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CAD/CAM

the international C. E. magazine of digital dentistry

1 2012

_c.e. article
Setting the standard and achieving success

_clinical perspective
With E4D chairside CAD/CAM, 'old dogs' can learn new tricks

_finance
Tools for making prudent decisions

E4D *makes the difference* for Dr. Pescatore.

"The *E4D is more* than a piece of equipment, it is an *innovation* that is *taking CAD CAM to the next level.*"

- Christopher Pescatore, DMD
Danville, CA

MAKE THE DIFFERENCE
for your practice.

The E4D Dentist chairside CAD CAM system offers improved profitability, complete restorative control, and enhanced patient convenience using powder-free laser based scanning, intuitive design and precision milling – all in your office.

Call **1-877-293-4945** or go to **www.e4d.com/roi** to see how E4D can make a difference for you.

E4D Dentist

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Never look back

Gary Severance, DDS

Nearly 30 years ago, three technologies were introduced to dentistry in one year that forever changed the capabilities of communication, diagnosis and treatment: the first digital intraoral camera (Fuji/Fujicam®), the first intraoral digital X-ray system (Trophy®) and the first chairside digital restorative system (Siemens®/CEREC®) all made their North American appearance in 1987.

While two of the three technologies can now be found in nearly 70 percent of dental practices and are used daily to provide better dentistry, digital restorative dentistry has lagged behind with less than 10 percent of practices taking advantage of providing patients with a digital scan, digital design and in-office fabrication of the final restoration.

While chairside CAD/CAM technology has continued to progress over the nearly 30 years since its introduction, it wasn't until a laser-based system (E4D Dentist™) was introduced in 2008 that clinicians could actually "see" what they were capturing. The introduction of the E4D Dentist System provided dental professionals with the ability to fabricate a one-appointment, indirect ceramic restoration digitally without first covering the hard and soft surfaces to be scanned with powder. In addition, D4D Technologies introduced centralized education and remote support (Support on Sight or S.O.S.) to further facilitate integration of this technology into the modern dental practice.

Yet, what has kept chairside CAD/CAM from revolutionizing the capabilities of dentistry much like Lenscrafters® transformed the expectations and experiences of patients needing eyewear? The concept of "one-hour" eyeglasses was introduced in 1983 and now is an instantly recognizable and accepted concept that brings the technology and convenience to the patient with no compromise in quality. The same is true with today's chairside CAD/CAM systems — convenience with no compromise.

When asked why chairside CAD/CAM isn't the current standard of care in dentistry, the first answer from those in the profession is "the cost." Unfortunately, this answer is a common fallacy because in most cases, chairside CAD/CAM costs "less than what you're doing now" for the average private practitioner.

As you read through this issue of CAD/CAM magazine, you will meet clinicians and assistants who at first hesitated but then took the step into digital restorative care and have never looked back. You'll read of new technologies to promote the services to your patients and, most of all, understand the true cost of "not" incorporating chairside restorative care into your practice.

I encourage you to look forward and explore all that digital restorative care offers you, your team and your patients.

Sincerely,

Gary Severance, DDS
Chief Marketing Officer
D4D Technologies


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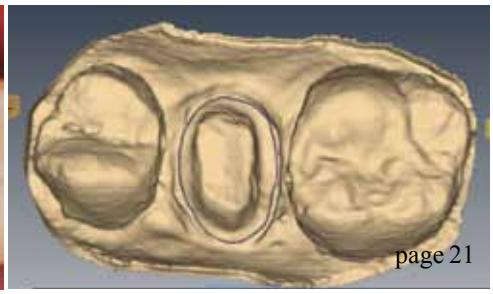
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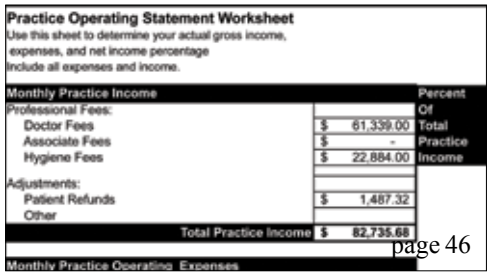

Practice Operating Statement Worksheet

Use this sheet to determine your actual gross income, expenses, and net income percentage
Include all expenses and income.

Monthly Practice Income		Percent Of
Professional Fees:		
Doctor Fees	$ 61,339.00	Total
Associate Fees	$ -	Practice
Hygiene Fees	$ 22,884.00	Income
Adjustments:		
Patient Refunds	$ 1,487.32	
Other		
Total Practice Income	$ 82,735.68	

Monthly Practice Operating Expenses

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DISCOVER THE DIFFERENCE

CREATE

DESIGN

- Autogenesis™ customizes the proposal to match the proximal central grooves, cusp heights, and marginal ridges
- Multiple design tools available like Rubber Tooth™ which makes the proposal as pliable as rubber
- Design up to 16 restorations simultaneously

CAPTURE

SCAN

- High speed laser captures digital scans without powder
- Three source scanning: intraoral, impressions or models
- Smart Scan Technology (SST) provides feedback on scanner motion for sharper models

COMPLETE

MILL

- Customized milling paths for optimal performance and restoration integrity
- Patented automatic tool changer automatically detects and replaces worn or broken burs
- Robust, heavy-duty design reduces vibration for high level precision and material performance

The E4D Dentist chairside CAD CAM system offers improved profitability, complete restorative control, and enhanced patient convenience using powder-free laser based scanning, intuitive design and precision milling – all in your office.

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E4D chairside CAD/CAM restorations: Case presentations and lessons learned

Author_Wally Renne, DMD

_c.e. credit part 1

This article qualifies for C.E. credit. To take the C.E. quiz, log on to *www.dtstudyclub.com*. The quiz will be available on Aug. 3.

_Despite the increasing popularity of the current CAD/CAM laboratory systems and continuing technical advances, some clinicians have remained reluctant to incorporate the very same CAD/CAM techniques into their clinical chairside practices. Two often-repeated misconceptions relate to the perceived lack of strength and lack of esthetics of the ceramics available for use with these systems.

A wide variety of materials are available to use with the E4D Dentist System™ (D4D Technologies), and each has a separate set of esthetic and mechanical properties that must be considered. This article will review current materials and show clinical examples of restorations made using the E4D Dentist System.

One distinct advantage of chairside CAD/CAM is having the ability to make restorations in a single visit from a solid pre-manufactured block that is essentially flawless in construction. A pre-manufactured block is made in ideal conditions, and as a result, has an ideal density with none of the residual porosity found in many layered or pressed porcelains.

Porosities may act as a weak point and lead to the buildup of internal tensile stress in the ceramic and eventually cause a catastrophic failure. Monolithic restorations have several distinct advantages over layered restorations when it comes to mechanical properties. Layered restorations are often veneered with weak feldspathic glasses that can chip or break, especially if not supported properly by the framework.

Furthermore, one does not need to worry about delamination and micro-chipping of the veneering porcelain, which has been reported to be as high as 25 percent for porcelain-fused-to-zirconium restorations.[1]

IPS Empress® (Ivoclar Vivdent) is a feldspathic glass with approximately 45 percent leucite crystals for dispersion strengthening. The 5 µm leucite crystals improve strength and fracture toughness by acting as "roadblocks" to prevent crack propagation. IPS Empress is an esthetic material and is available in polychromatic blended shades that give the restoration a layered appearance. Empress Multiblock has a flexural strength around 160 MPa and requires isolation and attention to detail when bonding to ensure long-term success.

IPS Empress has been on the market for approximately 24 years, and as a result, good clinical research on the longevity of these restorations exists

Fig. 1_Patient presents with cown missing from tooth #9. (Photos/ Provided by Dr. Wally Renne)

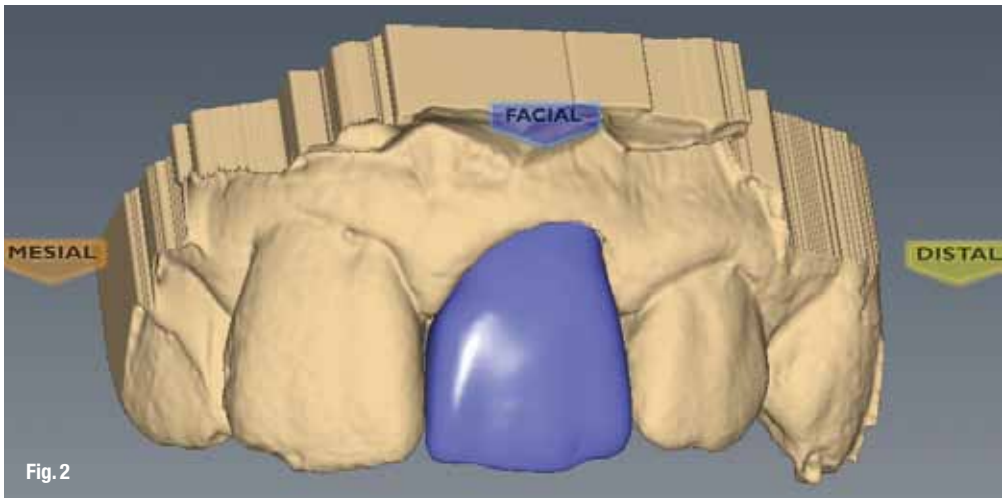

Fig. 2


Fig. 3

Fig. 2_E4D Dentist System is used to take a digital impression, then the restoration is designed using E4D DentaLogic Software.

Fig. 3_An IPS Empress DAC Multi A1 restoration is milled and custom characterized using IPS Empress Universal Stains.

in the literature. A literature review conducted by Brochu and El-Mowafy evaluated and summarized six clinical studies that met their inclusion criteria. They concluded the survival rates for IPS Empress inlays and onlays ranged from 96 percent at 4.5 years to 91 percent at seven years. IPS Empress crowns had a survival rate ranging from 92 percent to 99 percent at three to 3.5 years.

For both crowns and onlays, most failures were due to bulk fracture.[2] In general, IPS Empress has higher failure rates in the posterior than the anterior and higher fracture rates on molars compared with premolars.[3-6] Therefore, IPS Empress is an excellent material choice in the anterior for esthetically demanding patients. However, alternative materials exist for posterior use.

_Case presentation

A new patient called the office and said his crown "exploded." He presented to the clinic with the crown missing on #9 (Fig. 1). The E4D Dentist System was used to make a digital impression of the preparation and the bite registration. Using the intuitive design features in the E4D software, a restoration was designed (Fig. 2). An IPS Empress CAD Multi A1 restoration was milled and characterized using IPS Empress Universal Stains. For delivery, the crown was prepared by etching with 4.9 percent hydrofluoric acid for 60 seconds and silanated for 60 seconds with Monobond-Plus (Ivoclar Vivadent). The tooth was pumiced; Optibond XTR (Kerr) was applied and cured for 20 seconds; and Nexus 3 resin cement (Kerr) was used to bond the crown (Fig. 3).

The use of IPS Empress has been selective partly because of the popularity of IPS e.max® CAD (lithium disilicate). IPS e.max CAD comes in a lithium metasilicate state (blue color) that is not fully crystallized but can be easily machined. The milled restoration is then placed in the oven for 19 to 26 minutes to crystallize the glass. During crystallization, the lithium metasilicate crystals are replaced with lithium disilicate crystals, increasing flexural strength from around 160 MPa to 360 MPa.

IPS e.max was introduced to the market in 2006. Gehrt and colleagues followed 104 IPS e.max crowns in 44 patients and found the corresponding survival rate for all restorations was 97.4 percent after five years and 94.8 percent after eight years of clinical service with location not significantly impacting survival rate.[7] These results were for IPS e.max press restorations that were cut back and veneered. It can be hypothesized that monolithic chairside milled IPS e.max may perform better.

In a 10-year study, kern et. al. found three-unit fixed partial dentures (FPDs) made from monolithic


Fig. 4

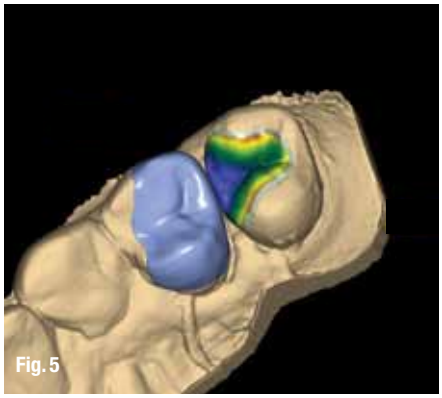
Fig. 5


Fig. 6

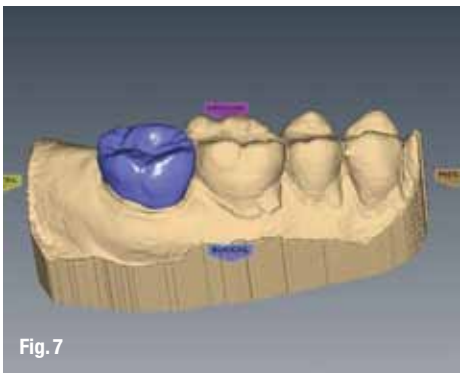
Fig. 7


Fig. 8


Fig. 9

Figs. 4–6_In this case, a patient who was not happy with the esthetics of an amalgam restoration presentsed with recurrent caries on the mesial of tooth #13. The E4D Dentist System was used to make a digital model, and restorations were milled out of IPS e.max CAD HT A2 blocks.

Figs. 7–9_With the strength of IPS e.max, predictable restoration of second molars using the E4D Dentist System is possible.

lithium disilicate ceramic showed five- and 10-year survival and success rates that were similar to those of conventional metal-ceramic FPDs.[8]

They concluded that for the monolithic lithium disilicate FPDs, the calculated survival rate was 100 percent after five years and dropped to 90.8 percent (when considering only catastrophic ceramic fractures) and 87.9 percent (when considering catastrophic ceramic fractures and biological failures) after 10 years.[8] It is interesting to note that all catastrophic failures occurred in molars.[8] Single-unit monolithic IPS e.max can be expected to perform better than FPDs in this study.

Interestingly for both clinical studies mentioned, the restorations that were conventionally cemented performed just as well as those that were bonded.[7,8] Therefore, assuming proper retention and resistance form has been achieved, it is acceptable to conventionally cement monolithic IPS e.max restorations.

Because of the incredible flexural strength of IPS e.max, some clinicians were concerned that IPS e.max may be aggressive on the opposing dentition. In a clinical study, Silva et. al. found IPS e.max to be more gentle on the opposing enamel than feldspathic ceramics with a wear rate on enamel similar to natural definition.[9] Chairside CAD/CAM allows the clinician to predictably provide more conservative restorations, such as IPS e.max inlays and onlays, that have a longevity similar to full coverage crowns.[10] The advantage to onlays over crowns is the conservation of healthy tooth structure and subsequent prolonging of the tooth's life cycle.

Chairside milled onlays are an ideal restoration compared with direct resins. Despite their popularity, large posterior resin-based composite (RBC) restorations last only six to seven years.[11,12] RBC restorations have poor clinical longevity, higher recurrent caries and greater need for replacement compared with the alternative, high-copper amalgam.[13–17]

Amalgam and cast gold are not a popular option for many patients because of esthetic concerns, and an E4D onlay restoration is the ideal treatment for many patients who refuse these alternative treatments. Milled inlays and onlays have been shown to be very successful.

One study found a success rate of 90.4 percent after 10 years with older feldspathic ceramics as well as older milling and design technology.[18]

In this case, the patient was not happy with the esthetics of the amalgam restorations, and she had recurrent caries on the mesial of #13. The E4D Dentist System was used to make a digital model, and the design software proposed well-contoured, anatomical restorations that were milled out of e.max CAD HT A2 blocks. For delivery, the restorations were prepared by etching with 4.9 percent hydrofluoric


Fig. 10


Fig. 11


Fig. 12


Fig. 13

acid for 20 seconds and silanating for 60 seconds with Monobond-Plus (Ivoclar Vivadent). The tooth was pumiced clean; Optibond XTR (Kerr) was applied and cured for 20 seconds; and Nexus 3 resin cement (Kerr) was used (Figs. 4–6).

Despite the benefits of onlays, single-unit crowns are still the preferred restoration for the general dentist, and the E4D Dentist System fabricates excellent restorations with a short learning curve. With the strength of IPS e.max, predictable restoration of second molars using the E4D Dentist System is possible (Figs. 7–9).

Once the learning curve of single-unit restorations is mastered, it will not be long before the benefits of the E4D Dentist System become apparent for more complicated cases. A 37-year-old male presented for a consult for dentures. He had been to several dentists and an immediate denture was the treatment plan he had selected. He presented with severe acid erosion and abrasion from a combination of gastroesophageal reflux disease (GERD) and bruxism (Figs.10, 11).

Occlusal examination revealed a lack of anterior guidance and posterior support. The lateral pterygoids were sensitive to palpation, and upon visual examination it was noted that he had hypertrophic masseters. Lip commissures were folded and he appeared to have a collapsed vertical dimension of occlusion (VDO). He did not close in a repeatable position and had a severe anterior deviation from centric relation.

When evaluating the location of the gingival margins it was determined that compensatory eruption had taken place. However, based on the closest speaking space during the production of sibilant sounds, the patient had excess freeway space.

It was determined that the patient lost vertical dimension of occlusion, and therefore compensatory eruption did not keep up with the rate of erosion. Two centric-relation (CR) records were made using bimanual manipulation, a custom triad jig and a rigid bite material. The case was mounted on a semi-adjustable articular in centric relation and the mounting was verified with the second CR record.

It was decided (based on freeway space, esthetics and phonetics) that to recapture the lost VDO the patient needed to be opened 2.5 mm in the anterior; this correlated to around 1 mm in the posterior. A diagnostic wax-up was made. The teeth were prepared and temporized based on the diagnostic wax-up (Figs. 12, 13). The patient was kept in temporaries for six weeks to verify tolerance of the new vertical dimension, phonetics (particularly "F" and "S" sounds) and CR.

In the provisionals, anterior guidance was established with no balancing interferences during lateral excursive movements. CR was stable and at the end of the six-week trial period the patient was pain-free

Figs. 10, 11_In this case, a 37-year-old male presened with severe acid erosion and abrasion from gastroesophageal reflux disease and bruxism.

Figs. 12, 13_After a diagnostic wax-up was made, the teeth were prepared and temporized.