educated staff persons accomplishes much of the clinical procedure, allowing dentists to do other diverse techniques at the same time the restorations are being made.
- They provide patients a single-appointment, relatively simple procedure that is interesting and exciting to them while also being a practice builder for the practitioner.
- There is a new vista of communication between dentists, dental technologists and assistants as the "sky" is opened to the CAD/CAM concept.
- Although CAD/CAM was pioneered by CEREC, E4D and others are now providing proven alternatives in this growing area.
- Moving rapidly beyond just fixed restorations into a convergence of multiple disciplines in dentistry, CAD/CAM now includes implant dentistry, orthodontics, occlusion and surgery.

There is no question that dentistry has awakened to the CAD/CAM concept. It is providing unprecedented service to millions of patients and deserves the attention of practitioners. Our basic and clinical research over 20 years in Clinicians Report® (www.cliniciansreport.org; formerly CRA) validates its use and future potential for the profession.



Dr. Gordon J. Christensen, top,
and Dr. Paul L. Child Jr.

Gordon J. Christensen, DDS, MSD, PhD
Paul L. Child Jr., DMD, CDT



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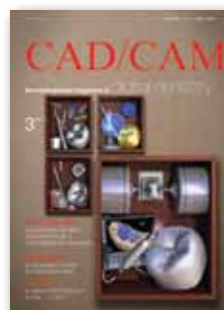
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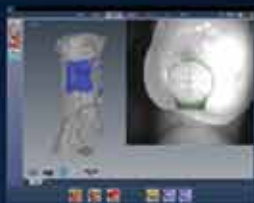
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DENTAL

Conservative dentistry achieved through a multi-disciplinary approach

Author _Thomas Colina, DMD

_c.e. credit part 1

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Combining orthodontics and CAD/CAM technology to achieve conservatism for a rehabilitation case

_Complex treatment needs can necessitate oral rehabilitation of patients. Often these patients will require a multi-disciplinary approach to correct problems. When patients have significant concerns, such as severe malocclusions or destruction of dental tissue, oral rehabilitation can entail extensive treatment that may involve reconstructions.

To return the patient to optimal function, regain normal form and address possible concerns such as esthetics, an integrated approach that involves various disciplines needs to be taken. The challenge posed to a particular treatment plan may involve the treatment of many teeth and possibly the need to prepare a significant number of teeth and corresponding dental tissue.

Another challenge in reconstruction cases is the cost associated with the restoration of numerous teeth. Cost may be a factor for patients. There are often many options and approaches that can lead to the same successful treatment outcome. The variety of options can be at different ends of the spectrum. Diagnostic tools, including tomograms and the use of CAD/CAM systems, are useful in achieving complex treatment goals. This paper presents a treatment option that is an alternative to the reconstruction approach through the innovative application of multiple disciplines and current technology.

_Case presentation

A 31-year-old male patient presented with the chief complaint of his upper front teeth restorations breaking off a few months after being placed. He has had the front teeth restored numerous times with the same outcome. A comprehensive examination and records revealed the following findings.

_Medical history and functional concerns

There is a history of arthritis in the family. The patient experiences transient pain from his back, neck and shoulders. He has noted he clenches and grinds

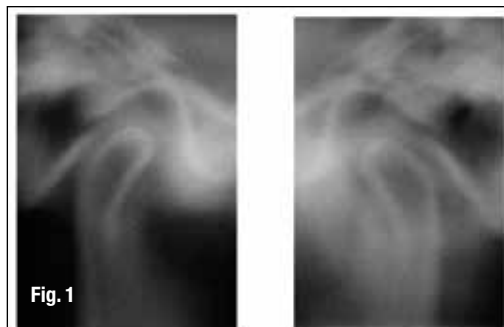


Fig. 1 _Corrected lateral tomograms of the TMJ at maximum intercuspation. Note the posteriorly displaced condyles that have undergone morphological bending. (Photos/Provided by Dr. Thomas Colina)



Fig. 2_Pretreatment photos.

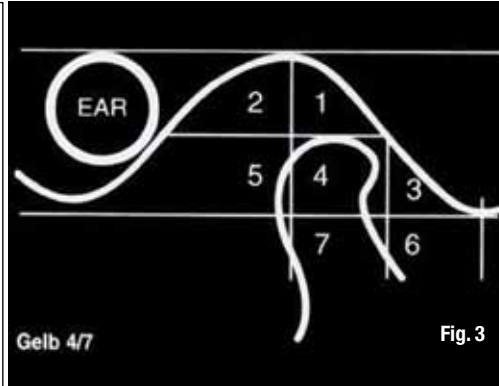


Fig. 3_Gelb 4/7 physiologic position.

his teeth day and night. He was involved in a motor vehicle accident and sustained head trauma 12 years before his presentation to our office. Along with routine examination protocols, the temporomandibular joint (TMJ) was examined using a TMJ health questionnaire, range of motion examination, muscle palpation and TMJ imaging.

TMJ findings and symptoms were: normal maximum opening to 53 mm; no limitation in excursion; at opening, there is a 2 mm deviation to the left. There is a posterior slide from centric relation to maximum intercuspation. The patient noted cracking noises from the TMJ at opening and closing, and there has been occasional locking of the TMJ through the years. He has slight hearing loss and tinnitus.

As a routine for patients exhibiting TMJ dysfunction, a TMJ tomogram series was taken. Tomographic series was achieved by use of a CranexTome (Soredex, Tuusula, Finland). The CranexTome has a unique spiral tomography for cross-sectional images. Interpretation of hard tissue imaging study would include the evaluation of condylar and temporal component morphology and integrity of the bony articulating surfaces. The TMJ is assessed for signs of remodeling, degenerative joint disease or morphological variations affecting the TMJ, jaw and skull.

Condylar position in maximum intercuspation is evaluated. The diagnostic tools are used not only for initial assessment to attain a working and definitive diagnosis, but during and after treatment to assess attainment of the treatment objectives. The corrected lateral TMJ view taken at maximum intercuspation reveals a posteriorly displaced condyle and morphological bending of the condyles (Fig. 1). The joint vibration analysis (JVA Bioresearch International, Milwaukee, Wis.) is used to assess TMJ health for patients and yielded fairly normal vibrations of the TMJ.

Skeletal pattern

Based on a cephalometric analysis, the patient presented with a Class I skeletal pattern with a slight retrognathic mandible.

Occlusion

A visual examination and cast analysis revealed a Class II dental pattern with a deep overbite and tight overjet, fractured upper incisor restorations, slight crowding of the upper and lower arches, and severe worn dentition (especially the anterior teeth). The upper incisors were retroclined, and the upper and lower incisors had severe wear (Fig. 2).

There was generalized moderate wear on the posterior teeth. The patient presented with a posterior shift of 2 mm from centric relation to maximum intercuspation.

Treatment options

The following treatment options were presented to the patient:

- *Reconstruction of the arches to achieve an idealized occlusion.* This first option would entail splint therapy and eventual reconstruction to achieve a stabilized occlusion. This approach will provide a stable occlusion and would entail restoration of numerous teeth – both anterior and posterior – to support the anticipated change in vertical dimension. The disadvantage to the approach is the introduction of artificial material in the mouth and the need for maintenance of the restorations. Of course, this approach also entails significant dental tissue reduction to provide partial and full coverage restorations to support the occlusal scheme.

In addition, although the treatment can be provided in a fairly short amount of time, the cost for the restorations can be significant for most patients.

- *Orthodontic approach to achieve the best possible occlusion and orthopedic alignment.* This approach provides for the patient an option to conserve dental structure, minimize the number of restorations to provide a stable and functional occlusion, and allows cost for the treatment to be more manageable. The disadvantage is the time required to achieve orthopedic and orthodontic correction.

Fig. 4_Debracket photos.

Fig. 5_Veneer post insert photos.



_Treatment plan details

Straight wire appliance treatment (SWA) was proposed to attain ideal inter- and intra-arch alignment augmented by a mandibular repositioning mechanics by way of posterior build-ups and elastics or a fixed orthotic or use of a Twin Force Appliance. This phase of treatment was anticipated to last 20 months. After the orthodontic treatment, restoration of the six anterior maxillary teeth with porcelain restorations would follow. The lower incisors will be evaluated for the need of restorations. The need for an upper bruxing appliance would also be evaluated after the completion of the restorations.

_Discussion of the treatment

The first phase of the treatment was the provision of orthodontic therapy using GAC Innovation C Self Ligating Bracket System. The Innovation C bracket system has a highly translucent porcelain structure and a rhodium coated clip, which provide superb esthetics as well as a high-torque component for the incisors of 17 degrees for the upper central and 10 degrees for the upper lateral incisors. One of the main goals for the treatment was the correction of the maxillary incisor torque. The retroclined upper incisors had contributed significantly to the severe wear of the anterior teeth and had resulted in an intercuspation that produced a posteriorly displaced condyle. The correction of the incisor torque brought about a natural repositioning of the mandible, which was a treatment goal for the patient. The JVA, which has been proven effective in discriminating joint vibrations to assess TMJ^{1,2} conditions, was utilized to evaluate the TMJ during and after treatment. Anterior repositioning of the mandible has been described in the literature as a viable approach in the treatment of Class II malocclusions and TMJ dysfunction.

Woodside³ and McNamara⁴ describe a functional approach to the correction of the Class II malocclusion. Anterior repositioning therapy has had a history

of more than 50 years. Gelb⁵ referred to his repositioning appliance in 1959 and described the Gelb 4/7 position, which is currently accepted in the literature and recognized by many practitioners treating TMJ dysfunction to correlate with the physiologic position of the condyle in the fossa (Fig. 3). Several functional appliance designs and their efficacy of improving TMJ dysfunction through mandibular repositioning have been described in later literature.^{6,7} Simmons⁸ further describes the alleviation of symptoms after mandibular repositioning.

As noted, there was a natural anterior repositioning of the mandible upon removal of the centric interference in this patient, and appliance therapy was unnecessary. Posterior resin build-ups with Class II elastic therapy were sufficient to erupt the posterior teeth to achieve stability of the posterior segment. The condylar position was evaluated by use of progress tomograms and was supported and accompanied with the alleviation of TMJ related symptoms. To address concerns over the color of the teeth, the patient opted to whiten the teeth before the provision of the definitive restorations for the anterior teeth. Upon evaluation of the post-orthodontic occlusion, to provide an occlusion with anterior guidance at protrusion and canine guidance at lateral excursion, it was adequate to provide restorations for only the upper incisor (Figs. 4, 5). The upper incisors were prepared conservatively and restored with porcelain IPS e.max CAD lithium disilicate veneers milled with the chairside E4D Dentist CAD/CAM system (D4D Technologies, Richardson, Texas) (Figs. 6, 7).

There are numerous systems that are currently available. Systems are available chairside or laboratory based. The E4D Dentist system allows the restorative dentist to have complete control of design and delivery of restorations. The system uses a laser capture to acquire a digital impression. The information is condensed, aided by computer, to an intuitive format that allows the restorative dentist to modify the design and send the design to a precise automated milling unit that uses robotic technology.



The system essentially automates many of the more mechanical and labor intensive procedures, such as waxing, investing, burnout, casting and/or pressing involved in conventional fabrication of dental restorations.⁹ Lithium disilicate (IPS e.max) has the superior flexural strength of 360 MPa to 400 MPa, as compared to the strength of ceramic for PFM crowns, which has the strength of 80 MPa to 100 MPa; veneered zirconia, which has a flexural strength of 100 MPa; and leucite glass, which has the strength of approximately 150 MPa to 160 MPa. Lithium disilicate is a highly esthetic, high-strength material that can be conventionally cemented or adhesively bonded.¹⁰ The pressable lithium disilicate is indicated for inlays, onlays, thin veneers, veneers, partial crowns, three-unit anterior bridges, three-unit premolar bridges, telescope primary crowns and implant restoration while the machinable lithium disilicate is indicated for all the previous applications except bridges.¹¹⁻¹⁴

Summary

Reconstructive treatment usually entails significant correction of malocclusion and the maxillomandibular relationship. Many patients requiring reconstruction commonly present with varying functional concerns, including TMJ dysfunction and associated symptoms. Technology, such as tomogram series and the use of JVA, could serve as standard equipment in the diagnosis and treatment of these patients as well as aid in objectively evaluating the TMJ condition during and after the treatment. The goal of any treatment is to provide the patient with good esthetics, comfort and long-term function. The innovative melding of disciplines and the use of current materials and technology can allow conservation of dental tissue that is irreversibly altered and removed using the traditional reconstructive approaches.

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Figs. 6, 7_ E4D veneer design for teeth #22, #21, #11 and #12. Conservative design achieved, made possible with post-orthodontic idealized occlusion.

Fig. 8_ Reflected frontal closeup.

_contact

CAD/CAM



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Welcome to the 'Block Party'

Author_Curtis Jansen, DDS

_c.e. credit part 2

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Restorative clinicians have been spoiled in the past regarding materials for direct and indirect restorations. We've had the great luxury of seeing an ad in a journal, getting an offer in the mail or online, or attending a C.E. course about a new product, technique or service, and then immediately or the next day, we could take action. If we saw a new restorative material for fabricating restorations, we would simply write the request on a lab slip for the new material and expect to get it back in a couple weeks.

Think of the poor laboratory technician on the other end, reading perhaps for the first time, the method you want used to fabricate your restoration or a specific new material or a mix of materials and techniques. Remember, a laboratory slip or prescription is a work authorization, and if you write one, the laboratory technician has to comply. If we change our minds for the next restoration, we simply prescribe something else. I'm sure technicians sometimes

feel as if they're chasing their tails with all the new materials, techniques and requests. Consider the investment in materials, systems, training and the learning curve they have to endure every time a new material is prescribed.

To the relief of patients, dentists, team members and technicians comes CAD/CAM dentistry and a little bit of sense and sensibility regarding dental materials. Dental material manufacturers need to invest in the technology, methodology and product design, as well as the material evolution to the restoration (blocks, mandrels, discs), in order to introduce a new material for CAD/CAM dentistry. Then, in collaboration, dental CAD (computer-aided design) and dental CAM (computer-aided manufacturing) developers must work with that material to produce consistent optimized results. This takes time and effort. Only those materials proven through economic evaluation, clinical validity and proven demand will make it to the final stages and into the software of the CAD systems and into the mills of the CAM systems and ultimately into our patients' mouths.

CAD/CAM also requires the dentist to take more control of all facets of patient care; it requires more thought than a whim and a handwritten prescription to choose the right material. CAD/CAM requires thinking through the restorative and esthetic process before proceeding with a restoration, all better things for the dental professional as a whole. As more and more laboratories and dentists invest in digital dentistry, everyone gains.

I'm "all in" for "daily digital dentistry." I have digital impression-only systems and a chairside CAD/CAM System, E4D Dentist (Fig. 1). There still isn't just one system that can complete all of the restorative indications we have in dentistry. It is my preference to select the techniques and materials that excel in a particular area, rather than compromise to have one system that says it does a little of everything. For me



Fig. 1

(Photos/Provided by
Dr. Curtis Jansen)



Fig. 2



Fig. 3

Figs. 2, 3 Lava Ultimate is ideal for implant superstructures

and my practice (a prosthodontic practice located in Monterey, Calif.), all of my single-unit restorations are fabricated using the E4D Dentist system. In addition, with the opening of E4D Sky™ Network and the newest version of the E4D's DentaLogic software, more and more of my total restorative care will be touched by digital technologies on a daily basis.

When you are first introduced to CAD/CAM chairside dentistry, you have the opportunity to refine your thinking on restorative care. You'll no doubt become a better diagnostician and clinician — because of looking at your preoperative conditions and preparations on a large monitor — but also a better and more confident provider of when to do what in different clinical situations.

Given the number of restorative materials available at your fingertips, you'll make better-educated decisions with each particular patient situation. Using the E4D Dentist system, you have access to a number of proven materials (blocks), each with either an Ivoclar Vivadent or 3M ESPE logo on it, so you know exactly what you are getting. The abundance of material options allows you to select the best one for the given clinical situation. A quick review of what is available follows.

Block Party attendees

Resin

In the category of resin, you have the option to select the Paradigm MZ100 block from 3M ESPE. Complementing the success of the direct restorative Filtek Z100, this block contains ceramic particles with an average size of 0.6 microns with cross-linked monomers that provide the ideal wear resistance, strength and radiopacity necessary for posterior use. I use it primarily for partial coverage restorations as well as some full coverage restorations on implants. The use of this resin for indirect restorations requires placement using an adhesive cementation protocol. I personally have an onlay restored with MZ100 in my own mouth, tooth #3.

When compared to conventional feldspathic porcelain restorations fabricated with chairside CAD/CAM, the Paradigm MZ100 restorations showed better color match through 10 years.¹ This same study also showed no difference in margin finish, surface finish, anatomic form, caries or sensitivity. The authors actually concluded that "the composite inlays performed as well as the porcelain inlays with less bulk inlay fracture." In an in vitro fatigue study on occlusal veneer restorations,² Paradigm MZ100 had significantly higher fatigue resistance (100 percent survival at 185,000 cycles up to 1400N loads) compared to CAD/CAM feldspathic porcelain (0 percent survival).

Resin nano ceramic

A new category for chairside CAD/CAM dentistry is the resin nano ceramic created with the introduction of the new Lava™ Ultimate block. This material defines a new category, resin nano ceramic, which provides some unique and beneficial characteristics for us to have for chairside. We all know that 3M ESPE and its Lava brand have become synonymous with zirconia restorations and they've expanded this technology to additional digital applications. Lava Ultimate material contains a blend of three fillers: zirconia and silica nanoparticles agglomerated into clusters, individually bonded silica nanoparticles and individually bonded zirconia nanoparticles.³

Lava Ultimate contains approximately 79 percent (by weight) of this filler blend that reinforces a highly cross-linked polymeric matrix cured using a proprietary manufacturing process. The result is a unique block with indications for chairside fabrication (blocks) and use. It's indicated for a full range of permanent, adhesive, single-unit restorations including crowns, onlays, inlays and veneers. The material is ideally suited for implant supported restorations (Figs. 2, 3) because of its high 200 MPa flexural strength (higher than conventional feldspathic blocks and layering ceramic used in metal-ceramics) and relatively low modulus (compared to ceramics).



Figs. 4–6 IPS e.max CAD and IPS Empress CAD provide strength and beauty for challenging esthetic cases



From a time management standpoint, the use of resin or resin-ceramic system provides faster milling times and no need for an additional step of sintering or firing. As a sign of its full confidence in this new category of material, 3M ESPE has introduced a unique 10-year warranty on the use of the Lava Ultimate block. The 3M ESPE Lava Ultimate block is offered in eight shades with two translucency options (LT and HT).

Glass ceramic

In the glass ceramic category, with E4D Dentist you have the two most popular ceramics in the history of dentistry at your fingertips, IPS Empress CAD and IPS e.max CAD in block form. These blocks can be used together or separately depending on the clinical situation to create extremely esthetic restorations. Here an example is shown milling both IPS Empress (#7–#10) and IPS e.max (#6 and #11) (Figs. 4–6).

Figs. 7,8 The B.O.B. (Burn Out Block) provides the opportunity to design cast gold restorations virtually.

Leucite-reinforced ceramics

IPS Empress ushered in the esthetic revolution,

and I've had nearly 15 years of clinical utilization of the IPS Empress material, first via the press technique and now through milling of the IPS Empress CAD blocks. IPS Empress CAD blocks are available in two translucencies (LT and HT), as well as the extremely useful IPS Empress CAD Multiblock. The IPS Empress CAD Multiblock has a blend of translucency and color intensity graduating through the block from the cervical position to the occlusal/incisal.

The coordinated DentaLogic software of the E4D Dentist system provides a simple way to position your restoration first virtually then actually within the block in order to customize the shade and translucency of your restoration even before you begin any customization. The clinical documentation, verification and confidence of using IPS Empress have been established via long-term data.⁴

Lithium disilicate glass ceramic

IPS e.max CAD is a high-strength glass ceramic with a flexural strength of 360–400 MPa that defines a new level of strength for metal-free restorations, while veneering ceramics (for metal, zirconia or ceramic substructures) exhibit strengths in the 100–120 MPa range. IPS e.max CAD provides a monolithic full-contour material that was predicted to resist fractures and chipping greater than other layered processes (veneered metals, ceramics or zirconia). In a comparative study of durability and fracture resistance between layered, lab-fabricated zirconia



It's all about the preparation

It should be noted that the proper and successful utilization of any of the metal-free types of materials (resin, resin ceramic, glass ceramic) require following approved preparation guidelines. These are simply providing proper clearance for the particular material – typically 1.5–2 mm occlusally (2 mm for implant restorations) and 1 mm axially; heavy chamfer or shoulder; rounded internal angles and butt joint margins – which need to be visible! All digital capture systems today can only capture what they see, and if you clinically can't see the margins, don't try to capture them digitally – first gain visualization through proper soft-tissue management. With all these materials, the preparation is of the utmost importance!

Concern has been raised by those without firsthand experi-

ence about the esthetic limitations of mono-block restorations or the limited longevity of surface-characterized (glazed) metal-free restorations. It should be noted it is often the dental bur that removes the glazed surface and not natural wear; one need only walk on 2,000-year-old tiles in Europe to realize the natural fusion of the glazed material into the base ceramic. Proper design, record (bite) taking and attention to detail in the use of various software packages, along with the replication of the virtual design in ceramic after choosing the correct shade and translucency, quickly relieve any hesitations about esthetics and reinforce the benefits of doing more and more chairside restorative treatment.

restorations and monolithic IPS e.max restorations, the IPS e.max restorations provided reduced fracture and more durable results.⁵

IPS e.max CAD blocks have the unique characteristic of being distributed in a partially crystallized stage (blue to violet colored). This means that, after milling, the IPS e.max CAD blocks need to be fully crystallized in a two-stage ceramic oven (e.g. Programat CS) prior to final delivery. This provides a major benefit to the entire procedure, with the advantages that the IPS e.max CAD milled restoration can be tried in the mouth and contacts verified before final crystallization and characterization. This makes the final delivery of the restoration more predictable and consistent.

The introduction of Dentalogic software version 2.0 coincides with the availability of additional shades of IPS e.max CAD for chairside use. IPS e.max CAD Impulse introduces five new shades, three Value and two Opal shades. Because of the different brightness values of the three Value blocks, restorations can be optimally integrated into the surrounding tooth structure in terms of their shade. The two Opal blocks allow clinicians to imitate the lifelike opalescent effect, which is desired in anterior restorations. The Opal blocks are ideally suited for the fabrication of veneers and thin veneers.

IPS e.max CAD blocks can also be seated with adhesive or conventional protocol depending on the retentive characteristics of the preparation following approved guidelines (see box).

Acrylic

Even though the price of gold has reached an all-time high,⁶ if nostalgia and/or clinical concern of adequate clearance, margin design or material preference steer you toward metal-based restorations, you can still take advantage of digital scanning and designing benefits while providing you or your

laboratory with a simplified fabrication process for metal-based (gold) restorations. The B.O.B (Burn Out Block) block from D4D Technologies can be selected for any preparation style and then scanned and milled for presentation to a laboratory for investment, burn-out and casting (or pressing), thus providing you with consistency in design, contacts and contour for your skilled design applications (Figs. 7, 8).

Conclusion

Chairside CAD/CAM systems have provided clinicians with a new level of control in the practice of dentistry. From diagnosis through preparation and material selection, clinicians now have the capability of selecting materials with proven clinical performance and delivering restorations with unmatched efficiency and productivity. The categories of resin, resin ceramic and glass ceramic give today's modern practices the ability to offer solutions for the majority of crown and bridge indications right in the office.

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_contact CAD/CAM



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Bringing it all together with CAD/CAM

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Fig. 1



Fig. 2

Fig. 1 | The patient presented with a large composite restoration on tooth #20 that had previously undergone endodontic therapy.

(Photos/Provided by
Dr. Paresh Shah)

Fig. 2 | Occlusal view of prepared tooth #20 before restoration with the IPS e.max CAD crown.

Editorial Note: These images have not been retouched. The black specks apparent on some images were on the camera lens.

How a CAD/CAM system, an all-ceramic material and a dual-curing adhesive resin cement bring it all together

Today's dental professionals have the unique ability to provide patients with advanced restorative treatments in a single appointment using state-of-the-art CAD/CAM technologies and esthetic all-ceramic materials.^{1,2} Available for chairside use, convenient CAD/CAM systems offer greater simplicity and efficiency than earlier technologies. Combined with the exceptionally strong and esthetic all-ceramic materials currently available, chairside fabrication allows dentists to reduce the number of follow-up appointments and the amount of chair-time required to prepare, design, fabricate and seat restorations.^{1,2}

Patients benefit from these advances through lowered cost and same-day dental treatment without the need for multiple follow-up visits.

Advanced CAD/CAM Technology

Among the various CAD/CAM systems available, the E4D Dentist system (D4D Technologies, Richardson, Texas) enables dental professionals to fabricate restorations chairside in a single appointment.^{3,4} The unique three-dimensional software (DentaLogic™, D4D Technologies) of the E4D System was designed with dentist input to ensure the greatest intuitiveness. Additionally, the combined equipment and software enables dentists to design and mill multiple restorations at the same time. Further, the E4D System and DentaLogic software can be learned quickly and easily.

Using the E4D technology, dental professionals now have the ability to scan the hard and soft tissues of the oral cavity without using scanning powder.^{3,4} The scanner was developed with three scanning capabilities, including intraoral digital impressions, mouth impressions and models. Multiple design tools assist the dentist and team in creating restorations after preparations have been scanned. Once a restoration has been designed in the three-

dimensional rendering software, the restoration design is then transferred to the milling unit via wireless networking. The dual-spindle milling technology of the system then uses fine diamond burs to shape a variety of materials into dental restorations that meet the precise case requirements. The accuracy of the milling system produces restorations demonstrating excellent fit and higher strength.^{3,4}

The E4D system also provides dental professionals the best in customer service. Utilizing the system's software and advanced wireless networking capabilities, dental professionals gain access to a broad range of live and remote support from dedicated D4D staff members. Once connected, E4D experts can assist users in a variety of tasks, from designing to troubleshooting. Just as quickly as this technology has evolved, so have the materials available to fabricate CAD/CAM restorations.

Lithium Disilicate Glass Ceramic

IPS e.max CAD (Ivoclar Vivadent, Amherst, N.Y.) is a lithium disilicate glass ceramic material designed for CAD/CAM milling that demonstrates high strength and natural optical qualities. Once milled in the office or in the dental laboratory, IPS e.max CAD lithium-disilicate restorations achieve a monolithic strength of 360 MPa, which ensures a long-lasting result.^{5,6}

Adhesive cementation using a separate dental conditioner is not indicated when ceramic thickness is 1.5 mm or greater because the material demonstrates high strength.^{5,6} IPS e.max CAD restorations may be seated using self-adhesive resin cements and self-adhesive composite cements to ensure all case requirements are met.

The lithium disilicate glass ceramic material also demonstrates excellent optical qualities when placed intraorally. After CAD/CAM processing, restorations milled from IPS e.max CAD require further characterization. When added before the crystallization



Fig. 3



Fig. 4



Fig. 5



Fig. 6

process, subsequent polishing is unnecessary. Additionally, IPS e.max CAD is available in low translucency (LT) and high translucency (HT) blocks to ensure restorations appear lifelike and indistinguishable from surrounding dentition.^{5,6}

Because of its optical properties and strength, IPS e.max CAD may be used for restoration of both the anterior and posterior dentition. Further, the material offers a restorative solution in cases requiring inlays and onlays, thin veneers (0.3 mm), partial and full crowns, as well as implant superstructures.^{5,6}

Case presentation

A male presented with concerns regarding the health and esthetics of tooth #20. The patient had previously undergone endodontic therapy on tooth #20, and a large and unesthetic composite restoration had been placed (Fig 1).

To address the patient's esthetic concerns and restore health to the tooth, the treatment plan included restoration of tooth #20 with a highly esthetic and strong lithium disilicate glass ceramic crown (IPS e.max CAD). The crown would be CAD/CAM processed chairside and seated the same day using self-adhesive resin cement (Multilink Automix, Ivoclar Vivadent).

Clinical protocol

Tooth #20 was prepared per manufacturer's instructions for placement of a lithium disilicate crown (Fig 2). A circumferential shoulder was created with rounded internal edges. A digital impression was captured and the crown was then designed in the CAD/CAM software (DentaLogic) and milled via lithium disilicate block.

Before crystallization and characterization, the milled restoration was tried in the patient's mouth to verify occlusion and fit (Fig. 3). With IPS e.max CAD, if adjustments were necessary, they could have been completed before the final firing to reduce the risk of compromising strength. After verifying fit, the lithium-disilicate crown was fired, and then sintered in a ceramic furnace (Programat CS, Ivoclar Vivadent) according to manufacturer instructions (Figs. 4,5).

Once fired, the lithium disilicate crown was conditioned with an etchant (Ceramic Etching Gel, Ivoclar Vivadent). The etchant was applied to the internal surfaces of the restoration and agitated for 20 seconds. The restoration was rinsed with copious amounts of water. To ensure a sound bond between the restoration and cement, a single component universal primer (Monobond Plus, Ivoclar Vivadent) was applied with a microbrush to the internal surfaces

Fig. 3 Prior to crystallization, the IPS e.max CAD lithium disilicate crown was tried on the preparation to verify occlusion and fit.

Fig. 4 The IPS e.max CAD crown was crystallized and characterized to create individual characteristics within the restoration.

Fig. 5 The crown was crystallized in the Programat CS porcelain firing furnace per manufacturer instructions.

Fig. 6 The mixed Multilink A&B primer solution was applied over the entire surface of the prepared tooth and air-dried.

Fig. 7 Excess cement was removed prior to final polymerization.

Fig. 8 The completed IPS e.max CAD crown for tooth #20 appeared indistinguishable from the surrounding dentition.



around the margins (Fig. 7). The cement was light cured for 20 seconds using an LED curing light (Elipar S10, 3M ESPE, St. Paul, Minn.). Once light cured, additional excess cement was removed using the dental explorer.

A separating strip (Brasseler USA, Savannah, Ga.) was used to remove excess cement from interproximal spaces. This separating strip does not have an abrasive side, but is serrated to loosen and remove cured cement from interproximal spaces. Once all excess cement was removed, the restoration was complete.

The completed E4D CAD/CAM-processed IPS e.max CAD lithium disilicate crown demonstrated excellent fit, function and esthetics, while using Multilink Automix adhesive resin cement ensured a long-term bond (Fig 8).^{7,8}

Conclusion

Utilizing state-of-the-art CAD/CAM technology and advanced material sciences, the author provided the patient with a durable, long-lasting and highly esthetic restoration in only one appointment. Beneficial to dentists, same-day dentistry with advanced CAD/CAM technologies and materials, such as IPS e.max CAD, offers greater efficiency and simplicity in practice by speeding the restorative process. Subsequently, patients enjoy the ability to have a restoration fabricated and placed in a single day without having to return to the office for a second visit. Same-day IPS e.max E4D CAD/CAM restorations also fit comfortably and appear indistinguishable from the surrounding dentition.

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of the restoration. The primer was then air dried to remove any excess.

Prior to cementation, tooth #20 was isolated to control moisture and other contaminants. A two-component enamel-dentin primer (Multilink A/B, Ivoclar Vivadent) was then placed on the preparation. The primers were mixed in a 1:1 ratio. The mixed primers were applied to all surfaces of the prepared tooth and air dried (Fig. 6).

Dual-curing adhesive resin cement (Multilink Automix, Ivoclar Vivadent) was then extruded from the automix syringe and placed on the internal surfaces of the crown. Available in yellow, transparent and white-opaque shades, the adhesive cement enables dentists to further enhance the esthetics of the restoration. The resin cement also facilitates fast and easy cleanup of excess. The automix tip simplified placement and allowed exact dosing to minimize waste.^{7,8}

After cement placement, the crown was seated on the preparation and excess cement was displaced. A microbrush was used to remove excess cement

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CAD/CAM-processed lithium disilicate restorations: the replacement for PFM restorations

Author_Jeff Scott, DMD

The demand for lifelike dental restorations has increased with media coverage promoting "smile makeovers." Dental patients seek perfection in increasing numbers and have become willing to undergo elective procedures to achieve the perfect "Hollywood smile." With an emphasis on natural esthetics, dentists have often struggled to marry effective conventional restorative materials and techniques that deliver proper function and oral health with patient expectations for the esthetic results.^{1,2}

considered ideal in many instances, dentists now have the option to achieve everything from basic posterior restorations all the way to complete comprehensive restorative cases in-office using chairside CAD/CAM technology and materials. Restorations may now be designed, milled and seated in a single appointment, increasing the level of service to patients while reducing cost and the amount of time required for treatment.^{1,2}

E4D System

The E4D Dentist system (D4D Technologies, Richardson, Texas) offers many advantageous features over CAD/CAM systems of the past. The unique three-dimensional software (DentaLogic,™ D4D Technologies) of the E4D System was designed to provide dentists the ability to design/mill multiple restorations at the same time. Additionally, restorations may be fabricated chairside and in many cases, in a single appointment.^{3,4}

Utilizing a three-dimensional high-speed laser scanner, the E4D System can scan both hard and soft tissues for intraoral digital impressions, mouth impressions and models, without the use of conventional scanning powders. The system also incorporates multiple design tools to assist the dentist when fabricating restorations in a single appointment. After rendering the restorative design, it may then be sent wirelessly to the precision milling system that uses dual spindles and fine diamond burs to efficiently fabricate various CAD materials into restorations that demonstrate excellent fit, higher strength and lifelike esthetics.^{3,4}

To further aid dentists, D4D provides remote Design-on-Site (DOS) and Support-on-Sight (SOS) services from various company specialists, who can

CAD/CAM

Collaboration between technician and dentist in comprehensive esthetic, severe wear and complex implant cases is critical to successful restoration. Although cases fabricated in the laboratory are still

Fig. 1 A preoperative shade photograph of tooth #21 was taken to aid in determining the proper shade of the IPS e.max CAD lithium disilicate glass ceramic block. (Photos/Provided by Dr. Jeff Scott)



Fig. 1



Fig. 2



Fig. 3

then observe, assist or troubleshoot during the scanning, designing and milling process.^{3,4}

Material considerations

Historically, porcelain-fused-to-metal (PFM) crowns have been considered the ideal restoration in the posterior region of the oral cavity. Although PFM crowns may function for extended periods of time and demonstrate acceptable esthetics, dental professionals have often experienced numerous clinical challenges with this class of restoration.⁵

Among the many various challenges, in order to achieve acceptable esthetic and functional results, the preparation design for PFM restorations requires more aggressive removal of sound tooth structure. Additionally, PFM restorations require metal copings that are costly and notoriously difficult to mask with conventional porcelain materials.^{5,6} Therefore, high opacity ceramics were used and esthetics sacrificed when attempting to cover metal substrates. Also contributing to the lack of esthetics, the gingival-porcelain margins of PFM restorations typically appear unnatural.⁵

Because of this, restorative materials that can be fabricated quickly and more cost-effectively with innovative chairside CAD/CAM technologies and materials are slowly replacing PFM restorations.⁵

IPS e.max CAD

Among these materials, IPS e.max CAD lithium disilicate glass ceramic (Ivoclar Vivadent, Amherst, N.Y.) is an innovative all-ceramic material that demonstrates exceptional monolithic strength. CAD/CAM processed in-office or in the dental laboratory, IPS e.max CAD blocks demonstrate a high flexural strength of 360 MPa. Strong and durable, the all-ceramic material is highly resistant to the forces of mastication over the long term. The material may be used for a variety of indications in the anterior and posterior, including inlays and onlays, veneers, par-

tial and full crowns, and implant superstructures.^{7,8}

IPS e.max CAD restorations also demonstrate lifelike optical properties and naturally appearing esthetics. However, additional characterization may be instilled in IPS e.max CAD restorations using stains and glazes to ensure that restorations appear indistinguishable from the surrounding dentition. Offering a variety of esthetic solutions, IPS e.max CAD lithium disilicate glass ceramic blocks are available in high-translucency (HT) and low-translucency (LT) formats, and are now also available in IPS e.max CAD Impulse shades. The LT blocks are considered ideal when fabricating crowns and implant-retained restorations, while inlay and partial crown restorations are best completed with HT blocks. The new IPS e.max Impulse blocks are supplied in three Values (Value 1, 2, 3) and two Opal shades (Opal 1, 2). They are mainly used to fabricate thin veneers, partials, and single crowns. The suitable block can be selected depending on the preferred fabrication technique (staining, cut-back or layering technique) and the individual patient situation at hand.^{7,8}

The following case examples demonstrate the use of E4D CAD/CAM-processed IPS e.max CAD lithium disilicate glass ceramic restorations and adhesive resin cements (Multilink Automix, Ivoclar Vivadent; UNICEM 2 Automix, 3M ESPE, St. Paul, Minn.) to restore function and oral health, while still meeting the esthetic demands of patients.

Case No. 1

A patient presented with recurrent decay surrounding a large amalgam restoration, along with a deep non-carious cervical lesion in the lower left first premolar. The patient's second premolar and first molar had been restored many years before with PFM crowns.

Although the patient expressed dissatisfaction with the appearance of the old PFM restorations, the crowns lacked pathology and were still functioning. Therefore, she decided to only restore the first

Fig. 2 After milling, the high translucency (HT) IPS e.max CAD full crown was characterized further to blend with the patient's natural dentition and seated intraorally.

Fig. 3 The preoperative scan was used as a fabrication guide to ensure ideal fit and function of the definitive IPS e.max CAD crown while also reducing the need for occlusal adjustments.



Fig. 4



Fig. 5

Fig. 4 A conservative IPS e.max CAD lithium disilicate glass ceramic inlay was recommended to the patient to replace a large defective amalgam restoration.

Fig. 5 The IPS e.max CAD inlay was seated with dual-cure Multilink Automix adhesive resin cement and demonstrated excellent fit, strength and esthetics.

author CAD/CAM



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premolar, tooth #21. Because of the excessive wear present on the first premolar, it was decided that an esthetic CAD/CAM-processed lithium disilicate glass ceramic crown (IPS e.max CAD) would be fabricated and seated in the posterior.

Typically, an impression of the tooth would be taken and a provisional crown would be fabricated, but in this case, a second seating appointment was avoided by completing the procedure that day.

To fabricate the crown, a high-translucency (HT) D2 IPS e.max lithium disilicate block was chosen to mimic the incisal two-thirds of the natural dentition (Fig. 1). Although highly esthetic, the IPS e.max CAD blocks appear slightly monochromatic once fabricated. Therefore, to produce a natural color gradient, crystal stain was added to the cervical one-third of the restoration, and white streaks were added to simulate small vertical craze lines prior to firing. Once the stains were added, a light coat of glaze was placed on the crown to reproduce the surface texture and luster of the neighboring teeth. The restoration was then fired, tried-in and seated with a self-etching resin cement (RelyX Unicem 2, 3M ESPE) in shade TR. This resin cement was chosen because it demonstrates low solubility and high-bond strength.

Upon completion of the case, the patient was pleased with the esthetics and function of her E4D chairside CAD/CAM-processed IPS e.max CAD crown (Figs. 2, 3).

Case No. 2

A patient presented with a defective amalgam restoration and expressed a desire for a new conservative, long-lasting and esthetic restoration. The treatment plan included an IPS e.max CAD inlay/onlay to provide strength in the central groove and buccal cusp areas. After preparation was complete, the area was scanned intraorally, designed and milled with the E4D Dentist CAD/CAM system. Preparation for this type of restoration is very different from a

traditional gold inlay or onlay because all internal line angles must be rounded, making provisional retention challenging.

After staining and glazing, the intaglio surface of the lithium disilicate restoration was sandblasted with aluminum oxide at 1 bar of pressure. The restoration was then etched with hydrofluoric acid for 20 seconds and rinsed with copious amounts of water. A silane coupling agent (Monobond Plus, Ivoclar Vivadent) was applied for 60 seconds, then air-dried. The cavity preparation was cleaned and rinsed and the dentin was left slightly damp. The preparation was then scrubbed with a mixture of a priming adhesive (Multilink A and B, Ivoclar Vivadent) for 15 seconds and vigorously dried. Multilink Automix was then dispensed into the cavity preparation and the restoration seated. Multilink Automix was chosen for the additional bond strength it provides in a non-retentive preparation design and in high-function areas.

Excess cement was removed, and the restoration was light cured for 40 seconds. Occlusal adjustments were then made as necessary and the restoration was polished with an intraoral porcelain polishing system (Komet, Rock Hill, S.C.). Once seated, the E4D chairside CAD/CAM-processed IPS e.max CAD restoration fit the functional and esthetic demands of this patient in a single appointment (Figs. 4, 5).

Case No. 3

A patient presented with a fractured distal-marginal ridge on the upper right first premolar that was trapping food and causing cold sensitivity. Further examination also revealed two relatively small occlusal amalgams in the first and second premolars and visible crack lines running mesial-distal through both teeth (Fig. 6). The patient was also concerned with the color of the teeth at the facial margin. The patient was aware of a bruxing habit and expressed concern because of a history of broken teeth and

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Fig. 6



Fig. 7

Fig. 6 A patient with a history of bruxism presented to the office seeking an esthetic solution for a fractured distal-marginal ridge on tooth #5 and visible mesial-distal crack lines running through both teeth #4 and #5.

Fig. 7 IPS e.max CAD lithium disilicate glass ceramic blocks were CAD/CAM-processed with the E4D System into esthetic restorations for teeth #4 and #5, then seated with Multilink Automix.



Fig. 8

Fig. 8 The facial margins of the restorations demonstrated excellent marginal integrity and lifelike esthetics in the buccal photograph that was taken immediately after seating.

porcelain from previous crowns. The treatment plan for this patient included a nighttime appliance to prevent further damage from bruxing, as well as high-strength monolithic esthetic restorations. Because of a somewhat dark dentin color, a low-translucency (LT) IPS e.max CAD A1 block was chosen.

Initially, a preoperative quadrant alginate impression was taken. The affected dentition was then prepared, and another series of impressions taken with a quick-setting polyvinyl-siloxane (PVS) impression material (Quick-Step, 3M ESPE). A bisacryl provisional restoration (Henry Schein Dental, Melville, N.Y.) was seated with temporary cement (Fynal, Dentsply Caulk, Milford, Del.). After scanning the models, the IPS e.max CAD restorations were designed and milled with the E4D CAD/CAM system. The crowns were then fitted to the solid model of the preparations and a laboratory microscope was used to confirm the marginal fit.

To speed-up seating, the interproximal contacts were adjusted on the laboratory bench. Further, the E4D software allows the preoperative model to be scanned. The preparation model can then be superimposed onto the design of the proposed crowns. This minimizes the occlusal adjustment necessary at placement while maintaining the staining and

characterization that has been built into the ceramic surface. Upon completion of firing and minimal adjustments, Multilink Automix dual-cure adhesive resin cement was used to seat the definitive restorations intraorally (Fig. 7).

The patient was pleased with the strength and esthetic results of the E4D Dentist CAD/CAM-processed IPS e.max CAD crowns, which appeared indistinguishable from the surrounding dentition (Fig 8).

Conclusion

Although CAD/CAM technology promotes greater ease-of-use and efficiency, there is a learning curve and the technology must be mastered to be utilized to its full potential. To fully implement CAD/CAM into the dental practice, dentists must be determined and committed to training themselves as well as their team members. E4D Dentist offers basic to advanced training courses and excellent phone support to facilitate this process.

Additionally, dentists must understand that material selection is crucial in the success of CAD/CAM integration. Once familiar with the intricacies of CAD/CAM technologies and materials, the dentist, team members and, most importantly, the patient, will benefit tremendously.^{1,2}

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_contact

CAD/CAM

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A CAD/CAM gallery

Author_ Graeme Millicich, BDS

_Bonded ceramic restorations using lithium disilicate IPS e.max, be it pressed or CAD, open up a range of restorative options that have not really been available in the past with conventional restorations using cementation for retention. The primary issue with many of the potential minimally invasive preparation designs is they are essentially non-retentive if using conventional cementation, and temporization for two weeks is a real clinical challenge.

Same-day CAD/CAM dentistry solves this problem and allows for less invasive preparation de-

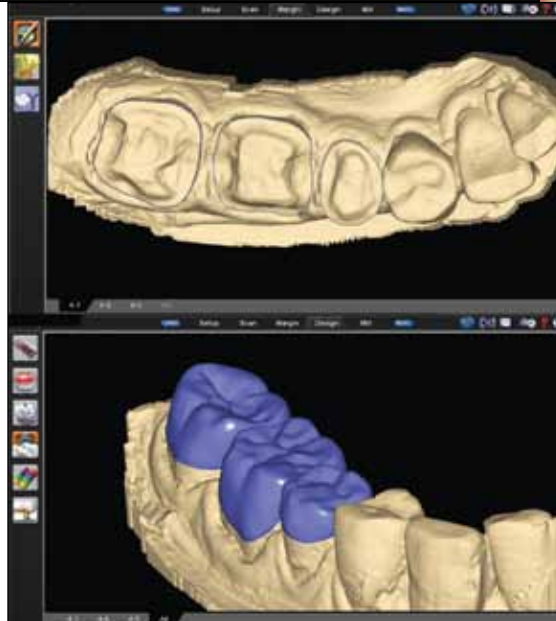
signs, retaining more healthy tooth structure and reducing the insult on the pulp that is associated with conventional full-ferrule cementation crown designs. It begs the question: Do we design our preparations just to make our temporaries last for two weeks?

The development of IPS e.max was the trigger that finally pushed me to embrace CAD/CAM mid-2009. The results possible for a beginner amazed me, and two years later, I am still in awe of how simple and easy it is to create quality restorations._

_Case No. 1

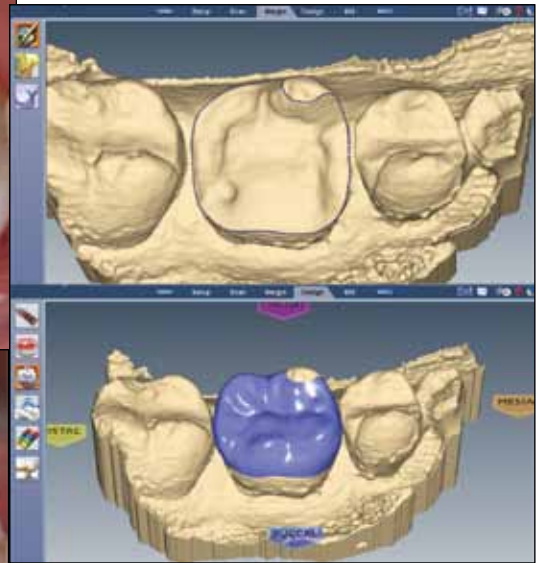


Case No. 1 Adhesive preparation design keeps margins supra-gingival, assisting design and placement; here seating of IPS e.max restorations aided with Triodont Griptabs and Isolite. (Photos/Provided by Dr. Graeme Millicich)



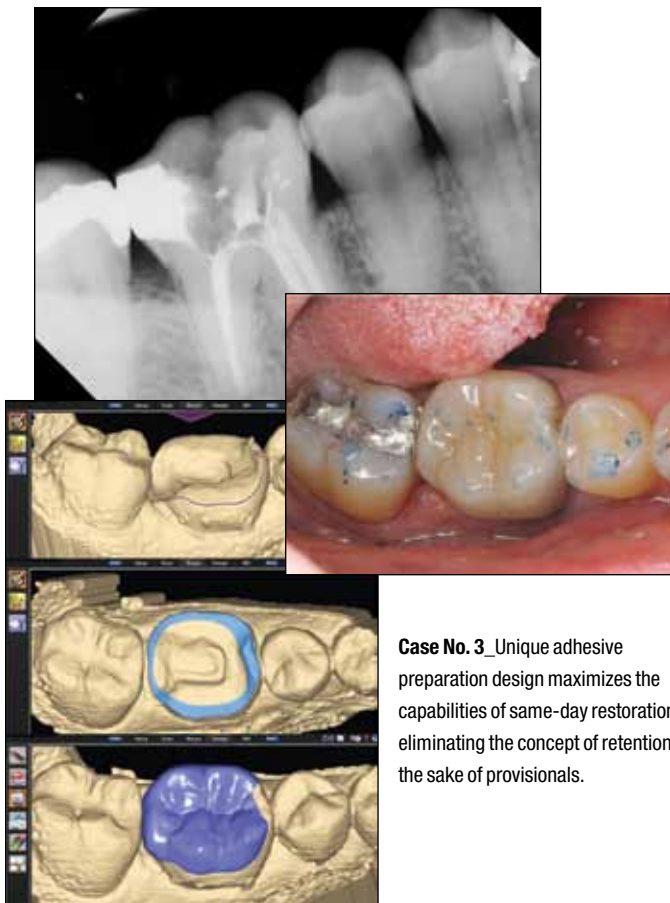


_Case No. 2



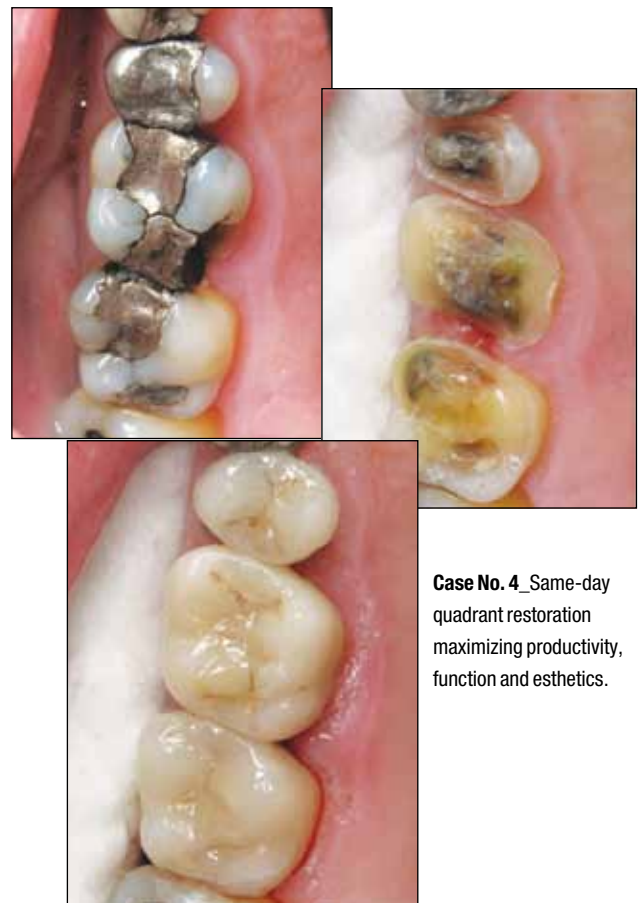
Case No. 2 Utilizing esthetic metal-free restorations such as IPS e.max (high translucency) allows placement of margin at an ideal location rather than hiding it equi- or sub-gingival.

_Case No. 3



Case No. 3 Unique adhesive preparation design maximizes the capabilities of same-day restorations, eliminating the concept of retention for the sake of provisionals.

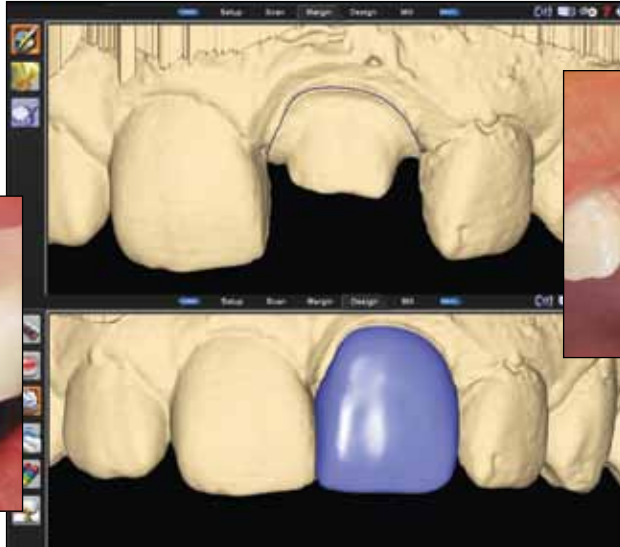
_Case No. 4



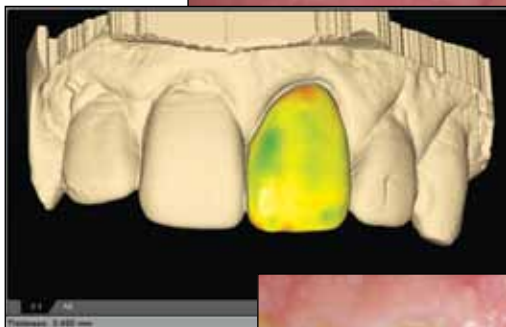
Case No. 4 Same-day quadrant restoration maximizing productivity, function and esthetics.

_Case No. 5

Case No. 5_ Chairside CAD/CAM is the perfect complement for anterior single-tooth restorations; here IPS Empress Multiblock provided an immediate solution for a trauma case.



_Case No. 6



Case No. 6_ Minimal preparation is combined with proper material selection (IPS e.max low translucency) to achieve conservation and esthetics in one appointment.



_Case No. 7



Case No. 7_ Minimal facial veneer preparations and restorations provide a long-term alternative to failing direct composites.

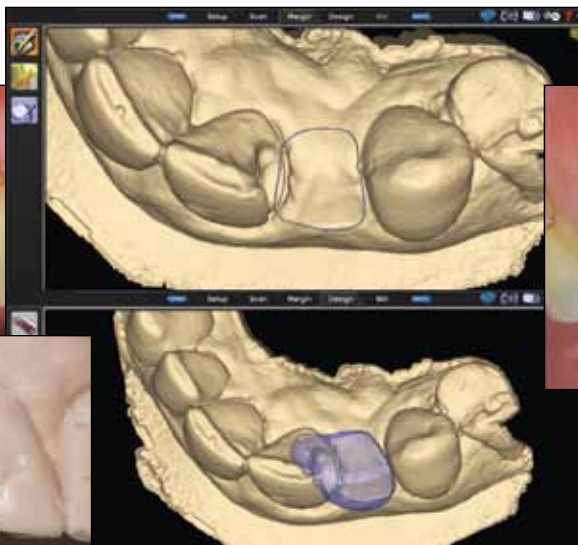


_Case No. 8



Case No. 8_ Full contour IPS e.max restoration scanned, designed and milled chairside provides the total solution.

_Case No. 9



Case No. 9_ Taking design to the limits, and although not formally recommended, necessity is the mother of invention and this IPS e.max restoration provides a unique alternative solution.

_about the author

CAD/CAM



Graeme Milicich, BDS, has been a dentist in Hamilton, New Zealand, since he graduated in 1976 and is one of three dentists at Anglesea Clinic Dental Care in the center of Hamilton. He has more than 12 years of experience in international lecturing and research in minimal intervention, lasers and restorative techniques. In conjunction with lecturing, he has also developed nine educational CD-ROMs to assist fellow professionals, their staff and their patients in easily understanding the various concepts associated with the ever-expanding field of minimally invasive dentistry. His newest CD is "Anterior Single Crown Aesthetics, using CAD/CAM," teaching how to create the results seen in these cases. (See www.advancedental-ltd.com for more information.) Milicich introduced the E4D Dentist chairside CAD/CAM system into his practice in July 2009.

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A convenient cement for CAD/CAM inlays

Author_John C. Cranham, DDS



Adhesive Resin Cement. This case will demonstrate the use of RelyX Unicem 2 cement and an IPS e.max CAD block.

_Case presentation

The patient had been with the practice for some time, undergoing orthodontic and orthognathic procedures to better position her teeth and jaw. The final steps in her treatment plan included replacement of several large amalgam restorations. Tooth #3 exhibited recurrent decay around a large tooth surface amalgam restoration. The buccal lingual dimension of the box was beyond what we felt would be treatable with a direct resin restoration, so it was determined to restore the tooth with a surface inlay made with the E4D Dentist system.

The amalgam was removed and the caries excavated to create an ideal box form preparation (Fig. 1). The prep was then scanned with the E4D scanner (Fig. 2), and the final restoration was milled from an e.max HT block in color A2. Staining and glazing were performed to further characterize the inlay. RelyX Unicem 2 Automix cement was applied to the preparation and to the bottom side of the inlay, and the restoration was then seated onto the tooth. The area was light cured for two seconds in order to partially cure the excess cement, after which it was easily removed with an instrument. A full light cure was then performed and the restoration was finished and polished (Figs. 3, 4).

Fig. 1 _The preparation following removal of the amalgam. (Photos/ Provided by Dr. John Cranham)

_For any indirect restorative procedure, use of the right cement is critical to ensure longevity of the restoration and patient satisfaction. In my practice, we utilize three different types of cement, each one carefully selected to best suit the specific material and clinical situation. To place gold PFMs or zirconia restorations in cases with good retention and resistance form, I utilize a resin-reinforced glass ionomer, such as 3M™ ESPE™ RelyX™ Luting Plus Cement. To place veneers or onlay restorations in cases without good retention and resistance form, I prefer a resin system, combined with a fourth- or fifth-generation adhesive.

In these cases, I typically utilize a combination of phosphoric acid, 3M ESPE Adper™ Single Bond Plus Adhesive and 3M ESPE RelyX Veneer Cement, ensuring an adequate light cure at the appropriate steps. Finally, to maximize bond strength for inlays and onlays created with a millable block for the E4D system in cases with acceptable retention and resistance form, I utilize 3M ESPE RelyX Unicem™ 2 Self-



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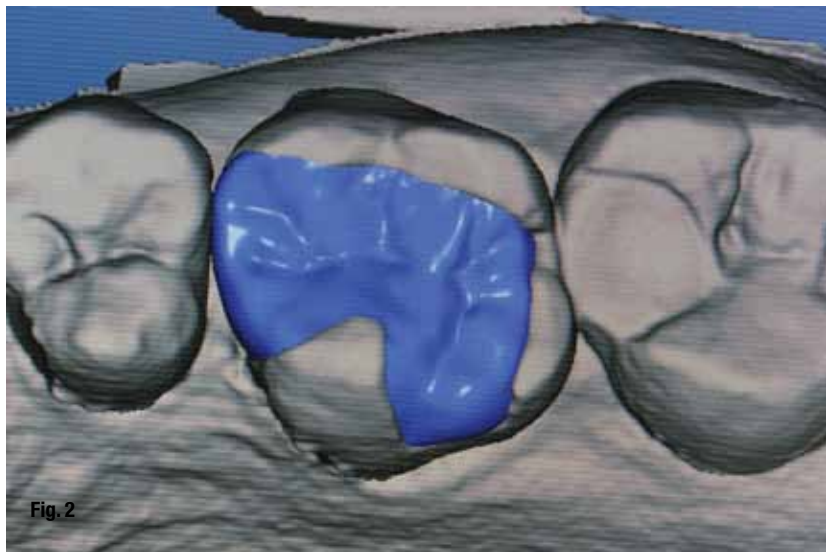
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‘In my practice, we utilize three different types of cement, each one carefully selected to best suit the specific material and clinical situation.’

Discussion

The individual properties of a cement can have a major effect on its convenience and utility chair-side. RelyX Unicem 2 cement improves upon the already popular RelyX Unicem cement, providing many of the same characteristics that have made the first generation so well liked. The viscosity of the material makes it very easy to seat restorations; it is not too thick, but once the restoration is in place, it doesn't move. The cement's easy cleanup is also another winning characteristic. Furthermore, the new automix delivery system eliminates the need for handmixing and ensures a consistent and reliable mix that can be dispensed directly onto the tooth and the restoration. These qualities make RelyX Unicem 2 cement the go-to material in my office for CAD block inlays and onlays with good retention and resistance form.



Fig. 2_ Designing the restoration with the E4D DentaLogic software.

Fig. 3_ Light curing the cement.

Fig. 4_ The final result.

_about the author

CAD/CAM



John C. Cranham, DDS, has a contemporary dental practice in Chesapeake, Va., focusing on cosmetic, restorative and implant services. He is the clinical director of The Dawson Academy, where he is involved with many of the lecture and hands-on courses within curriculum. Cranham also is the founder of Cranham

Dental Seminars, which in February 2008 merged with the Dawson Academy. As an active educator, he has provided more than 650 days of continuing education for dental professionals throughout the world. Cranham has published numerous articles on restorative dentistry. He maintains a strong commitment to providing the highest quality of dental care, along with developing sound educational programs that exceed the needs of today's dental professional. Cranham can be reached at smildoc@aol.com.

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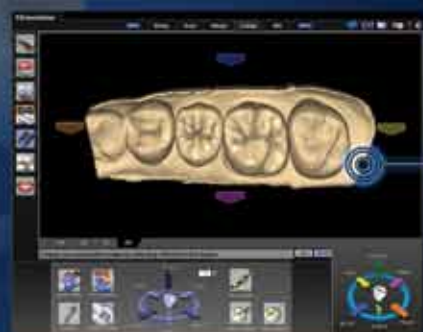
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‘The million dollar PPO’

Author_Matthew Krieger, DMD

Using technology to increase productivity in an insurance-based practice

“Hello, my name is Matthew Krieger and I take insurance.” It used to feel like an admission or confession when I would discuss my practice with other dentists. I would say it with a feeling of hesitation as if my practice was somehow not as desirable as the gold standard fee-for-service practices that dentists are always boasting about. I assumed if I were participating with preferred provider organizations (PPO) and accepting reduced fees, my practice was somehow less than ideal. I decided then to create a practice that was extremely efficient and highly productive while still participating with insurance companies.

During the last five years, my practice has doubled in revenue. In 2010, it grew 18 percent while other practices were struggling to stay even. It consistently produces more than \$1 million on a four-day workweek, with an average collection rate of 98 percent. It maintains an overhead of about 55 percent and normally attracts more than 30 new patients per month. It is able to do all of this while participating with more than 15 preferred provider organizations, as well as several reduced-fee plans and two union plans. I attribute the success to five key factors:

- **Technical Skill:** Proficiency in clinical, diagnostic and communication skills for the dentist and team
- **Team:** Highly skilled, motivated, well-trained and easily adaptable individuals
- **Systems:** Clear, effective protocol for clinical, administrative and financial practice management
- **Marketing:** Effective marketing and advertising to generate awareness and new patients

- **Technology:** Cutting-edge technology to increase efficiency and improve productivity

Although every factor plays a critical role in the growth and success of a practice, technology has the most significant impact on my practice's ability to generate high-quality restorative dentistry in a faster and less stressful way. My practice utilizes networked office management software with computers in every operatory, office and support area. In addition to digital radiography, we regularly use intraoral cameras, diode and erbium lasers and, most importantly, CAD/CAM technology.

Our ability to provide high-quality dentistry with ease and efficiency relies on the integration and utilization of all of these different technologies, with the E4D Dentist CAD/CAM system being at the center of our restorative treatment appointments.

The decision to purchase and implement new technology can be challenging. In a PPO practice, the decision can be even more intimidating. With a lower profit margin, added capital expenditures can have more of an impact on your bottom line. I considered several factors when choosing to add CAD/CAM to my technology armamentarium. The quality, fit and durability of the restorations were the primary focus of my clinical decision. The profitability, practical application and return on my investment were the primary focus of my business decision.

CAD/CAM technology provides a significant and immediate financial advantage for PPO practices. It allows a dentist to produce inlays, onlays and crowns (single and/or multiple units) in one visit. It reduces overhead by eliminating lab costs. It

Fig. 1_Pre-op. (Photos/Provided by Dr. Matthew Krieger)



Fig. 1



Fig. 2

Fig. 2_CAD/CAM IPS e.max crowns

reduces material costs associated with impressions and temporizations as well chair time. It provides an immediate and significant tax benefit under the current Section 179 deduction.

Every patient visit costs a practice time and money. Each time a patient is seated we use perishable goods, expend valuable chair time, utilize staff time and must track and manage scheduling. The average crown delivery visit requires 30 minutes of chair time, and costs a practice more than \$50 in overhead expense. It is critical to maximize the efficiency with which you provide dentistry in order to remain profitable as a PPO practice, and one visit is more efficient than two. The economic benefit of single-visit vs. multiple-visit indirect restorative dentistry is obvious and impactful.

Postoperative

In addition to an increase in total profit and hourly productivity, the dentist has 30 to 45 minutes of additional down time to produce more dentistry, provide hygiene exams and perform administrative duties.

Beyond the financial return on investment are the intangible and immeasurable benefits that same-day dentistry provides. If a patient does not need a temporary crown, he is less likely to call you over the weekend to have the temporary re-cemented. If a second visit is not necessary to insert a crown, then cancelling, changing or not showing for the appointment are eliminated. This reduces stress and opens up time in your schedule to produce more dentistry.

Whenever I am speaking with dentists or team members about practice management and increasing production, marketing strategies invariably become a topic of discussion. I usually suggest that the best marketing techniques focus on addressing the concerns that our patients have regarding dentistry. Fear, money, time and discomfort are common barriers to dental treatment. CAD/CAM addresses the issue of time quite well. For most patients every dental visit represents time away from work, families or other important tasks. By providing same-day restorative treatment, you are saving your patients precious time. People don't like going to the dentist. It's not personal. It's just not pleasant. Have you ever had a colonoscopy? Not a great memory. Now imagine the thought of a colonoscopy that took not one but two visits and required you to "wear a temp between each visit, which may fall out." It is much easier for patients to accept treatment if they can fit it into their budgets as well as into their schedules. Show patients that you value their time and that you have made a significant time/money investment in your practice in

Crowns 13 and 14	Traditional Restorative Treatment	CAD/CAM Treatment
Visits (Time)	150 minutes	135 minutes
Lab Cost	\$250	\$0
Materials Cost	\$100	\$80
Staff Cost	\$40	\$50
Average PPO Fee	\$1,722 (861 each)	\$1,722 (861 each)
Hourly Production (per Hr.) (Fee/Time)	\$688.80	\$765.33
Total Profit (Fee – Cost)	\$1,372	\$1,592
Dr. Down Time	15 min.	45 min

order to facilitate the ease and efficiency with which you can provide treatment, and I will show you a great marketing strategy.

Not only is time a major deterrent to treatment acceptance but so is fear. When patients are told that they need a crown, these are some of the thoughts and images that come to mind: awful tasting impression materials or temps that fall out during an important meeting. They picture ugly gray lines around old crowns near their gum lines. Think about how powerful a marketing tool it is to be able to tell patients that in your practice they don't need any impressions (no goo), they don't have to wear a temp, there is no metal under the crown so they won't get gray lines, and the entire procedure can be done in one visit during which they will have 30 to 45 minutes to catch up on work, return e-mails or just relax and watch TV (I have TVs in all of my operatories).

When patients leave with a brand new crown and go back to work or out with friends, they are going to talk about what a wonderful and convenient experience they just had in your office. "No, I don't have to go back; my dentist can do crowns in one day." That's how to market your practice, and that's the most significant return on your investment that the E4D Dentist system has to offer.

By offering CAD/CAM, you are able to address two common and significant barriers to treatment acceptance. Same-day dentistry is a powerful marketing tool, as well as an effective way to increase the frequency with which your patients choose to move ahead with restorative dentistry.

Although the decision to implement new technology into your practice is stressful and challenging, how unproductive you are without it should be of greater concern. Make an investment in your office, your team and your practice, and the results you see will far outweigh the financial concerns that are preventing you from making a huge leap forward. Then when you're asked about "taking insurance," you'll be able to answer with far less reservation.

Table 1 During this procedure, Dr. Krieger delivered two Empress CAD/CAM crowns and produced an additional \$565 in direct restorative dentistry in his second chair. The total office production for the two-hour time span was \$2,157.

contact CAD/CAM



Dr. Matthew Krieger is a 1998 graduate of New Jersey Dental School. He completed a GPR at Mt. Sinai Hospital in New York City. He started his practice in 2003 and built it into a full-time practice in just one year. He has consistently grossed more than \$1 million since 2006. In addition to a full-time private practice, Krieger is the founder and CEO of Symposia C.E., as well as a practice efficiency consultant with High Performance Dental Consulting. Krieger maintains more than 500 hours of C.E. credits and continues to expand his knowledge in dental practice management. You can reach Krieger at drmkrieger@yahoo.com.

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In-office CAD/CAM isn't for me ... or is it?

Author_Ch Charles Regalado, DDS

Experiences of an E4D novice

“In-office CAD/CAM just isn't for me, at least right now.”

“I don't produce enough single posterior units to afford one of those.”

“The design on the screen looks better than the real product you get.”

“Crowns in one day? Great idea, but I don't want to lose the quality I get from my laboratory.”

Have you ever muttered anything close to one of these statements or something similar to justify not taking a closer look at an investment such as CAD/CAM technology? I sure did and for several years. If you are like me, you've had representatives talk to you touting the wonders of in-office CAD/CAM. Likewise, if you are like me, you thought to yourself, “The technology is fascinating. This is likely the future of dentistry. Wouldn't it be nice to finish treatment in one visit, especially for those difficult patients I'd rather not have to see so soon again? It sure would be nice to actually take home more of that crown fee, but ...”

The “but” was my stopping point too.

Initially, I had difficulty justifying an investment in CAD/CAM technology when seemingly everything else in my practice needed attention. Owning a business surprises you with constant unplanned expenses, and this technology especially seemed to tip a bit too far on the “not now” side of my rationale.

I had read articles in journals espousing the merits of CAD/CAM, how top dental schools were implementing it into their curriculum, how patients

would start to inquire and want this technology for a multitude of very practical reasons — not the least of which include healthful reasons. I know for me, personally, given the choice of two weeks with a temporary crown, knowing it is leaking because of limits of temporary cements, having my dentin soaking in bacteria all the while, is not the best tooth protection available. So, if I don't want that, why would I want my patients to have that?

Then, upon receiving a call from my Henry Schein technology representative last fall, I immediately thought this was just another time I'd have to say, “Thanks for the call, John. Not today, John. Maybe later, John. Uh huh ... yes, thanks ... goodbye.”

I had heard the sales pitch before, and don't get me wrong, it's always good. At the same time, I'd not been particularly blown away with some of the crowns I'd seen on patients of mine who had received in-office CAD/CAM restorations elsewhere. That, of course, is not to say that operator skill had nothing to do with it. I knew the technology was better than what I'd seen, but I just wasn't there yet. Besides, I surely did not want to mess with applying powder in a wet mouth! To be honest, I thought nothing beat the product I'd receive from my lab technician.

I realized that everything in me that was once saying “No,” was now urging me to give it another look. This time my representative brought some sample restorations for me to see. Holding these in my hand and admiring the exquisite detail, I had to ask a rather foolish question, “Were these fabricated directly from the E4D mill? These look just like what I get back from my lab.”

His answer was simply, “Yes,” and with that, he had my attention. “What about powder?” I asked.

“No powder needed,” he said. I knew he had something worthwhile, and that what I had once looked at many years ago was not what CAD/CAM is today. If I could get this kind of detail from a milled crown, now knowing the multiple advantages of in-office

Fig. 1 A quick model is made of my first E4D crown for my “test” of quality. Note that margins close perfectly. (Adjacent contacts were cut away to remove seating interferences.) (Photos/Provided by Dr. Charles Regalado)



restorations, then I could not see any reason to not give it a good, serious investigation.

I was invited to D4D Technologies in Dallas for an E4D Dentist Preview event, and the experience blew me away. Seeing the differences between the different CAD/CAM machines and meeting the helpful and supportive staff solidified my decision, that this was a product that I knew I wanted. But most of all, the ease of use with the E4D software was exciting because I knew I'd be able to get started right away when I received my E4D Dentist system.

That was my introduction to E4D, and after having this in my office for the past seven months, I can candidly say that if you were to take away my E4D, you'd take away the most fun I've ever had in dentistry. Yes, that's right — fun! You know, that thing we all want the most in our lives so we can be at our best physically and emotionally, both at the office and at home.

Face it, you went into dentistry likely because you are passionate about health care and providing the ultimate in patient care. However, if you're like me, you probably quickly found that running a practice can exhaust you by the end of the day. I believe providing efficient, quality care is the key component to maintaining a life balance, and frankly, these things just aren't mutually exclusive! This is how it really should be, and today's technology is the powerful engine that is driving us to greater successes in producing such quality in our dentistry. It makes our lives easier and, thus, brings that needed joy and energy into our day.

'What drives quality is our control of the situation'

My mentor Ron Jackson has a philosophy I love: "Don't practice 'hope dentistry.'"

I would add, to the best of your ability at least, we know we can't control everything in dentistry as long as a human mouth is involved. Hope dentistry is when you hope things go right. For some dentists



Fig. 2 Follow up X-ray confirms perfect marginal closure of my first crown made by E4D.

considering CAD/CAM, they hope it can produce for them the same (or better) quality restorations that they can get from their lab. Yet we've all likely had to return a crown because the shade is off or you forgot to mention that you wanted broader contacts, a fuller contour to avoid food packing at the gingiva or many other reasons, including poor fit.

These are the frustrations associated with not having better control of those features you expected (and needed) in those restorations. This is where E4D shines. I've found that I have all the control I've ever wanted in the final look, shape and color of my porcelain restorations. Yes, when I step back and admire what I've done, there is a great sense of satisfaction and pride in what I've just achieved.

The materials available for milling with the E4D are the same materials I've used when offering all-ceramic restorations fabricated by a laboratory. Because labs incorporate scanning and milling technol-

Fig. 3a Preop buccal view of tooth #2 before preparation for full-coverage, all-ceramic crown.

Fig. 3b Post op view of #2 after placement of IPS e.max high-translucency crown. Note that margins left 3 mm supragingivally are invisible.





Figs. 4a, 4b_Pre-op views. Patient disliked rotations and wear of #10, midline slant, improper proportions of all incisors and facial composite veneer of lingually positioned #8 done previously to bring facial plane into arch. She also thought #6 was slightly short for her liking.

Figs. 5a, 5b_Final veneers on model. Note small incisal 'cap' milled by E4D for cuspid #6. The milling capability of E4D is nothing short of amazing. Thinness of veneers can be seen by black show-through on certain restorations.

ogy, it only made sense that I could benefit from CAD/CAM too, without coming up short on material quality, durability and beauty. In fact, quality can actually increase because the intuitive DentaLogic™ software quickly illustrates areas where your preparation fails to meet the required thickness. Rather than paying for a restoration that is too thin or have the patient return for a second preparation appointment, everything is easily corrected in the first appointment with the patient in the chair.

_'But what about those margins?'

People ask me all the time, "Does the E4D produce margins as well as a lab-fabricated crown?" My answer is, it will produce as good a margin as you want it to give you. The old adage "garbage in, garbage out" rings true with this kind of technology. Give the E4D a great preparation and you'll get a great fit. What's more, I no longer shy away from taking a postoperative radiograph, because I've simply learned to trust this technology.

I'll be the first to admit that although I embraced CAD/CAM technology, there was still a nagging skeptical side of me, so naturally I spent time testing each crown at the beginning of my learning period just to make sure things fit as well as I wanted them to. By simply pouring the impression of a tooth scanned in the mouth, a model is quickly made, and then I could see for myself how the E4D truly performed (Fig. 1). It did not take long to convince me that I had little to worry about (Figs. 2–3b).

_'That's nice, but I don't produce enough single units to make it worthwhile'

This is precisely what I thought and why I never really ventured to dive into in-office CAD/CAM. Now, I'll be candid here: Many clinicians may not practice like I do. I chose long ago to significantly limit my number of treatment rooms and patients seen per day. I probably see a fraction of what the average dental office sees in a day. Moreover, that should encourage anyone considering in-office CAD/CAM because if it can be profitable in a smaller, limited-capacity office, then surely any office will reap huge financial benefits. How do I know? Because even in my smaller practice, looking over my expenses in the first three months alone since integrating the E4D, I had saved more than \$10,000 in fabrication costs! I don't need to tell you how much more average offices would save more than that amount. I have no reservations in saying that my purchase has proven to be a "no-brainer" financially.

_'What about anteriors?'

This was a key concern of mine regarding the abilities of CAD/CAM. I was under the impression that while posterior teeth were a good indication for in-office milled crowns, anterior teeth would remain the domain of laboratories. Because my practice involved anterior cases quite frequently, unless I could be convinced I could create and custom-shade anterior teeth, my use for the E4D would be too limited (Figs. 4a, b).



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Fig. 6a



Fig. 6b

Figs. 6a, 6b Post-op views of e.max veneers #7–10 and incisal cap on #6, correcting all concerns of patient.

What I found was that anteriors are even more fun and exciting to produce, and patients have been absolutely thrilled with the results. Taking the Smile Design advanced education course taught by Lee Culp, CDT, was almost essential for me to learn the nuances of anterior tooth design. I am not a ceramist, and my skills are certainly not equal to the master of technicians (Lee); however, I must say the marginal fit — even when milling very thin veneers at 0.4 mm — is humbly phenomenal (Figs. 5a, 5b). There is no reason whatsoever to believe that in-office CAD/CAM is limited to “non-esthetic zone” areas. I’ve done more than a few anterior cases, anterior implant cases and full-arch cases, and the results have been as good as I’ve received in the past (Figs. 6a, 6b).

‘The economy is bad! Insurance benefits are declining!’

Recently, in my state, one of the main dental insurers used by a majority of employers just cut reimbursements by a very substantial margin. This has hurt and ultimately angered many dentists.

While I, too, am frustrated by this, it is precisely why I could not be happier that I have an E4D in my office. Now is the time to be saving on expenses. It’s not the time to be looking for cheaper labs or cheaper materials. It’s not the time to ignore progressive technology such as in-office CAD/CAM; I believe it’s time to embrace it!

The sting of the economic downturn is muted for me because I can make most of my own previously outsourced restorations. I can look my patient in the face and tell him or her that even though the economy is forcing dentists to take measures they never thought they would have needed, they will be receiving from me the same quality of restoration without exception. I’ve found great comfort in owning CAD/CAM with the current economy, and I consider myself one of the lucky ones.

Here is a recent example: I’m finishing a near full-mouth case on a patient that requires a three-unit

lab-processed bridge. I figured that the cost of the three units I’ll pay the lab for will be more than twice the amount I’ll pay for the 13 units I’ll fabricate with my E4D!

‘Finally, the joy of giving’

Not only does my E4D allow me to really enjoy dentistry on a daily basis because it’s fun, it gives me the control I desire and satisfies the creative part of me. It also gives me the greatest satisfaction — the ability to give back without hesitation to people that need help because of the costs associated with the lab portion.

I always have those people in my practice that would love a great smile but simply cannot afford my dentistry for a variety of reasons. My heart goes out to them, as I’m sure yours does too, yet it is not always feasible to provide a low-cost (or no-cost) solution to them.

Now I have a very simple and powerful way to give something to them that could change their lives, and it doesn’t cost anywhere near what it would have in the past.

To be able to quickly and easily provide dentistry in a charitable way is probably one of the greatest ways to provide vitality to not only the patient but to yourself. It’s invigorating; and now with the E4D in my office, costs are minimized. I am able to give my time and talent without compromise, and the final realization for these patients goes beyond words.

In my experience, nothing has enhanced my satisfaction in dentistry quite like the E4D Dentist system. With it, I’m learning and growing on a daily basis. It has made me a better, happier (and busier!) dentist with more creative control and financial stability than before, and a more altruistic person without the need to lower my standards below the kind of quality I’ve strived for over the years.

Is CAD/CAM for you? Remember when I told you I did not think it was for me? I could not have been more wrong. So, what does the future hold for you? _

_contact

CAD/CAM



Charles Regalado, DDS, is in private practice in Spokane, Wash. He is a 1991 graduate of the University of Washington and enjoys speaking to dentists and hygienists on a variety of topics, mainly involving esthetic dentistry. He loves teaching and, in addition to his practice, is currently part of the faculty at Eastern Washington University School of Dental Hygiene teaching restorative procedures. He purchased his E4D in December 2010 and has loved every minute of it.

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Time to lose 'the wait'!

Author_Dean Saiki, DDS

_Elective services are a large part of dental procedures. Yet, according to the article "How Dentistry Weathers a Slow Economy" by Roger P. Levin, DDS, while patients tend to keep preventive care appointments, elective services decline during times of financial struggle. To protect against a stagnant economy, dentists need to consider ways to increase patient flow and satisfaction. I found the E4D (D4D Technologies, Richardson, Texas) in-office CAD/CAM system increased the vitality of my practice financially, professionally and personally at a time when I hear my peers struggling to maintain their own and their staff's motivation. Although it's tempting to avoid a financial investment, now is the ideal time to place your practice a step above the competition. Don't wait, and here's why.

_Boosting practice economics

When first introduced to CAD/CAM technology, I knew it would change the future of dentistry, but I resisted the investment. It took 10 years to pay off my practice, and I wasn't eager to jump back into debt.

As a solo practitioner, I was apprehensive. I knew in the long run it would be to my advantage, but I needed to become comfortable with the idea. When I realized the increasing cost of laboratory bills, I began talking with colleagues who had purchased other CAD/CAM systems, as well as those who invested in the E4D.

Of the systems available, what convinced me to choose E4D was the opportunity to preview the system in action. I had a behind-the-scenes look at how the machine was developed, created and "real time" supported by D4D. The thought of investing in CAD/CAM technology and being left to your own devices to learn how to use it can be intimidating. D4D eliminates the uncertainty with its comprehensive educational resources, continuing education courses, on-site setup and training and remote Support on



Sight. When I realized I wouldn't be forgotten once I purchased it, I knew E4D was for me.

Choosing to embrace E4D digital dentistry is one of the best professional decisions I've made. It's fast, much easier to use than you would think and the results are phenomenal. Before E4D, two weeks would pass between my patient's first appointment and seating their crown. With E4D, it takes less than two hours, 1 hour and 40 minutes on average. Because the time factor for fabrications has been so accelerated with the E4D, it has increased the number of patients we can see in a day and increased patient acceptance. This, in turn, has increased our production and collection numbers, all while reducing laboratory costs.

The E4D has definitely had a positive economic impact on my practice and, as a result, is paying for itself. At a time when I felt my practice was coasting and I was worried about the economy, the E4D has proven to be a huge advantage, and not only financially. While many of my peers struggle through the recession, my practice continues to earn and grow in numerous other ways.

_Professional satisfaction

The personal and professional satisfaction I have experienced since incorporating the E4D into my practice is unprecedented in my experience. It has

‘Offering innovative technology to our patients and mastering it has given both my staff and me personal satisfaction.’

sparked my enthusiasm. I enjoy coming to work and providing my patients with state-of-the-art technology and innovative services that I couldn't in the past. For my patients, visiting the dentist today is a completely different experience than before I invested in the E4D. My patients can watch a fabrication from behind the scenes and see it being designed and created all in a single visit. If a patient comes in at 8 a.m., he (or she) can be out by 9:40 a.m. Within that time, I sit down with the patient to explain the process and show him how we design the restorations. I love designing my own restorations. It's both challenging and rewarding. The E4D system has changed my role as a dentist, as well as the dynamics between my patients and me.

My team members have also embraced the E4D technology. When a patient is apprehensive about undergoing a restoration, they enthusiastically answer their questions and describe the procedure. They love to inform our patients that a restoration can now be completed in a single visit and that there is no longer a need for the icky, gooey, impression material. They are excited that we can provide better service, more comfortably and faster, and in the event that there is an unscheduled emergency, my assistants are very adept at fabricating crowns.

It would be a shame to invest in new technology only to spend your time fumbling around trying to learn how to use it. You would lose money, time and patients. That's why I believe that D4D should be credited not only for creating the E4D but also for standing behind it as extensively as it does. In two and a half years, I have not had a problem or glitch that wasn't immediately addressed to my complete satisfaction. Help is available whenever we need it - something we couldn't do without. The support that D4D provides makes the E4D so unique. I am also impressed with how supportive D4D is of our thoughts, ideas and suggestions concerning changes and updates regarding the E4D system.

Dentistry has come a long way from 15 years ago: new technology, digital X-rays, intraoral cameras. For patients, it has become quick, easy and educational, and you can see their excitement and satisfaction. Investing in new technology has had a positive impact on my staff and me both personally and professionally.

_Personal success

Although I have always loved what I do, I have definitely noticed a difference since incorporating new technology into my practice. Offering innovative technology to our patients and mastering it has given both my staff and me personal satisfaction. We enjoy coming to work and serving our patients. With each new restoration, we learn how to do things faster and better. It's simply more exciting. Knowing that we are providing our patients with cutting-edge services and that financially we are doing well is very gratifying.

Another personal advantage for me is that if I can't be in the office because of illness, family emergency or vacation, my staff members can bring the dentist who is filling in for me up to speed regarding the new technology. They are eager and proud to share our new technology and their expertise with the new doctors.

_Conclusion

Investing in the E4D Dentist system has advanced my operations and services and given my practice a competitive edge. Looking back, I realize my reluctance to invest denied not only me but also my patients and staff the many advantages the E4D in-office CAD/CAM system can provide. Based on my experience, I would advise my colleagues not to wait like I did. The E4D has definitely helped my practice weather the economic storm. As the saying goes: Hindsight is 20/20 vision. Don't wait. Now's the time to invest in E4D.

_about the author

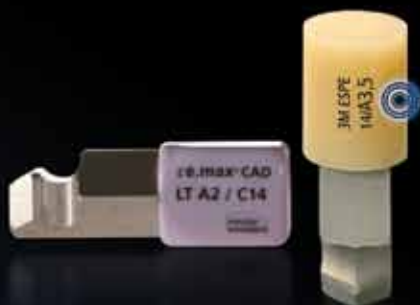
CAD/CAM



Dr. Dean Saiki graduated from the University of Southern California School of Dentistry in 1988. He has been practicing in San Diego North County since 1989. He's been a member of the ADA, CDA and San Diego Dental Society for more than 20 years. He attends regular bimonthly study club meetings to continue the ongoing educational process and loves training in the latest dental technologies. He has maintained his practice in Oceanside since 1990.

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DENTAL

The perception vs. reality of chairside CAD/CAM dentistry

Author | Alex Touchstone, DDS

I've been practicing restorative dentistry for more than 17 years, and during all but three months of that time, I've utilized chairside CAD/CAM dentistry on nearly a daily basis in my practice. Three months out of dental school, I purchased my first chairside CAD/CAM system — the CEREC 2 — on the Internet. The system arrived in my office with an owner's manual written in German; so that was my introduction, initiation and education in chairside CAD/CAM dentistry. During the next 17 years, I upgraded my system, improved my technique and began to teach others.

I trained clinicians, technicians and dental assistants on the basics, advanced techniques and even the future of CAD/CAM dentistry. I've trained thousands of dental professionals during the years and have heard and seen it all: the good and the bad, the perceptions and the realities. I've recently switched brands of systems, but not the quality of care.

Chairside CAD/CAM dentistry is only a vehicle to the result: quality patient care. The fundamentals of restorative dentistry, clinical skills, material understanding, proper diagnosis and treatment planning are required to drive any system to excellence. Allow me to share with you some of the common statements relating to CAD/CAM dentistry that I've heard, which like most things, are based on a lack of understanding, personal biases or a lack of firsthand experience that often generates these misconceptions.

— Perception: 'Only one system works'

I've recently switched systems; specifically, from the CEREC system to the E4D Dentist system. I can tell you both systems can create beautiful, well-fitting restorations. Each one does it in a little different method — one uses powder, one takes more images and gathers more data — but both are capable of successfully changing everything in a restorative practice: control of variables, convenience for the patient, dental team motivation and the bottom line. There are other differences in the systems — such as in software, milling, manufacturers, education, support and distributors — but they both work probably better than you've ever imagined. You owe it to yourself, your practice, your team and your patients to check them both out.

More important than the system is you: your attitude and ability to change (for the better) your team's involvement and your clinical skills. The incorporation of any technology (digital X-rays, patient management, lasers, magnification) typically makes you a "better" clinician by providing more information to make better decisions, and chairside CAD/CAM dentistry is no different. Being able to see your preparations on a large screen, to rotate, zoom and view from any angle will improve your evaluation of your preparations and your soft-tissue management. Yet, it isn't the system, it's the dentistry. Both systems will allow you to get where you want to go, but you have to drive.

Reality: It's not the system; it's the dentist and the team.

— Perception: 'I can figure it out by myself'

Seventeen years ago, the only CAD/CAM education I could find was by trying to translate an owner's manual from German just so I could turn on the CAD/CAM system. Today there is a plethora of educational opportunities: you can join proprietary websites with video lessons; you can purchase complete DVD sets of interactive learning opportunities; or attend basic training sessions, most of which are set-up by private clinicians that offer to show you "their" way. More than four years ago, D4D Technologies (the E4D guys) clearly recognized deficiencies in many of these methods and introduced a novel approach to education and support. From the very beginning, D4D instituted mandatory training and education and offered unlimited remote support with every purchase. The company also implemented the "team approach" to chairside CAD/CAM dentistry by offering a revolutionary certification program for dental assistants called the CAD/CAM Dental Designer (CDD).

Knowing dentists, I'm sure that when most of them first hear they are required to attend training before they can get the system in their office, they look at that as an unnecessary hassle. However, let me tell you that education and support is the most important aspect of your successful journey to CAD/CAM dentistry — not only for you, but also for your team. Included in each E4D system purchase is not only training for you, but also for one of your assistants; and this includes everything, i.e., trans-

portation, accommodations and a guarantee for a great experience. Too often, I've seen compromised basic education in order to up-sell or move someone toward advanced education opportunities. While there is a right time for advanced courses, it varies by individual and by experiences and shouldn't be predetermined at basic training.

In addition, most educational experiences enlighten the students during the course, but then fall short on follow-up and compliance once the course is over. D4D Technologies addresses this with a third day of education in your office called integration. Soon after your system is set up, a clinical "integration" specialist will arrive at your office and assist you for "the first day of the rest of your life with digital dentistry." Then the true support kicks in with Support on Sight (SOS), which is also included with the system. One of the advantages of being introduced to E4D CAD/CAM dentistry during the Internet age is the requirement and advantage of having every customer online, which means an Internet access connection is mandatory for every E4D System. That's so dental technicians, dental assistants and hardware and software experts, part of the E4D SOS team, can log into your system (when requested) and remotely provide customer support. No more trying to tell someone over the phone what your screen looks like because the SOS team can take control of your system, help with designs, diagnosis of your hardware and also answer any questions about the operation of your system.

Reality: Education and support makes all the difference in the world of CAD/CAM.

Perception: 'My patients don't care about the benefits of chairside dentistry'

If you feel this way, it's a good bet you haven't asked them or you aren't a patient-centered practice. It isn't just being able to offer these restorations in one appointment, in one day, the next day or by the weekend, but more about being able to say "Yes!" to any patient inquiry. Chairside CAD/CAM dentistry gives you complete control of the entire process as well as many more options to provide quality care to your patients instead of always having to say, "We'll see you in two weeks."

While there is nothing wrong with the two-week turnaround we've become accustomed to (or better said, locked into), why is that the only option?

Disregarding when you are dealing with sensitivity or changing the occlusal scheme, why not offer the patient the option of getting it all done today, or "Let's prep on your way into work and seat on your way back from work." In today's economic times, being attentive to patients' needs, concerns (leaving work too often) and convenience factors (running

errands while the restorations are milling) is what will delineate those practices that flourish vs. simply survive. The same reasons you're using to consider staying open late on some nights, adding weekend hours or adding an associate to cover more opportunities for patient care are the exact same reason you should consider offering additional treatment options and chairside CAD/CAM dentistry to your patient base.

Reality: All patients appreciate convenience.

Perception: 'Faster is better'

I cringe a bit when I hear some debates about the use of new technology that focus on how minutes can be saved through "bypassing this" or choosing a certain setting vs. the "correct one." It's curious because it's as if our entire dental career has been spent waiting weeks for restorations and now we're concerned about seconds. While time is money, it works both ways, on the front end and the back end. If by choosing a setting or making a material decision simply because it saves time on the front end (the dental appointment), you lose on the back end by compromising the ultimate success of the restoration (longevity and performance), which means that one's priorities are now upside down.

While this question is most likely anecdotal and we may never have the true answer, I'd caution everyone to pause when they are told to select one material, system or procedure over the other simply because of a quantity of time saved. My advice is to choose based on the quality of the result and not the quantity of minutes you'll save (or lose).

Reality: Dentistry is not a race; seek quality over quantity.

Perception: 'It costs too much'

While we all like to look at the price tag, in investments and in technology you need to look at the "real cost vs. benefit" or the return on investment (ROI) to your practice. It is much easier for us to casually pass by a \$200 lab bill 30 times each month vs. the seriousness and hesitation we give to a \$100,000 purchase. Take a few minutes with your accountant (or your spouse) to total the fabrication fees you've paid, or intend to pay in the next five years, and compare that to investing and making monthly payments on a technology that will allow you to most likely fabricate 70 percent of those cases yourself (essentially all the single units).

Next, add in all the tax benefits of Section 179 and capital equipment and you'll likely discover that the reality is a real eye opener. In the majority of situations, the cost (money, time and personnel) of fabricating single units yourself with a chairside CAD/CAM system is probably less than what you are doing

_contact CAD/CAM



Alex Touchstone, DDS, has 17 years clinical experience in application of CAD/CAM dentistry in his dental practice. He holds two U.S. patents in the area of shade control for translucent dental restorations. During the past several years, he has had the privilege of teaching hundreds of dentists every year how to grow their practices through proper integration of carefully selected technologies. He currently has the privilege of serving as the team leader of the online education and networking portal, www.CADCAMCAN.com, created for the benefit of the E4D community. He can be reached at alex@cadcamcan.com.

now. In fact, doing dentistry the way you have been doing is what "costs too much."

Reality: Most likely, a chairside CAD/CAM system costs less than what you are doing now.

Perception: 'Oh, I looked at it before and it's not for me.'

Having spent 17 years defending and promoting chairside CAD/CAM dentistry, I'm pretty sure I've heard most of the excuses/reasons for not considering it. While there are certainly some valid reasons why it isn't for everyone, some comments should be reconsidered: "Oh, I've seen patients come through my office that have hideous looking CAD/CAM restorations — no anatomy and just ugly — I'd never do those." "They fit like socks on a rooster." "I know Bob bought one, and now it sits in the corner."

Indeed, technological development has gone through massive advances and what was once described as an "island of ceramic in a sea of cement" has now evolved to restorations that can have a marginal fit equal to or better than lab-fabricated restorations. So yes, early CAD/CAM promises don't come close to today's capabilities.

On the other hand, in that same practice that noticed the one CAD/CAM restoration, there were

probably hundreds of chairside CAD/CAM restorations that went through undetected and assumed to be lab-fabricated restorations. The difference between a noticeable and an undetected CAD/CAM restoration is probably not the technology but rather the clinician. We have to understand that no restoration goes into the mouth without the conscious decision and the professional skill of the clinician. If a less than ideal restoration is permanently placed, it isn't so much a factor of one system or technique vs. another, but rather the clinical skill or judgment of the clinician.

For those who have simply taken their peers' opinions, read blogs or had good and bad experiences but haven't checked out today's chairside CAD/CAM dentistry for themselves, I encourage you to do so. The first cell phone was introduced the same decade as the first CAD/CAM chairside dentistry system, and neither bears any resemblance to the technologies offered today. Take a fresh look for yourself.

Reality: If you haven't looked at chairside CAD/CAM in the last year, you haven't looked at all.

If you've read this far, hopefully it means that even if you may have shared some of the perceptions listed above, you're now willing to consider the possibility that technology can offer improvements in restorative dentistry.

AD

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Today's in-office CAD/CAM is how to add 'Wow!' to your practice

Author_Robert Stanton, DMD

_There are many reasons to invest in in-office CAD/CAM technology. For some, they see it as a way to increase productivity and reduce costs. For others, it's a way to provide better quality dentistry. Then, of course, there's the group that just wants to have more fun while delivering dentistry. Those are the main factors from the clinician's perspective. However, the factors that "wow" you as a clinician are totally different from the ones that "wow" your patients. There is no single procedure or technique in dentistry that is more impressive to a patient than the fabrication of a single-visit CAD/CAM restoration.

For starters, the company backing the E4D Dentist system provides all the training and support needed to take full advantage of its innovative technology and intuitive software, so you can truly embrace all the "wow" factors in your practice. The training and education at the E4D University anticipates and responds to user needs before they occur. The negative stigma that is often times associated with the failed integration of in-office CAD/CAM was borne from inadequately trained users wasting time and achieving poor results. E4D users do not experience this frustration.

Advanced education opportunities — including those focusing on specific topics such as smile design — take into consideration user experiences to create a better learning environment, one that's leading the industry.

Then, after fully supported and coordinated system integration, the dedicated customer service continues with Support-on-Sight (SOS), which provides real-time guidance, even during large esthetic cases, to remove any concerns about your success. Whether refining a restoration or offering recommendations for realizing predictable results, the support that's provided for the E4D Dentist system is unmatched and foolproof because the support staff has full access to the E4D Design Center, Mill and software.

You and members of your team will be inspired to treat large, multi-unit anterior and full/dual-arch cases while controlling all aspects of the process yourselves — from impression taking to restoration design, milling to characterization — simply because you can. There are polychromatic blocks with variable opacities layered within that create milled restorations with inherent transitions from cervical to incisal translucency. Your patients will be "wowed" and appreciative of receiving such high-caliber esthetic dentistry without the mess, inconvenience, delay or uncertainty associated with laboratory fabricated restorations. They won't need temporaries, repeat appointments or the risks associated with remakes, and the bond strengths and flexural strengths the same-day CAD/CAM user can achieve are unmatched.

Whereas earlier generations of CAD/CAM design software may have stifled the esthetic sensibilities of dentists desiring complete control over restoration

Fig. 1_Patient presents with a chief complaint of wanting to close the black triangle between his front teeth and make his front four teeth more uniform and match his existing restorative. Four single-visit units were treatment planned. (Photos/ Provided by Dr. Robert Stanton)



Fig. 1

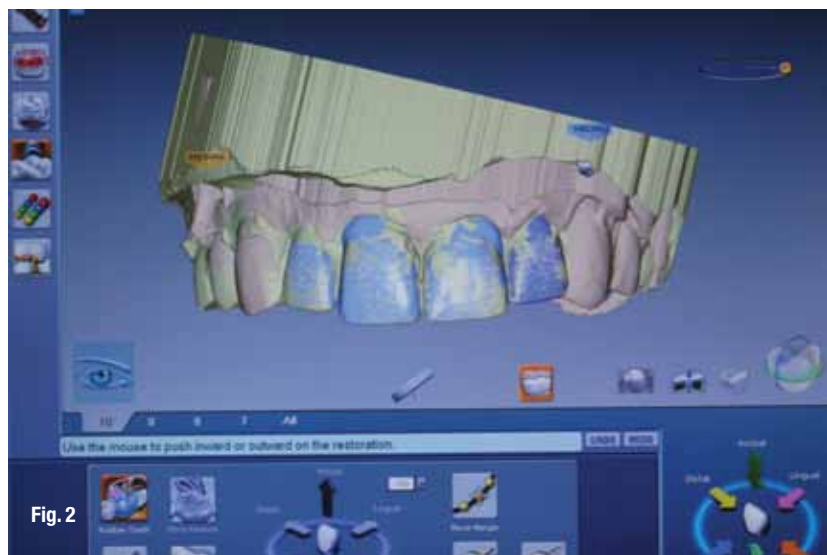


Fig. 2



Fig. 3



Fig. 4

Fig. 2_ The E4D stitches the wax-up model to the prep model, and the user can toggle between the two while designing the restorations to ensure precision.

Fig. 3_ All interproximal contacts can be adjusted while examining embrasures and facial contours, again ensuring precision.

Fig. 4_ The patient is extremely satisfied with this single-visit result. Material is Empress CAD (Ivoclar Vivadent) Multi A2 with single-bake characterization using sunset and incisal 1 and 2 only.

creation, the E4D Dentist system allows for confirmation of all design factors. These include principles of symmetry, proportion, length/width ratio, contact placement and embrasures. E4D's software begins with a more accurate design, then offers a wide range of tools to create whatever global and delicate changes are required to finalize the design in much less time. Additionally, the E4D software allows for simultaneous design and finalization of as many units as the operator needs with tools that can be set to modify one restoration at a time or all restorations together in proportion.

The design software may sound complicated, therefore restricting its use to the dentist only, but this is not the case at all. Rather, the software layout is designed to be so intuitive and user-friendly that an assistant who has undergone two days of training can effectively perform the entire process from scanning, designing, milling and characterization. Think of how much more efficient your practice could be if not only you were performing single-visit dentistry but if you, the dentist, were able to do it in less of your own time.

With the E4D Dentist system in-office CAD/CAM, the result is an accurate and precision restorative case that will "wow" patients on multiple levels: convenience, comfort, esthetics, fit, advanced technology and clinical excellence. Patients love the way it looks. They love the way it feels. They love the time that it saves. You will love the time it saves you, as well as the profits you'll enjoy by using the system versus a laboratory. And your dental team will love the added roles they'll play in patient treatment and elevating the image and reputation of the practice.

The case demonstrated on these pages illustrate the strengths and advantages of the E4D software._

_about the author

CAD/CAM



Robert Stanton, DMD, is a practicing dentist in Ft. Lauderdale, Fla. He is a graduate of the University of Miami and later Tufts Dental School in Boston, Mass., graduating with honors. Named one of the Top 100 Best Young Dentists in the Country in 2001, Stanton is also a faculty member in the

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CAD/CAM

the international C.E. magazine of digital dentistry

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