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CAD/CAM

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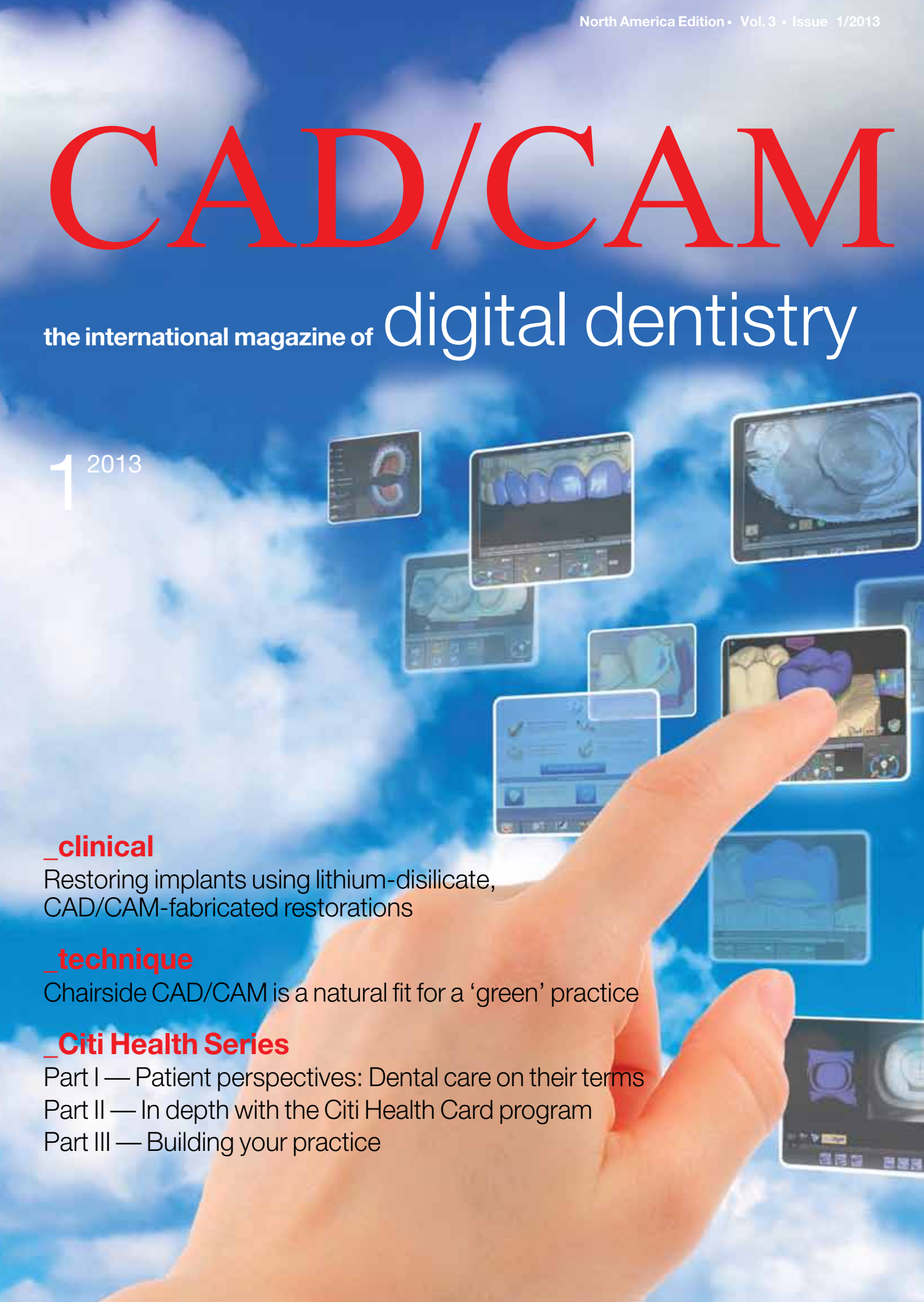
1 2013



_clinical

Restoring implants using lithium-disilicate, CAD/CAM-fabricated restorations

_technique

Chairside CAD/CAM is a natural fit for a 'green' practice

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Generations of digital dentistry

Terence Yacovitch, BSc, DDS

_2013 should prove to be another key year in the digital dentistry arena. With more and more digital dental technologies emerging and existing ones expanding capabilities, progressive and business-minded dental professionals will be able to work in a virtual world, designing world-class restorations with a myriad of ceramic and alternative materials.

In the 1980s, we were one of the first offices in Canada to adopt an intraoral camera and print system — we have never looked back. It forever changed how we inform, educate and treat our family of patients. Reflecting on how we toiled without the digital tools available today, my associates and I wonder: How did we do it?

In 2003, we purchased the only chairside CAD/CAM system available, taking delivery of the second unit in Quebec. Ceramic and restorative protocol in our office changed dramatically. The one-appointment restorative ceramic world was now available to our patients.

The learning curve was not difficult at all. As a student at McGill University's faculty of dentistry in the 1970s, I was part of the generation of dental students who did their own wax-ups, castings, porcelain stacking, staining/glazing, etc. When it came to CAD/CAM designing, staining and characterizing, the integration was both painless and seamless.

I've welcomed another generation of dentists into my practice: my daughter, a recent McGill graduate who has been in the world of digital radiography and record keeping from the start of her training. The hurdles that so many of us have had to overcome in adapting to new technologies have never been an issue for her. Working in the same practice with this new generation practitioner-daughter has been a wonderful experience. Her education provided her with a deep understanding of the physiology, anatomy and biochemistry of the human system. This took decades of continuing education on my part in my own quest for more understanding in these areas. The harmonizing of anatomy and physiology with restorative principles has been the cornerstone of our clinical success. It is amazing to think that many among this new generation of dentists will utilize digital technology on every patient, every day and never know dentistry without it.

There is no doubt that the digital age has transformed the techniques and protocols that we use in dentistry today. Everything is so much easier and faster. From using the intraoral camera for education and documentation, to the advancement of digital radiography, to the ability to "flash" treatment recommendations to patients and their insurance providers in an instant, our ability to use technology at such a high level makes us scratch our heads and wonder how we endured the endless hours spent performing these tasks in the past.

Computerized scheduling and billings, Websites, LED curing lights, lasers, piezo scalers, electric handpieces, endodontic apex locators, Invisalign and the emergence of 3-D imaging ... the revolution is truly amazing. As we look ahead we can only wonder: How far can it go for the next generation of dentists?

Technology has now enabled my practice to provide a very high level of patient care with treatments that were previously referred out to select specialists at a very high level of patient care. The potential of orthodontic treatment and solutions with invisible braces is infinite. Our in-office implant placement using conservative, flapless surgery principles has been a success. Our patients appreciate us taking care of them from start to finish! They tell us so routinely.

I'm again stepping into a new generation of chairside CAD/CAM with the E4D system, which provides powder-free scanning, intuitive software, first-class customer support and education, and I look forward to all that another new technology will bring to me, my family and my patients. Life and dentistry just keep getting better and better, generation after generation.

Terence Yacovitch, BSc, DDS
Montreal, Quebec


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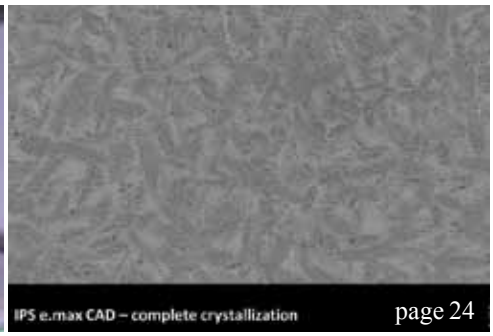

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on the cover

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Stress-free (really!) resin nano ceramic veneers

Author_Tony Soileau, DDS


Fig. 1


Fig. 2


Fig. 3

Fig. 1_Pre-operative. (Photos/Provided by Dr. Tony Soileau)

Fig. 2_Wax-up.

Fig. 3_Initial prep with coarse diamond.

_Many patients would love to have a captivating smile that is both straight and white. Orthodontic treatment is of course one option to achieve this, but many patients would prefer not to wear braces on their teeth or wait months for the results.

As far as achieving that bright, white smile, bleaching only gives minimal results for some patients. Therefore, an alternative option in many of these cases is porcelain veneers, but as we know, this treatment can be too costly for many patients.

This leaves composite veneers as the next choice. However, dentists often ignore this option for a variety of reasons. It is difficult to obtain the skill level and master the technique to create composite veneers that match the esthetics of porcelain.

Layered composite veneers pose a number of challenges: bubbles incorporated into the layers, difficult contacts, uneven shading with layers and achieving a high luster in the mouth, just to name a few.

While these challenges can be overcome, the process takes time. If it takes a dentist half of a workday to create eight composite veneers, then he must charge half his daily production goal to be profitable. Additionally, future adjustment and repair appointments must also be taken into consideration.

_A new alternative

3M ESPE has recently introduced a new restorative material that eliminates many of the barriers to creating affordable, esthetic veneers, in addition to crowns, inlays and onlays. 3M™ ESPE™ Lava™ Ultimate restorative is a new class of CAD/CAM material that offers a fast, no-firing process. 3M ESPE has created this material, a resin nano ceramic, based on its expertise in both ceramics and nanotechnology, and it consists of a blend of approximately 80 percent nanoceramic particles embedded in a highly cured resin matrix.

With this technology, the material maintains its outstanding polish over the long term, provides excellent wear resistance and has stain resistance for color stability. Additionally, the blocks are easy to mill, helping maximize the productivity of the E4D

system. Once milled, the restorations can be polished in just a few minutes, with no additional firing step necessary. Once in the mouth, the material can also be easily adjusted and repaired with composite, allowing dentists to build up and reseal restorations.

The restorative is available in eight shades, including four shades that are offered in both high and low translucencies. With these choices, dentists have plenty of options for achieving natural esthetics.

3M ESPE is offering this material with a 10-year warranty, a strong testament to its resiliency in the mouth. The restorative is incredibly durable and shock absorbent, and in fact is an ideal choice for implant-supported restorations, thanks to its high flexural strength and low wear. These properties help reduce stress to the implant.

In terms of veneers, the use of this resin nano ceramic material eliminates many of the challenges outlined above. The material is uniform in color with no voids to contend with and produces a polish that is close, if not equal to, glazed porcelain. The anatomy, incisal edge position, interproximal contacts and polish are all completed prior to the patient coming to the office.

With these attributes, Lava Ultimate restorative is an attractive material for bringing greater efficiency to veneer treatment and simplifying the process, resulting in a more affordable smile makeover material for patients. The following case will demonstrate these benefits.

_Case report

A female patient with a career in the public eye came to the office desiring a new, fuller smile with longer teeth (Fig. 1). The patient stated that she wanted her smile to be slightly whiter but still very natural. Given these requests, porcelain veneers were the first treatment discussed with the patient. However, this option was too costly, so after discussing the pros and cons, Lava Ultimate restorative veneers were chosen as the best option.

Shade BL1 was selected, and esthetic expectations were discussed with the patient (Fig. 2). Impressions were taken, and a wax-up was developed by the clinician and approved by the patient (Fig. 3) .

At the preparation appointment, only topical anesthetic was used for retraction cord placement. The cord (Ultrapak 000, Ultradent) was placed using a hemostatic agent (ViscoStat Clear, Ultradent) as a lubricant. By placing cord at the beginning of the appointment, adequate time was ensured for proper retraction.

The teeth were minimally prepped with coarse and fine diamonds (856LC and 856LF diamond burs, Axis Dental) and the existing composite was removed (Fig. 4). Diamond strips (Perforated Diamond Finishing Strips Medium Grit, Axis Dental) were used to slightly break the contact between the teeth to facilitate increased accuracy of the impression (Fig. 5). The strip was only placed through the contact once to avoide creating an "open contact." The minimal preps were then rinsed and inspected.

Impressions were taken using 3M ESPE Imprint™ 3 VPS Impression Material, and temporaries were placed (Luxatemp Fluorescence, Zenith Dental) utilizing a matrix made from the wax-up (Fig. 6). The flash


Fig. 4


Fig. 5

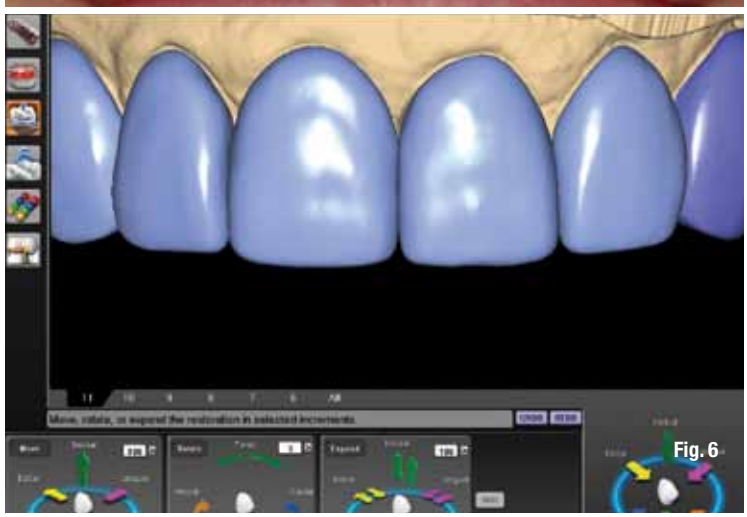
Fig. 6

Fig. 4_Breaking contacts with diamond strip.

Fig. 5_Temporaries after removal of matrix before polishing.

Fig. 6_Lava Ultimate restorative veneers designed on E4D software.


Fig. 7


Fig. 8


Fig. 9

Fig. 7_Lava Ultimate restorative veneers milled out.

Fig. 8_Lava Ultimate restorative veneers seated on model before contact adjustments.

Fig. 9_Etchant applied in spot and spread over prep.

was cleaned up using 12 fluted carbide burs (TDF-9UF finishing carbide, Axis Dental) and polished with diamond paste (Zircon-Brite, DVA). Using a smooth wax up and well-made matrix helps ensure very little clean up.

The temporaries were then evaluated over several weeks to ensure the new length would be compatible with the patient's occlusion. The impression was then scanned using the E4D system (Fig. 7). The Lava Ultimate restorative veneers were designed and milled out of shade BL1 (Fig. 8). The veneers were then removed from the block with diamond disk (D805EF-160 Diamond Disk, Axis Dental) and the sprue removed with heatless stone wheels (GF703-HP100 stone wheel, Axis Dental).

The veneers were tried on a stone model for accuracy of fit and contacts (Fig. 9). Each veneer was individually shaped, anatomy developed (M842R-018HP lab diamond, Axis Dental), and smoothed (P344 Ceraglaze pre polisher, Axis Dental). The veneers were then polished to a glaze shine using a diamond paste (Zircon-Brite DVA) and Robinson wheels. Lava Ultimate restorative polishes to a very high luster compared to traditional layered composite.

At the seating appointment, the veneers were tried in and approved by the patient. The teeth were etched for 15 seconds (Ultra-Etch, Ultradent), rinsed, primed (Optibond Solo Plus, Kerr) and cured for 10 seconds each (Fig. 9). Etchant was applied in a small dot and then spread with a quick tip to ensure adequate coverage.

A tongue and bite block was used during this step; if the patient's swallow proved to contaminate the teeth with saliva during the cementation process, a rubber dam would have been used.

A layer of bonding agent (Optibond Solo Plus, Kerr) was applied to the internal surface of each veneer and cured for three seconds. Resin cement (NX 3, Kerr) was loaded into the veneers, which were then seated on the tooth, beginning with the centrals and then working outward until all veneers were seated.

The excess cement on the facial and lingual surfaces was then removed with cotton rolls and the veneers inspected for proper seating. The cement was spot cured for three seconds on each tooth. The excess cement was then removed from between the teeth with floss and a scalpel. The veneers were cured for 20 seconds each to fully cure the cement.

Finishing burs (TDF-9UF finishing carbide, Axis Dental) were then used to remove the remaining cement, refine the margins and adjust the occlusion (Fig. 10). Postoperative photos were taken completely dry to show the true polish (Figs. 11, 12). Note the addition of the two veneers on the first premolars. The patient was so pleased with the result of the original six veneers that she returned for two more veneers to further fill out her smile!

_Conclusion

For many years, the available restorative options for veneer treatments were expensive, technique sensitive, time intensive or a combination of all of these. This has likely resulted in many patients delaying or declining treatment, resulting in lost opportunities for practices and patients remaining unhappy with their smiles.

With the introduction of any new restorative


Fig. 10


Fig. 11


Fig. 12

Fig. 10_Removing excess cured cement and refining margins.

Fig. 11_Postoperative photo on dry teeth demonstrates the high polish.

Fig. 12_The patient was so satisfied with the original six veneers that she requested an additional two veneers to complete her smile.

material, E4D users must carefully evaluate its potential for fitting into the practice in an efficient and productive way.

This case of veneer treatment with Lava Ultimate restorative provides a helpful example of how the right restorative material can fit the unmet needs of patients and dentists. The use of Lava Ultimate restorative allows composite veneers to be stress free and profitable for the dental team, as well as affordable and attractive for the average patient.

This case took only one and a half hours of my time. Thirty minutes were spent prepping the teeth and one hour was spent to cement all eight veneers. The rest of the work was completed by my dental team. This means the case was not only stress-free, but very profitable for the practice.

The result for the patient was a new smile that was much more satisfying, made with a material that has the durability to continue looking beautiful and lifelike for many years.

Veneer treatment is only one of several indications for Lava Ultimate restorative. It is also very useful in treatments for crowns, inlays and onlays, and the fact that it can be repaired intraorally with composite makes it an attractive alternative to many less flexible milling materials.

The fast milling, no-firing process for Lava Ultimate restorative makes it a natural fit for maximizing productivity with E4D systems, and the material's great polish and durability mean that no esthetic trade-offs are necessary. E4D dentists now have a versatile, strong, beautiful material that is a natural fit for meeting their productivity goals._

_about the author

Tony Soileau, DDS, is a general dentist from Lafayette, La. His practice focuses on restorative rehabilitation and cosmetic enhancements, and he graduated from LSU School of Dentistry in New Orleans in 1994. He has been president of his local dental society and is an associate professor at LSU School of Dentistry. He has been a faculty member of the Institute of Oral Art and Design (IOAD) in Tampa, Fla., and the Pacific Aesthetic Continuum (PAC~Live) in San Francisco. He is a member of the ADDA, LDA, ADA, AGD, AACD and has fellowship in the Academy of Comprehensive Esthetics. He has published more than 50 articles on esthetic dentistry as well as incorporating technology into a general dentistry practice in leading dental journals. Soileau has been an Eco Member tester for E4D since 2006 and has more than 5,000 restorations cemented. He has restored his patients with porcelain and composite veneers, full- and partial-coverage crowns, inlays/onlays, as well as full-mouth rehabilitation, all with the use of the E4D system. You may contact him at *tony@smilesbysoileau.com*.

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Restoring implants using lithium-disilicate, CAD/CAM-fabricated restorations

Author_Walter G. Renee, DMD

_Today's consumers are always searching for the ultimate bargain, even when it comes to their dental care. They want high-quality results and minimally invasive treatments. The majority of modern dental procedures and techniques are trending toward satisfying these demands.

As a result, CAD/CAM technology has been incorporated into an increasing number of dental procedures, enabling dentists and their teams to offer state-of-the-art care to patients in half the time of traditional methods.

Moreover, when it comes to implant-supported restorations, CAD/CAM technology efficiently and effectively produces restorations that demonstrate high-strength properties for durable, long-lasting results that can withstand implant forces.

Research has shown that esthetic, ceramic, CAD/CAM-fabricated molar crowns supported by implants gained high strength values when used in conjunction with adhesive cements, particularly in cases with titanium and zirconia implant abutments.[1,2]

One of the most challenging aspects of a restorative case, however, is matching the abutment, restoration and adjacent dentition in perfect harmony. This is especially difficult with single-unit restoration cases because human dentition exhibits different colors, shades, tones and hues. It never presents one simple color found on the standard shade guide.

Yet, using highly esthetic lithium-disilicate value blocks (IPS e.max CAD, Ivoclar Vivadent, Amherst, N.Y.) milled in the E4D in-office CAD/CAM system, dentists can create restorations that are durable, strong and indistinguishable from surrounding dentition, facilitating the highest level of esthetics and function.

_Material selection/fabrication

The E4D in-office CAD/CAM system enables clinicians to design, fabricate and place first-rate esthetic restorations in a single visit. The high-quality ceramic restorations also demonstrate excellent strength, fit and longevity suitable for a broad range of indications and contribute to predictable outcomes.[3,4]

Among the benefits of utilizing the E4D in-office CAD/CAM system to design and fabricate lithium-disilicate restorations is the ability to capture state-of-the-art, powder-free digital impressions. These

Fig. 1_Patient presented with retained primary molars A and J. (Photos/Provided by Dr. Walter J. Renee)

Fig. 2_Pre-operative right buccal view of retained primary molars A and J.


Fig. 3

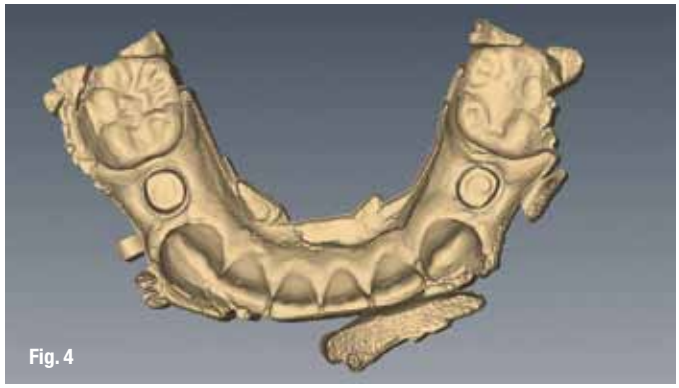
Fig. 4

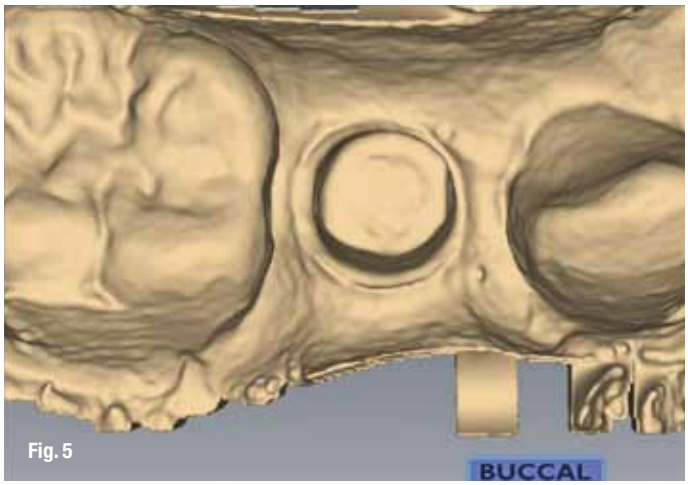

Fig. 5

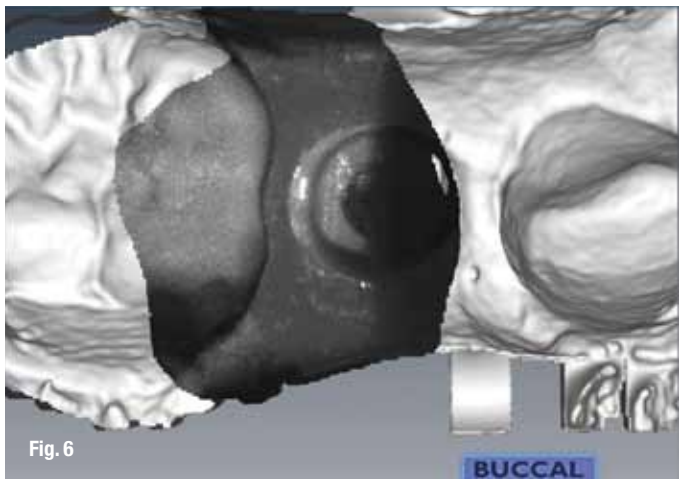

Fig. 6

Fig. 3_Pre-operative mesial view of retained primary molars A and J.

Fig. 4_The zirconium abutments (Astra OsseoSpeed, Dentsply) were placed and scanned using the E4D intraoral scanner.

Fig. 5_The zirconium abutment margins were marked in the buccal area.

Fig. 6_Viewing zirconium in subgingival locations was simplified using the E4D ICE system.

can be taken from multiple angles for customized accuracy and optimal efficiency. Additionally, both hard and soft tissues can be scanned, depending on the case.

Preparation and margin assessment are completed simultaneously, and high-tech software fabricates multiple digital models at once. If needed, sculpting tools facilitate corrections by reimaging, eliminating the need for constructing multiple models or placing temporaries.

During the milling process, the unit's robust design minimizes vibrations, resulting in micron-precise accuracy for enhanced fit and function of the final restoration.[4]

As dental practices have moved toward in-office CAD/CAM, innovative ceramic materials have been developed that address material issues regarding strength and esthetics. These new and improved ceramics are designed to endure CAD/CAM processing without chipping or fracturing. They can be milled to full contour for improved fit and function.[5]

For example, there are many advantages to placing monolithic lithium-disilicate restorations (IPS e.max CAD). These restorations exhibit the same structural and esthetic properties of ceramic, yet demonstrate high-strength resistance to long-term mastication forces.[4] They also blend seamlessly with natural dentition.

Additionally, these restorations are indicated for full-coverage posterior and anterior crowns, although the material itself may be milled for cases requiring thin veneers, minimally invasive inlays and onlays, partial crowns, implant superstructures and three-unit bridges.[5,6]

Research shows that restorations fabricated with CAD/CAM perform better and are more durable compared to other available restorative options.[4] The lithium-disilicate crystals in the IPS e.max material, in particular, deflect, branch or blunt cracks, increasing the flexural and overall strength of the material to a range of 360 to 400 MPA.[3]

These high-strength characteristics, capacity for milling to full-contour and placement with adhesive bonding or conventional cementation render IPS e.max CAD monolithic restorations practical for restoring in-office implant restorations.[4] Additionally, a strong bond between the restoration and underlying tooth substrates can be achieved.[5]

_Case presentation

A 28-year-old patient presented with retained primary molars A and J (Figs. 1–3). These would be extracted and replaced with implant-supported crown restorations fabricated in-office using the E4D CAD/CAM system and a lithium-disilicate (IPS e.max CAD)

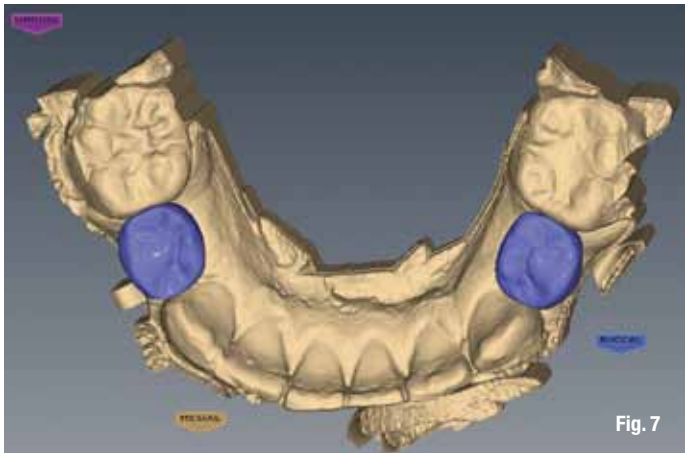
Fig. 7

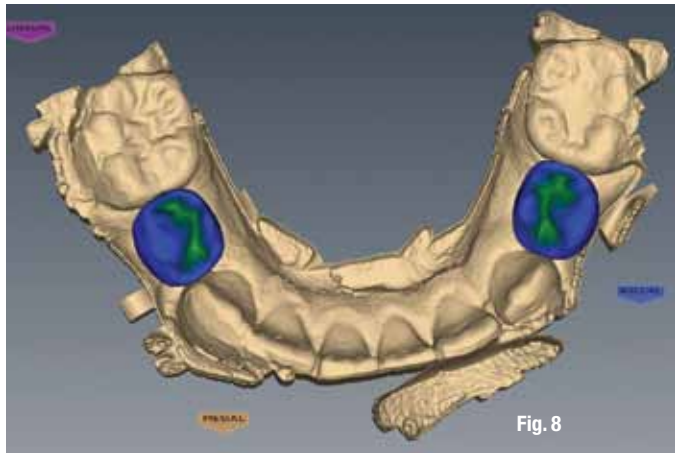
Fig. 8

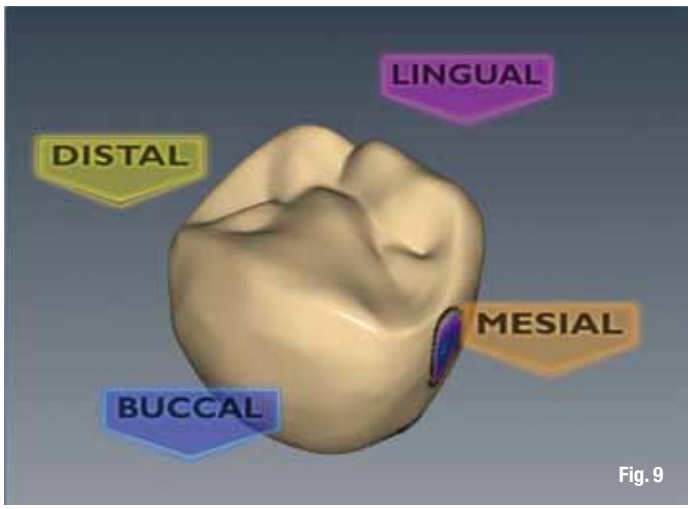

Fig. 9

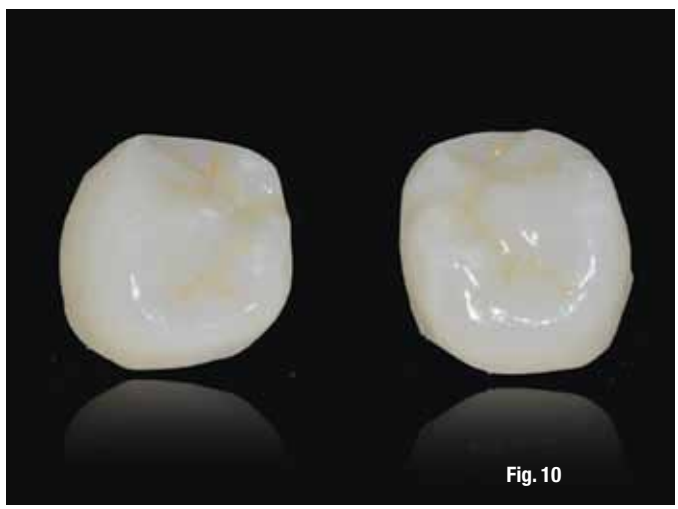
Fig. 10

material. The Value 1 Impulse blocks were selected because they are ideal for implant crowns, providing the ideal level of translucency.

Implants were placed and the patient was provided with zirconium abutments (Astra OsseoSpeed, Dentsply). To fabricate the crown restorations, the abutments were scanned using the E4D intraoral scanner (Fig. 4), and the zirconium abutment margins were marked (Fig. 5). The E4D ICE software enabled easy viewing of the zirconium margins in subgingival locations (Fig. 6).

The E4D design software was used to virtually create the lithium-disilicate crown restorations for the two premolars (Fig. 7). The software also enabled verification of material thickness (Fig. 8). In particular, the E4D Autogenesis software was used to create ideal tooth anatomy and contours, with the buccal area 2 mm thick and the distal area 1.5 mm thick, which was perfect for the lithium disilicate (IPS e.max CAD) material (Fig. 9).

The Value 1 Impulse blocks (IPS e.max) were milled and fired in one cycle, resulting in highly esthetic and monolithic crown restorations (Fig. 10).

The implant screw access canals were sealed using a provisional inlay material (Systemp.inlay, Ivoclar Vivadent). To prepare the lithium-disilicate crowns for placement, the internal aspects were etched with 5 percent hydrofluoric acid (IPS® Ceramic Etching Gel) for 20 seconds, then rinsed and dried.

Then, a silane primer (Monobond Plus) was placed inside the crowns for 60 seconds and also on the zirconium abutments as a zirconium primer for 60 seconds, using the phosphoric acid methacrylate and sulfide methacrylate to bond to zirconium. The restorations were then cemented using a universal resin cement, without primers (Multilink, Ivoclar Vivadent).

_Conclusion

IPS e.max CAD restorations provide predictable results for restoring implants (Figs. 11–14). The Value Impulse blocks lend to the creation of restorations that blend seamlessly with the adjacent natural dentition, yet they provide the ideal level of translucency to mask zirconium abutments.

In this case, the patient was pleased with the natural looking treatment results that were achieved by combining the IPS e.max CAD material with E4D in-office fabrication technology._

Fig. 7_Image of the final restoration design proposed by the E4D design software for milling using lithium-disilicate material.

Fig. 8_The restoration's material thickness was verified using the E4D Autogenesis software. The blue areas equaled 2 mm and the green 1.5 mm, which was ideal for the selected IPS e.max CAD lithium disilicate material.

Fig. 9_The E4D Autogenesis software resulted in appropriate anatomical contours.

Fig. 10_The IPS e.max CAD Value 1 Impulse blocks were milled and fired in one cycle, producing highly esthetic monolithic crown restorations.

Fig. 11_Postoperative view of the milled restorations.

Fig. 12_Postoperative facial view of the completed restorations.

Fig. 13_Postoperative view of the final monolithic crowns on the abutments to replace the retained primary teeth A and J.

Fig. 14_Postoperative close-up view demonstrating the excellent color, function and esthetic properties of the Value 1 Impulse block. The monolithic crowns seamlessly match surrounding dentition and blend with perfect translucency to mask the underlying zirconium.


Fig. 11


Fig. 12


Fig. 13


Fig. 14

_References

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_about the author

CAD/CAM

Walter G. Renne, DMD, is a 2003 graduate of the College of Charleston and a 2008 graduate of the Medical University of South Carolina College of Dental Medicine. He is active in undergraduate dental education and holds a full time faculty position in the Department of Oral Rehabilitation at MUSC. He is the course director for CAD/CAM technologies and ceramics and runs the E4D CAD/CAM clinic at MUSC. Renne maintains an active general dentistry practice utilizing both the CEREC AC and E4D systems. His special interests in patient treatment include advances in CAD/CAM dentistry, adhesive dentistry and conservative dentistry. He is active in dental research and currently has a patent pending for a new dental adhesive that is permanently antimicrobial in addition to having revolutionary bond durability components that prevent enzyme degradation of the hybrid layer. This bonding agent may prevent recurrent caries and bond breakdown in the long term. You may contact Renne at *renne@musc.edu.*

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Chairside CAD/CAM is a natural fit for a 'green' practice

Author_Lance Panarello, DMD

_The world of dentistry is rapidly changing. After graduating in 1997, I joined my father, Dr. Chris Panarello, in practice and quickly realized that new technologies and materials were propelling dentistry forward. It was clear to me that I needed to be at the forefront of these changes to be successful. Tooth-colored composites, veneers, whitening, implants and rotary endo were just some of the new clinical advances.

Technology was, and remains, a big part of the challenges confronting us. Implementing clinical and technological advances over the last 16 years has seen our practice grow, serving thousands of new patients and increasing production fifteen fold. Our blessing is the result of three basic commitments: service, clinical advances within the practice and the integration of technology.

Through the years our practice has adopted a wide variety of technologies, including lasers, electric handpieces, digital X-rays, i-CAT, and most recently, the E4D Dentist System™ (D4D Technologies) chairside CAD/CAM. These investments are hugely important to both patients and team members.

The team becomes energized because they want to work in a technologically advanced practice, not a dinosaur reserve. They are truly happy and will talk about the new advancements all day long, inspiring patients who will refer family, friends and work colleagues. Happy team = happy patients = practice success!

Why is our patients' experience so important to us? Simply stated, relating to our patients is the foundation of the practice. This is instilled in our "4 minute rule," which is applied to every patient: take time to speak to and know your patient before anything else.

This overriding concern for both our team and our patients manifests itself in our "green practice" culture. With 32 staff members treating upwards of 100 patients daily, we recognized the important benefits of creating a healthy, eco-friendly practice environment.

In 2008, our dream of a green practice became a reality and we introduced the first truly green dental building in the United States. No pun intended, E4D was a natural fit for the patients and clinical team at Dental Health Care Associates.

Adding technology is great, but it needs to be implemented. With four dentists and a large staff, we needed to ensure seamless integration of the E4D system to harness its awesome versatility. Whether it's same-day crowns or more complex cases requiring a second appointment, the result is more patient options and better patient care. The two cases that follow fully illustrate this concept.

_Case No. 1: IPS e.max restorative

The first case was an older implant case from 2004. A 34-year-old male presented with a traditional porcelain-fused-to-metal (PFM) crown on tooth number #8. The mesial lingual porcelain fractured, making the tooth cosmetically undesirable (Fig. 1). The patient wanted it replaced on a Friday for a family event that weekend. E4D provided a perfect option. The patient was anesthetized and the old PFM crown was removed using a Two Striper® 767.9C diamond from Premier Dental.

To optimize E4D dentistry, I chose complementary products that increase my speed and efficiency. Quality cutting instruments and rotary polishing systems save time and reduce patient trauma. Regarding material selection, IPS e.max CAD material shade A1


Fig. 1

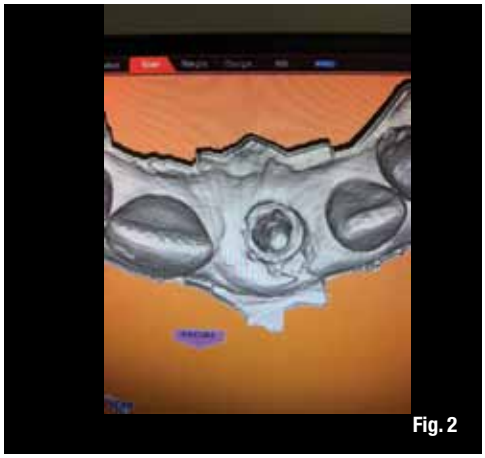
Fig. 2


Fig. 3

C14 was chosen for strength, esthetics and longevity.

This was an older generation implant placement (the technique was to over-sink), thus a direct scan or impression scan would be tough with the collar 5–7 mm below the tissue. As a result, an impression coping was placed on the Strauman implant and the impression captured was scanned (Fig. 2). The bite was scanned intraorally.

After the impression was scanned, the block was selected, margin defined and the design completed. After discussing the pre-op photo, the designer and I decided on a final shape that would minimize the unsightly black triangle.

Because the patient could not afford to redo #9, we had a challenging dilemma. Not only could the ideal cosmetic contours be difficult to obtain, but also matching a PFM to an all-ceramic was also problematic. The block was loaded in the E4D mill, where the Two Striper® milling diamonds produce a smooth, anatomically correct restoration.

After firing, the crown was tried in. The occlusion was adjusted, and some facial contours and line angles were reshaped to narrow the appearance of #8.

Because the patient was unable to afford to veneer #7 and #10, our goal was to shrink the look to manage the anterior size and spacing properly. This is a real-world case utilizing the versatility of E4D where a full smile enhancement treatment plan is not an option.

It further illustrates the hurdles that need to be overcome on a daily basis. There was also loss of papilla between #8 and #9. The black triangle was unable to be fully cosmetically corrected because of economics. Tight gingival contact would have resulted in an overly wide tooth, so an improvement in the space could be corrected.

Cementation was done using Monobond Plus (Ivoclar Vivadent) and MultiLink (Ivoclar Vivadent). Excess cement was removed and the restoration was cured 10 seconds buccal, lingual and occlusal with a Bluephase (Ivoclar Vivadent) curing light. Finally, the restoration was polished using Premier's Diamond Twist SCO™ single-paste, single-step system intraorally (Fig. 3).

With time of the essence, the rotary polished IPS e.max worked best for this patient. How often do you need to adjust after you have cemented? The patient sits up and says, "I think it needs one more adjustment," which usually happens throughout the course of a week.

The final polish that was achieved was outstanding (Fig. 4). Less than one minute to complete a high luster and no firing to reglaze. Wow, start to finish in less than 1 hour and 20 minutes!

Once the gingiva has had a few weeks to adapt to the new restoration, a Biolase laser will be used to recontour the gingiva to match the profile of #9. There was some tissue collapse since the porcelain was missing on the previous restoration. In addition, sending the patient off to a rehearsal dinner with bleeding/red gingiva is not a great practice builder.

_Case No. 2: Lava Ultimate restorative

The next case further demonstrates the importance of a dental technology that accommodates today's busy professional patient population. The patient was a 44-year-old radio show host at a major area station and sports writer for the local professional basketball team.

You will notice number #15 is fractured and is going to be extracted later in the visit and replaced with an implant in the future. The extraction will come after the crown on #13 is completed.

His demanding schedule leaves us with very few appointment opportunities. Material selection in this case was largely driven by the time constraints, so we discussed and selected Lava Ultimate shade

Case No. 1_Figs. 1–3

(Photos/Provided by Dr. Lance Panarello)

Case No. 2_ Figs. 4, 5


Fig. 4

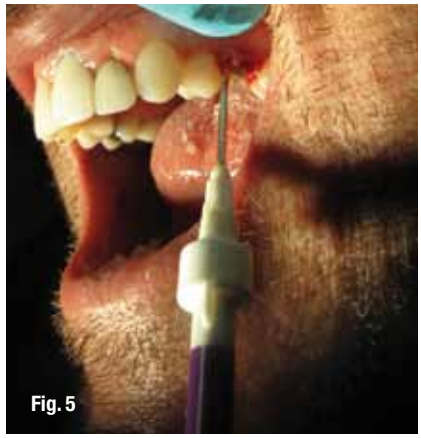
Fig. 5

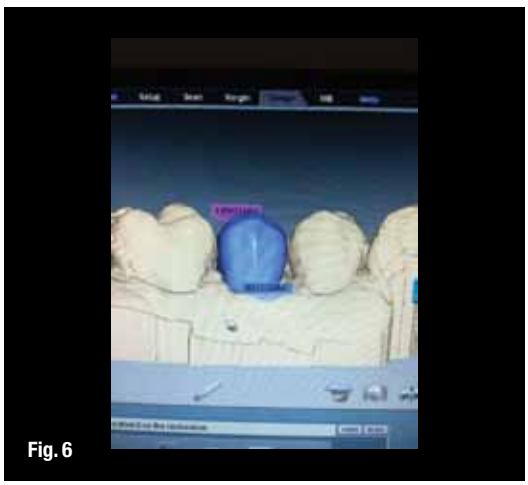
Fig. 6

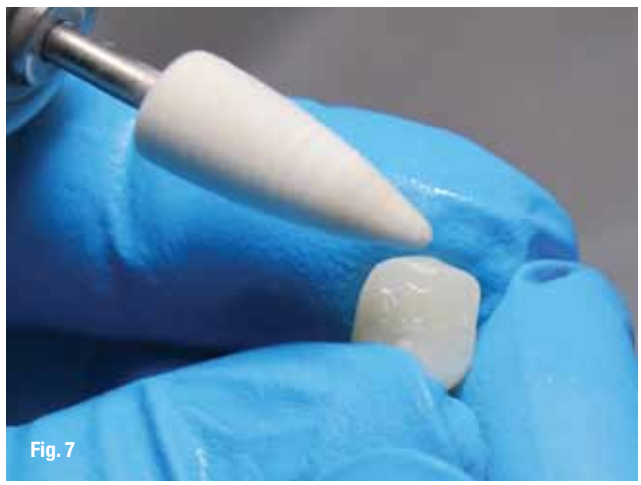
Fig. 7


Fig. 8

Editorial note: Crown designs completed by Krystina Atene, EFDA, and Carina Powers, EFDA, CDA.

B1 14L. This relatively new material mills faster, does not require crystallization firing and can be quickly adjusted and polished.

Thankfully, the E4D System offers a variety of top notch materials that fit different cases without compromising on strength and aesthetics. Tooth #13 had large carious lesions into the nerve that required root canal therapy. Upon completion of the root canal, a build-up was performed using Filtek 250 (3M ESPE) and SE Bond (Kuraray Dental). The preparation was performed with my go-to Two Striper diamond.

After completion of the preparation, the bleeding was controlled with Premier's Traxodent® Hemodent® Paste Retraction System placed in a cotton impression coping and held in place for one minute (Fig. 5).

The area was rinsed and dried. A final impression was taken with quickset Discus putty and 3M ESPE Imprint light body wash in a quadrant Premier Triple Tray.

As this was clearly a very complex restorative case (root canal, build up, crown, extraction) already constrained by time, and the fact that our E4D scanner was in use in another operatory, we could not do an intraoral scan. The 12 block was chosen, margin

defined, design completed and sent off to the mill (Fig. 6).

After try in and minor adjustment, the restoration was polished using the one-step Diamond Twist SCL™ Extra-Oral Polishing system (Fig. 7). The restoration was prepared and cemented according to the directions of 3M Rely X Unicem (Fig. 8).

Upon completion of clean-up, tooth #15 was extracted. Our very appreciative patient could now go home, get some rest and return to the studio in a few hours to give a plug to his favorite dental team who made his beautiful new tooth the same day!

_Conclusion

E4D dentistry provides more treatment options with excellent restorative materials to make more patients happy and comfortable. That fits perfectly with our green practice office that makes the entire staff of Dental Health Care Associates and all of our patients enjoy their experience here each day.

The purpose of this article was to demonstrate how complex a day in dentistry can be and how available technologies and a great staff influence it significantly. Everyday technology and efficiency can be used to make the impossible possible. This is not the dentistry I was doing five years ago.

Find a way to make technology a natural fit in your office. Dentistry keeps evolving, do you?

The ability to choose different ceramic materials, prep and polish to a high level in different situations using E4D CAD/CAM technology has helped to make dentistry just plain awesome._

_about the author

CAD/CAM

Lance Panarello, DMD, is a 1997 graduate of Temple University School of Dentistry. He is currently a partner in private practice, at Dental Health Care Associates (the first green dental building in the United States). He is a member of the AGD, ADA and AAFE. He is a speaker on efficiency, technology, productivity and building green. He is the co-owner of The Elite Dental Institute, a consulting company for efficiency, excellence and experience. You may contact Panarello at *meangreen machine4@yahoo.com.*

CAD/CAM dentistry and the laboratory technician: Partners in success

Author_Lee Culp, CDT/CTO, MicroDental Laboratories

_The concept of digital dentistry is one that started out small and has progressively increased in momentum until its boundaries appear to have become endless. New technologies in dentistry will only be successful if they are combined with a complete understanding of basic comprehensive dentistry. While new technology and computerization can make procedures more efficient, less labor-intensive and more consistent, it will not replace education, practical experience and clinical/technical judgment.

The most exciting factor surrounding these technologies is not, however, only in the potential applications of the technology that are being hypothesized by dental professionals. The excitement truly lies in the fact that these "hypothetical" applications are currently being developed today, and some are even in the final stages.

In a relatively short time period, distal technology will revolutionize the quality of dental care that is being delivered in modern practice. Implants are now well documented for fulfilling the functional requirements in prosthetic tooth replacement. These new technologies, along with the evolution of surgical and prosthetic techniques, allow the dental team predictable, consistent results in implant rehabilitation. Microdental is involved as a beta test area for many of these emerging technologies.

As dentistry evolves into the digital world, the successful incorporation of computerization and new technology will continue to provide more efficient methods of communication and fabrication, while at the same time retaining the individual creativity and artistry of the skilled dentist and dental technician. The utilization of new technology will be enhanced by a close cooperation and working relationship of the dentist/technician team.

The evolution from hand waxing to "digital waxing" using the diagnostic wax-up and provisional restorations, as well as their digital replicas to guide us in the creation of CAD/CAM restorations, will be presented. The utilization of these new technologies, along with the evolution from "hand" design to "digital" design – with the addition of the latest developments in intra-oral laser scanning, materials and computer milling/printing technology – will only enhance the close cooperation and working relationship of the dentist/dental laboratory team (Fig. 1).

The dental laboratory's primary role in restorative

(Photos/Provided by Lee Culp, CDT/CTO)

Fig. 1

Fig. 2


Fig. 3


Fig. 4

dentistry is to perfectly copy all of the functional and esthetic parameters that have been defined by the dentist into a restorative solution. Throughout the entire restorative process, from the initial patient consultation, diagnosis and treatment planning to final restoration placement, the communication routes between the dentist and the laboratory technician require a complete transfer of information.

Functional components, occlusal parameters, phonetics and esthetic requirements are just some of the essential types of information that are necessary for the technician to complete the fabrication of successful, functional and esthetic restorations.

Today, as in the past, the communication tools between the dentist and the technician are photography, written documentation and impressions of the patient's existing dentition. The clinical models from these impressions are created and mounted on an articulator that simulates the jaw movements of the mandible (Fig. 2).

_The digital laboratory

As restorative dentistry evolves into the digital world of image capture, computer design and the creation of dental restorations through robotics, the dental laboratory must evolve as well. To fully understand this concept, a laboratory must be clearly defined.

At first thought, it may seem that a laboratory is the place where a dentist sends his or her patient's impressions to (Fig. 3) be processed into restorations, which are sent back to the dentist for adjustment and delivery. This definition fits well with the traditional concept of a laboratory/dentist workflow.

However, just as the Internet has forever changed the landscape of communication through related computer technology, the possibility to use CAD/CAM restoration files electronically has provided the catalyst for a significant change in the way we view and structure the dentist/laboratory relationship.

Imagine that the laboratory is not a physical place, but exists only in (Fig. 4) the talents of those performing the restorative process: the dentist and the technician. The equipment used to create the restoration may be located centrally, remotely or both. The laboratory is essentially a workflow, which is as flexible as the abilities of the dentist, the technician and the equipment will allow.

The primary decision becomes where the hand-off from one partner to another should occur. The dentist, who has the ability to optically scan teeth for impression making and chooses CAD/CAM restorations as the best treatment option for his or her patients, has enhanced freedom as to where the hand-off to the technician should occur. As a result,the laboratory is no longer a place, it is rather to a great degree, virtual.

_Communication is key

The ability to facilitate communication between the dentist and the lab is of utmost importance and what makes the E4D system stand out. Tools such as the E4D Sky network enable E4D clinical operators to communicate and facilitate the transfer of data to technicians whenever laboratory involvement is required. With just a click, the entire case (whether scanned or completely designed) can be sent from chairside to the laboratory for fulfillment of the on-line prescription (Fig. 4).

_The digital process

The new millennium has brought with it a change in digital dentistry as more than 20 different CAD/CAM systems have now been introduced as solutions for restorative dentistry. The introduction of digital laboratory laser scanning technology along with its accompanying software allowed the dental laboratory to create a digital dental environment to accurately present a real 3-D virtual model that automatically takes into consideration the occlusal effect of the opposing and adjacent dentition.

Fig. 5

As well as the ability to design 16 individual full-contour, anatomically correct teeth at the same time (Fig. 5). It essentially takes a complex occulsal scheme and its parameters and condenses the information, displays it in an intuitive format that allows dental professionals with basic knowledge of dental anatomy and occlusion to make modifications to the design, and then sends it through to the automated milling unit.

For the dental lab profession, the introduction of digital technology effectively automated or even eliminated some of the more mechanical and labor-intensive procedures (waxing, investing, burnout, casting, and/or pressing) involved in the conventional fabrication of a dental restoration, allowing the dentist and technician the ability to create functional dental restorations with a consistent, precise method.

_Linear vs. vertical manufacturing

The successful laboratory of the future will need to focus not just on the quality of the end product, but also more efficient production methods to reduce turnaround time within the laboratory process. Digital technology will allow the laboratory production to become vertical rather than linear.

The current laboratory fabrication process follows a very linear progression: model fabrication, day one; waxing, day two; finishing, day three; ceramics, day four, etc. Average production time for an all-ceramic or porcelain-fused-to-metal restoration is approximately five to seven working days based on this fabrication method.

In the digital laboratory, impressions will still be received from the client. Instead of taking days or weeks to go through several processes, we will be able to accomplish the same process in two to three days.

Once the impression is received at the laboratory, the impression can be scanned and data sent to several digital production stations at the same time. This will potentially allow the model, the restorations (both framework and waxup) and the final ceramic restoration to be completed at the same time (Fig. 6).

_Digital diagnostic and treatment planning

The basis for all long-term success in restorative dentistry is a comprehensive diagnosis and treatment plan.

The ability to preview a case from start to finish, communicate and co-diagnose with other specialists and specialties about dental patients via the virtual world is the true power and capability of digital dentistry._

_about the author

CAD/CAM

Lee Culp, CDT, is the chief technology officer at DTI Technologies, where he guides the development of the DTI digital technologies program and its applied applications to restorative dentistry. Lee is also the editor in chief of Teamwork and associate editor of Spectrum. He is also on the editorial boards of Practical Procedures and Aesthetic Dentistry, Compendium and Inside Dentistry. Culp's professional memberships include the American College of Prosthodontics, American Equilibration Society, American Academy of Cosmetic Dentistry, Academy of CAD-CAM Dentistry and the American Prosthodontic Society. Culp is an accredited member of the American Academy of Cosmetic Dentistry. He is a leading resource/inventor for many of the materials, products and techniques used in dentistry today and holds numerous patents for his ideas and products. Culp writes many articles per year, and his writing, photography and teaching style have brought him international recognition as one of today's most exciting lecturers and innovative artisans in the specialties of digital dentistry, dental ceramics and functional esthetics.

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MICRODENTAL LABORATORIES

IPS e.max CAD: Proven and now faster!

Author_George W. Tysowsky, DDS, MPH

_When we speak with clinicians about IPS e.max CAD, one of the frequently mentioned comments is that IPS e.max CAD "never fails." While that may be a slight exaggeration, the fact is that IPS e.max CAD is extremely durable and creates a great opportunity for clinical success. Nearly 10 years of clinical data, with a 98.2 percent survival rate, is testimony to the proven technology of IPS e.max CAD.

Another frequent comment is "How can I shorten the crystallization time?" We realize time is critical in the dental practice, but equally critical is maintaining the key physical properties of IPS e.max CAD that make it a product you can rely on.

Ideally, it would be as simple as increasing the temperature and shortening the program time to speed up the crystallization process. The crystallization process includes four stages:

1) Drying
2) Heating
3) Holding
4) Cooling

Arbitrarily shortening any or all of these stages can cause negative ramifications to the restoration that range from poor glaze, shade mismatch, reduced strength, cracking and residual lithium silicate, which is highly soluble.

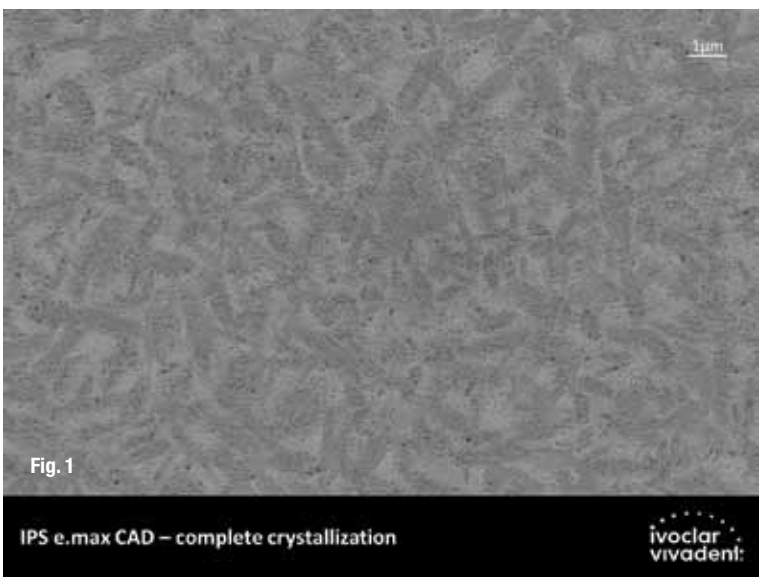
Our most recent goal was to determine if and where we could reduce the time of each stage and still achieve complete crystallization, thereby optimizing both the strength and esthetics demonstrated in a completely crystallized IPS e.max CAD restoration. Carefully going through each step of the process, we determined what we could and could not change.

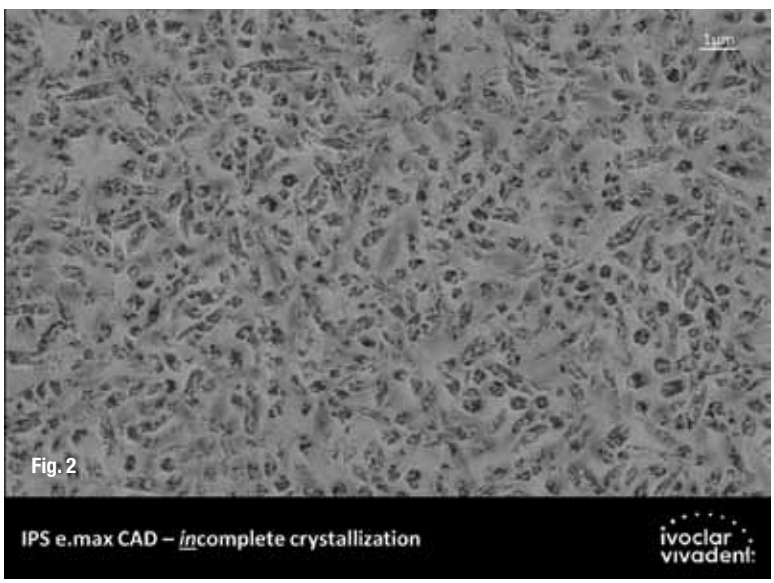
It was readily apparent that we could not change the drying stage and cooling stage. The drying stage is needed to dry out the organics in the glaze and object fix; this requires a fixed amount of energy and at this point cannot be modified. The cooling stage is dependent on time to reduce the temperature of the restoration. Cooling too fast generates residual stress in ceramic leading to cracks.

However, what we did determine is the heating and holding stages were areas that we could reduce,

Fig. 1_Complete crystallization with LS2 as main crystalline phase (elongated crystals resist attack of hydrofluoric acid (0.5 percent). (Photos/Provided by Dr. George Tysowsky)

Fig. 2_Incomplete crystallization with LS as residual crystalline phase [crystals dissolve by chemical attack, e.g., hygrofluoric acid (5 percent)].





and by focusing on these two stages we were able to reduce the overall crystallization time from 19:50 to 14:50, a reduction of approximately five minutes, while still achieving complete crystallization, strength and optimum esthetics.

During our testing we discovered that while the heating and holding stages were areas to modify, we found that certain programs that crystallize faster often leave residual lithium silicate (Figs. 1, 2), which can be dissolved away leaving a weaker, rougher restoration both initially and long term.

In order to achieve faster crystallization times, we are developing two tools:

1) New firing program for the Programat CS
2) New, smaller silver nitride firing tray

Additionally, there are several processing requirements:

1) HT and LT blocks can be speed crystallized; Impulse blocks require the full crystallization program
2) Maximum of two restorations
3) Only spray glaze can be used

Used in combination, the program, tray and processing requirements ensure complete crystallization and optimum esthetics. The new program and firing tray is now available and is a continuation of Ivoclar Vivadent's quest to offer innovative solutions with superior performance, esthetics and efficiency in CAD/CAM technology._

_about the author CAD/CAM

George W. Tysowsky, DDS, MPH, earned his DDS degree from the University of Minnesota, School of Dentistry, and a Masters of Public Health from Minnesota's School of Public Health. He also completed a general practice residency at St. Francis Medical Center/University of Connecticut. Tysowsky has published and lectured extensively throughout North America and Europe on the application of contemporary materials. You may contact him at: 175 Pineview Drive, Buffalo, N.Y., 14228; tel. (716) 691-2202.

With E4D in-office CAD/CAM, there are no compromises

Author_Charles Schof, DDS

_A few years ago, like so many of my peers I was faced with the dilemma of how to continue providing high-caliber dentistry within a stagnant economy. I wanted to increase my patient flow and deliver better customer service in a more efficient and profitable manner.

Simultaneously, I wanted to achieve this objective without raising the overhead costs to my practice. Additionally, the bottom line was that I wanted to take my practice to a different level, but I wasn't sure how to transform this vision into a reality.

After hearing about the E4D in-office CAD/CAM system, I traveled to the company's headquarters in Dallas. I toured the organization's facility, and once I learned firsthand about the company's philosophy and what its high-tech equipment offered, my mind was made up. I would invest in E4D, and it was the best decision I ever made for my practice.

Since I incorporated the E4D Dentist System into my practice, I have been able to enhance my previous services, which emphasized minimally invasive and state-of-the-art restorative care.

My patients love the convenience of same-day treatments, as well as the restorative results produced by the E4D system, so much that they don't want treatments using other restorative techniques or equipment. The materials available for use with the E4D Dentist System enable conservative preparations and are highly esthetic and durable.

Our practice is a step above the competition by offering unique services that demonstrate an advantage compared to other dental offices. As a result, we've been rewarded financially, professionally and personally by expanding our skill sets, embracing greater control over the restorative and creative processes, and assuming a total team approach. With E4D, I haven't compromised or cut corners with care or results, and here's why.

_No compromises with technology and equipment

In my experience, the E4D system simplifies the in-office restorative fabrication process. The system enables digital impressions on hard and soft tissues using powder-free laser scanning. Because the E4D system is less technique-sensitive, problems associated with adhesive dentistry are avoided.

Furthermore, I have found that digital models are formed quickly and accurately, with the intraoral scanner capturing multiple images from several angles. The software and broad range of design tools incorporate any necessary alterations to finalize the design of restorations in less time and with minimal effort.

The milling technology is also hassle-free. Precision burs minimize vibration occurrences. With the fabrication of every restoration, I achieve optimal design performance and marginal integrity. I am continually pleased with the level of accuracy that the E4D system produces.

_No compromises with esthetics and function

With the E4D in-office CAD/CAM system, I don't compromise esthetics for function or vise versa. I can fabricate durable restorations within my office that simultaneously meet my patient's high esthetic expectations in a single visit. Additionally, my team and I can flex our respective creative, clinical and technical muscles.

For example, I can perform a more conservative preparation. Then we can scan the tooth in the patient's mouth to capture the digital impressions, design the restoration on a 3-D virtual model to the proper proportions, and then mill the metal-free restoration. I can determine if critical individualized characterization is needed to enhance the results. If so, I can impart custom colors within my own practice and on my own time.

Overall, my practice maintains greater control over our treatments and no longer has to rely on assistance from an outside laboratory. This saves us time and money and is far more convenient for our patients. The finished restorations are esthetically pleasing and long lasting.

_No compromises with education and support services

D4D offers phenomenal support and stands behind its product. I have always been able to pick up the phone and have a trained specialist, clinician or technician answer my questions and offer unlimited support. When you are moving your practice forward and investing in state-of-the-art equipment, support is everything. Time to be efficient is impossible if you don't know how to use your technology and have to waste valuable time trying to learn on-site.

Money, time and patients would be lost, and nothing would be gained from your investment. Quite simply, I wouldn't have invested in the E4D system without the available and ongoing support I've received.

_No compromises in personal and professional success

I have always loved what I do as a dentist. However, since incorporating the innovative E4D technology into my practice and mastering it, I feel as though I have become a better dentist, and I've noticed a difference in my interactions with my patients, as well as my overall personal success.

I feel gratified and invigorated once again with dentistry. My newfound enthusiasm and reignited passion shows throughout the practice, and the interpersonal connections with my team members and patients have deepened. I pride myself in being able to take full responsibility for the design and fabrication process of restorations, which enables me to expand upon their trust in our practice.

With this technology, I can perform same-day restorations in a fraction of the time it once took, without compromising longevity, esthetics or function. My patients are part of their own restorative process and now have the ability to observe firsthand how their restorations are made. What's more, they love that they no longer have to return for multiple visits or need to wear temporaries.

As a solo practitioner, I have peace of mind because I can provide a service to my patients that I consistently feel good about. In these economically turbulent times, the E4D in-office CAD/CAM system has enabled our practice to lucratively elevate and safeguard our services.

_Conclusion

My practice as a collective whole has reaped the benefits of the state-of-the-art E4D in-office CAD/CAM system. Based on my experience, I wouldn't invest in anything else, and I would highly recommend this technology to my peers.

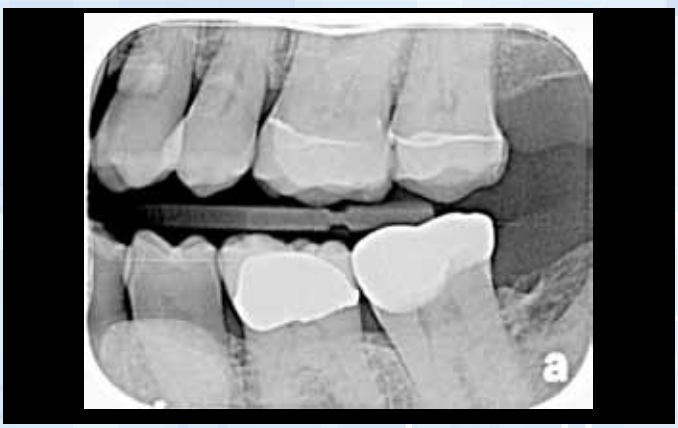
E4D will be a leader in CAD/CAM technology because the company standing behind it consistently pushes the envelope and improves upon a system that already works. This unwavering dedication will contribute to further advancements in the dental industry and, ultimately, within patient care._

Gallery photos on the following pages were provided by Dr. Charles Schof

_about the author CAD/CAM

Charles Schof earned his DDS at Louisiana State University of New Orleans in 1994 and his mastership in the Academy of General of General Dentistry in 2005. He recently added CAD/CAM technology to his practice and is currently participating in a one-year residency for dental implant restorations. Schof combines his passion for preventative, restorative and cosmetic dentistry and a love of people in running his private practice, Mandeville Center for Dental Excellence. He and his wife, Vicki Steen, MD, have three children. Schof also donates time to a local dental clinic, where he has had the honor of treating many of his most rewarding dental cases. You may contact him at *charlesschof69@gmail.com.*

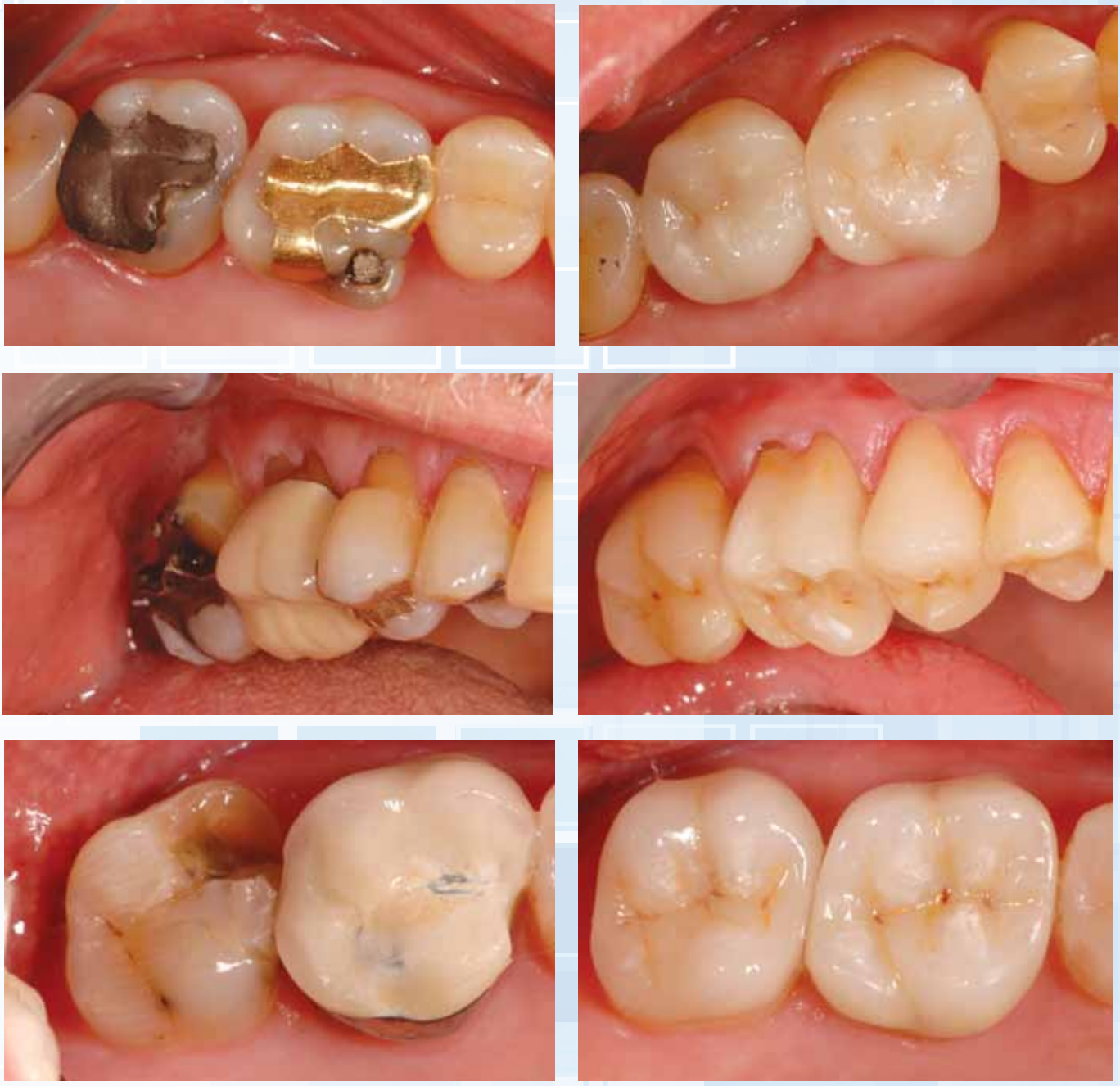
Posterior Function and Esthetics



Gallery No. 1: Posterior Function and Esthetics

'After hearing about the E4D in-office CAD/CAM system, I traveled to the company's headquarters in Dallas. I toured the organization's facility, and once I learned firsthand about the company's philosophy and what its high-tech equipment offered, my mind was made up. I would invest in E4D, and it was the best decision I ever made for my practice.'

Posterior Function and Esthetics

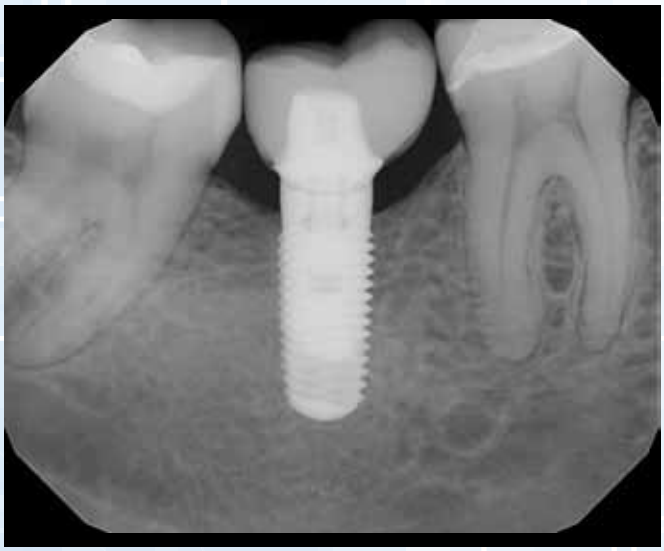


Gallery No. 2: Posterior Function and Esthetics

'Our practice is a step above the competition by offering unique services that demonstrate an advantage compared to other dental offices.'

Implants

Gallery No. 3: Implants



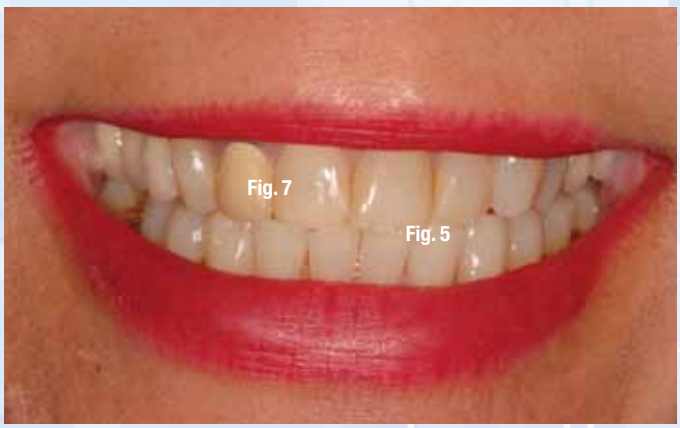
‘Digital models are formed quickly and accurately, with the intraoral scanner capturing multiple images from several angles. The software and broad range of design tools incorporate any necessary alterations to finalize the design of restorations in less time and with minimal effort.’

Anterior Function and Esthetics

Gallery No. 4: Anterior Function and Esthetics

‘With the E4D in-office CAD/CAM system,
I don’t compromise esthetics for function.’

Anterior Function and Esthetics



Gallery No. 5: Anterior Function and Esthetics

'When you are moving your practice forward and investing in state-of-the-art equipment, support is everything.'

Full Mouth

Gallery No. 6: Full Mouth

'Since incorporating the innovative E4D technology into my practice and mastering it, I feel as though I have become a better dentist.'

Predicting marginal fit of CAD/CAM crowns based on the presence or absence of common preparation error

Authors_Walter Renne, DMD,[1] Samuel T. McGill, DMD,[2] Kaitlyn VanSickle Forshee,[3] Michael R. DeFee,[4] and Anthony S. Mennito, DMD[5]

Medical University of South Carolina College of Dental Medicine, Charleston, S.C.

1 Assistant Professor, Department of Oral Rehabilitation.
2 Assistant Professor, Department of Oral Rehabilitation.
3 Predoctoral student.
4 Predoctoral student.
5 Clinical Instructor, Department of Oral Rehabilitation

_Statement of problem

Confusion exists as to what constitutes an ideal ceramic crown preparation and whether certain deviations from the ideal can affect the marginal fit of the milled restoration.

_Purpose

This study evaluated the marginal gap of E4D crowns fabricated on preparations completed by clinicians with varying levels of expertise to identify whether common errors affect marginal fit.

_Material and methods

The fit of 75 crowns fabricated with the E4D system on preparations of varying quality were examined for marginal fit by using the replica technique. These same preparations were then visually examined for common criteria for ceramic restorations and placed in one of three categories: excellent, fair, or poor. These visual examinations sought the presence of common preparation errors, particularly those involving the finish line. The average marginal gap values and standard deviations were calculated for each category, and the Kruskal-Wallis test was used to determine significance.

_Results

The results showed a statistically significant correlation between the marginal fit of a CAD/CAM fabricated crown and the quality of the preparation. The mean marginal gap of the crowns fabricated on ideal preparations was 38.5 µm, those considered fair had a mean marginal gap of 58.3 µm, while those categorized as poor averaged 90.1 µm. The fit differences among all three groups were statistically significant (P<.05).

_Conclusions

Within the limitations of this in vitro study, it can be concluded that preparation quality has a significant impact on marginal gap on crowns fabricated with a CAD/CAM system. (J Prosthet Dent 2012;108:310–315)._

Reprinted from the Journal of Prosthetic Dentistry, Vol.108, Issue 5; Walter Renne, DMD, Samuel T. McGill, DMD, Kaitlyn VanSickle, Forshee, Michael R. DeFee, and Anthony S. Mennito, DMD; Predicting marginal fit of CAD/CAM crowns based on the presence or absence of common preparation errors; 310–315; 2012; with permission from Elsevier.

Clinical implications

Research evidence shows that common preparation errors, when present, lead to poorer fitting restorations. Knowing what these common preparation errors are, and being able to recognize and eliminate them, will allow clinicians to improve the fit of their CAD/CAM restorations.

Dedicated to advancing dentistry through education

_E4D University, D4D's state-of-the-art education facility, is dedicated to advancing dentistry through utilization of the latest technologies, materials and techniques. With more than 9,200 square feet, the facility features multiple classrooms/lecture halls, a business center and a café, as well as the Operatory of the Future and the Imaging Integration Center for display and demonstration.

The faculty of dental, education and communications professionals provides an array of basic and advanced training courses, self-paced tutorials and video, print and online training materials specifically designed to further the capabilities of the experienced CAD/CAM user. Courses offered include the following:

E4D Elements Class

The E4D Dentist Elements course introduces the primary features and functions of the E4D Dentist System's Design Center and Milling Center and the DentaLogic software that powers the system.

Clinical Elements of Success

This one-day, hands-on course enables associates and auxiliaries who did not attend the E4D Dentist Elements two-day course to learn the clinical techniques and skills necessary for optimal E4D implementation in the practice.

E4D CAD CAMp

E4D CAD CAMp provides hands–on guided practice capturing digital impressions — intraorally, from impressions, and from models. Participants will learn the latest techniques for simplifying the design process as well as optimizing milling procedures.

E4D Beyond the Basics

This two day intermediate hands-on course will provide participants with comprehensive techniques on advanced scanning, design and practical principles needed to take the E4D system to the next level in clinical efficiency and functional esthetic success.

Mastering Digital Dentistry: Posteriors

This two-day advanced hands–on course will offer participants insight into the replication of posterior esthetics while focusing on proper function and occlusal harmony.

Mastering Digital Dentistry: Smile Design

This exciting two-day, hands-on course offers participants a unique insight into the replication of natural anterior esthetics while focusing on proper function and occlusal harmony

Focus on Veneers

This two-day intermediate hands-on course introduces concepts, design principles and workflow for the production of multiple anterior restorations, including advanced characterization and stain and glaze techniques.

CADapult Your E4D Practice

This one-day workshop is taught at locations around the United States and is a great refresher, providing demonstrations, lecture and participation to take participants to the next level in patient care and convenience with the E4D system._

For more information go to www.E4D.com *or scan the QR code to tour the facility.*

(Photo/Provided by D4D Technologies

Patient perspectives:
Dental care on their terms

Author_Keith Drayer, Vice President Henry Schein Financial Services

_Everyone deserves a healthy and beautiful smile. But not everyone can afford the up-front costs. Whether it's a treatment that's not covered by dental insurance or a lack of insurance, many patients believe that quality dental care is either out of reach or beyond their control. Moreover, this can be compounded even more when care is needed for more than one person in the family.

In fact, a 2011 report released by the Institute of Medicine, Advancing Oral Health in America, indicates that uneven and limited access to dental health care and coverage is a major factor contributing to the poor state of oral health across the nation.

Thanks to the innovative financing products offer by some of the nation's most reputable financial institutions, proactive and forward-thinking dental practices now have important tools to enable their patients and their families to get the quality care they need and deserve. For example, let's look again at the Citi Health Card program, but this time from the perspective of your patients.

As you know, the Citi Health Card is a health-care credit card that can be used over and over by a patient and his or her family members for the care they need and want across a wide range of medical fields. However, to a patient it can be so much more.

It can mean the difference between worrying about how to pay for a treatment and feeling great. Or, it can be the ticket to becoming the best versions of themselves. Plus, it can be a lifesaver when a family member isn't covered by insurance or if their employer-provided coverage doesn't go far enough.

Best of all, when you offer a strong patient financing program that puts care within reach, your patients will think of your practice as a trusted resource that has their best interests in mind.

_How patient financing empowers your patients and their families

Patient financing programs such as the Citi Health Card program can give your patients immediate ben-

(Photos/Provided by Henry Schein Financial Services)

efits in three ways. One, they give patients flexibility in how they can pay for procedures and treatments. Two, they're easy to use, which can encourage and facilitate ongoing care.

And finally, they can be easy to manage, so patients don't have to spend unnecessary time and effort on the financial component of their care.

So, using the Citi Health Card program as our benchmark, here's what a good patient financing program should offer your patients.

Flexible payment plans

- Flexible payment plans on qualified purchases and revolving credit options
- Low monthly payments and no pre-payment penalties
- No down payment required

Patients appreciate the ability to pay over time, especially when options such as 6-, 12-, 18- and 24-months no-interest financing are available. Not to mention, using a separate account for health-care expenses lets patients keep other resources and credit lines available for personal use.

Easy to use

- Fast credit decisions so treatments can begin right away
- No need to reapply for additional treatments or purchases
- Account can be used for all family members
- Accepted at a variety of participating provider offices

A product such as the Citi Health Card offers your patients a familiar and comfortable way to pay. It works just like a traditional credit card — albeit one with superior payment and financing options — so all patients have to do is swipe their card and be on their way.

There are no additional forms or paperwork for them or your practice. Once your patients see how easy it is to pay (and live with the payments), a huge hurdle to obtaining care is removed.

Easy to manage

- Dental treatment purchases are billed directly to the patient's account, allowing easy separation of health-care expenses and everyday purchases
- The ability to view, manage and pay the account online

It bears repeating: giving your patients a way to compartmentalize their dental and health-care costs can go a long way in helping them manage their everyday expenses. Combined with simple yet powerful online account management tools, your patients are sure to be more comfortable accepting larger procedures as well as ongoing preventative care.

As you can see, a quality patient financing program can empower your patients by reducing their reliance on insurance, thus improving their ability to accept your recommended course of treatment and removing financial concerns from the care equation.

Some things in life can wait. Fortunately, quality dental care doesn't have to be one of them thanks to products such as the Citi Health Card program._

_about the author

Keith Drayer is vice president, Henry Schein Financial Services. Henry Schein Financial Services helps you operate financially successful practices through its suite of business resources, including equipment, practice start-up and acquisition financing and through its value-added programs, including demographic reports, Henry Schein credit card, credit card processing and patient collections and financing. You may reach Keith Drayer at (800) 443-2756 or *hsfs@henryschein.com.*

In depth with the Citi Health Card program

Author_Keith Drayer, Vice President Henry Schein Financial Services

_There's no shortage of patient financing programs vying for your attention in today's marketplace. So here's a simple rule of thumb to help you cut through the clutter: What's good for your patients is good for your practice.

Keep that in mind when exploring your options and you're sure to end up with a program you're proud to offer. Let's take a closer look at the Citi Health Card program from Citi Retail Services and Henry Schein.

_What's in a name?

When it comes to money – especially yours and your patients' – you don't want to take any chances. After all, a patient financing program is only as good as the companies that back it. That's why the Citi Health Card program is always a top choice among dental professionals and patients alike.

If you haven't heard already, Citi Retail Services and Henry Schein recently announced a multi-year renewal and expansion of the Citi Health Card program.

Now, two giants in their respective industries are committed to the success of the Citi Health Card program for years to come. In addition, that can only result in more benefits to your patients and your practice. Here's a brief overview of what the program offers today.

_Patient benefits

For patients, the biggest obstacle to getting treatments is often financial concerns. With the Citi Health Card program, you can offer your patients flexible payment options for the qualifying dental treatments you provide.

- Patients can finance up to 100 percent of treatment costs and receive immediate care
- Simple, flexible financing options include "no-interest" payment plans and "budget monthly" payment plans with low monthly payments
- Payments are spread over time
- Fast credit decisions so treatment can begin right away
- Patients receive the services they need and deserve

(Photos/Provided by Henry Schein Financial Services)

- No application fees, prepayment penalties or down payments
- The Citi Health Card account can be used for additional dental procedures and/or family members

_Practice benefits

Compared to financing dental care yourself, the Citi Health Card program requires less time, costs less and has significantly lower risk, which is great news for your patients and your bottom line. Your focus can stay on care, not on collections:

- No enrollment fees and low merchant fees (MDRs)
- Easy Internet application and transaction processing; no special equipment needed
- Increased cash flow; receive settlement within three business days
- Enhanced training and support from Citi
- No minimum volume requirements and no additional equipment to purchase
- Dentrix and Easy Dental integration for seamless processing
- Daily and monthly settlement reporting
- Payment presentation forms make patient presentation simple and easy

With simple patient financing options and low merchant fees, the Citi Health Card program can be your key to a more profitable practice and more patients that are loyal. Moreover, with Citi Retail Services and Henry Schein behind you, you can be more confident than ever that you're offering patients a program that will stand by them and your practice. Mark it on your short list when you decide to take a serious look at the benefits of patient financing.

If you're looking for more information on the Citi Health Program, call (800) 443-2756 and choose Option 1, or email *hsfs@henryschein.com* to speak to a patient financing specialist._

_about the author CAD/CAM

Keith Drayer is vice president, Henry Schein Financial Services. Henry Schein Financial Services helps you operate financially successful practices through its suite of business resources, including equipment, practice start-up and acquisition financing and through its value-added programs, including demographic reports, Henry Schein credit card, credit card processing and patient collections and financing. You may reach Keith Drayer at (800) 443-2756 or *hsfs@henryschein.com.*

Building your practice

Author_Keith Drayer, Vice President Henry Schein Financial Services

_It's no secret that Americans have been living through difficult economic conditions for several years now. In turn, you practice is most likely facing challenges as a direct result. It's the usual suspects, but now with a new sense of urgency: attracting new patients, keeping current patients, presenting patients with the best course of treatment and collecting money.

If you're like many of your colleagues, the business side of your practice isn't always at the top of your mind. You're more focused on providing care and building strong relationships, not to mention adapting to your ever-changing appointment book.

Nevertheless, as things have slowed down, perhaps you've started to turn your attention to building and strengthening your practice.

"More dentists are becoming directly involved with the financial and management aspects of their practice because they're seeing a direct impact on their bottom line," said Joseph S. Tutor, DDS, Liverpool, N.Y. "And when you start looking at the numbers, you start focusing on practice building."

Generally, there are three ways to build your practice:

- Attract new patients
- Increase patient loyalty and patient visits
- Increase acceptance of care

A number of different approaches can accomplish these goals and many of them are well documented. However, there is a resource available that can help strengthen your practice from all three angles.

_Patient financing: Three challenges, one convenient solution

By simply adding a patient financing program to your practice's and patients' resources, you'll see immediate benefits that impact the three ways you want to grow your practice. (See the article "In depth with the Citi Health Card" on page 38 for a look at one of the better programs currently available.)

"A good patient-friendly financing program can not only increase patient acceptance of treatments, it can also provide patients with a much better ex-

(Photos/Provided by Henry Schein Financial Services)

perience when financial concerns are removed from the equation," explained Tutor. "And that can lead to more referrals and new patients."

_Attract new patients

As Tutor pointed out, offering flexible and convenient financing can dramatically improve your patients' impression of your practice and contribute to a healthy referral cycle. Another less mentioned benefit of some patient financing programs is the provider locator functions they offer.

For example, the Citi Health Card program gives cardholders a Web-based provider lookup tool. Therefore, even if a cardholder opened an account for a completely different procedure in another field of practice, they will be able to find dental practices that accept the card whenever they're looking for dental care. If you're on the list, it's one more reason for the patient to choose your practice.

_Increase patient loyalty and patient visits

There's perhaps nothing as important to building your practice as patient loyalty. Whether it's something as simple as a follow-up phone call or spending extra one-on-one time with a patient to explain a procedure, the most successful practices pay special attention to how they interact and communicate with patients. Again, this is another area where a good patient financing program can enhance the patient-practice relationship.

First, a patient financing program allows you to take the payment out of the process. When your patients aren't worried about how they'll pay — and you're not worried about how you'll get paid — everyone can focus on care. That's why programs such as the Citi Health Card offer a wide range of payment plans and financing options to fit every patient and fast settlement to practices in two to three business days.

Second, when your patients establish a financing program at your office, they are going to use it over and over with you. Suddenly, an elective treatment plan doesn't seem unrealistic when they realize they don't have to max out a credit card or dip into savings to make it possible. In addition, they'll be more likely to maintain a regular appointment schedule, which will help keep patient visits up.

The third reason is simple. When you don't have to play bill collector, you have more time to spend with your patients. More individualized care leads to happier, more satisfied and more loyal patients.

_Increase acceptance of care

Although about 70 percent of people in the workforce have some type of dental insurance, it tends to be limited, paying only for certain procedures and treatments. Perhaps one of the biggest benefits of a patient financing program to your practice is it removes roadblocks and third-party influence on treatments. Now care can be between you and your patients, not you and the insurance provider.

A patient financing program also allows your patients to take the long view when it comes to their dental health. When they have more time to pay for their procedures, you can provide a structured treatment regimen that fits their life and their budget. In addition, they can see you more regularly so you can adapt treatments to their changing needs.

Much of this article may seem like common sense, but as you know, sometimes the simplest solutions can have the biggest impact on your patients and your practice. Make sure you follow our in-depth look at patient financing with our spotlight on the Citi Health Card and our guide on empowering patients._

_about the author CAD/CAM

Keith Drayer is vice president, Henry Schein Financial Services. Henry Schein Financial Services helps you operate financially successful practices through its suite of business resources, including equipment, practice start-up and acquisition financing and through its value-added programs, including demographic reports, Henry Schein credit card, credit card processing and patient collections and financing. You may reach Keith Drayer at (800) 443-2756 or *hsfs@henryschein.com.*

Veneers with E4D

Charles Regalado

Pretty young mom hated her front incisors. Had rotated #7, Large composite veneer #8, slanted midline, poor proportions and uneven widths and incisal wear #10.

Close up reveals beautiful eMax BL3 HT ingots and improvements where patient wanted them.

Model shows excellent E4D fits. Note #6, I added a small "snowcap" in order to increase length. No prep, very thin, E4D did amazing job.

Final Smile. Patient loved it!

Note: This topic was created from a reply on the Best E4D® Case Challenge! topic.

Awesome! **Graeme Milicich**

Charles Regalado Thanks Graeme. E4D has been life-changing and lots of fun. Your single tooth case still amazes me.

And so many dentists ridicule CADCAM dentistry. They don't know what they are missing out on. It puts the fun back in the job. **Graeme Milicich**

About CadCamCan.com

CadCamCan.com (C3) is interactive information and education portal focused on dental chairside CAD/CAM and digital dentistry in general, but more specifically on the features and benefits of the E4D chairside CAD/CAM System manufactured by D4D Technologies.

C3 provides another voice and a variety of clinical perspectives to help dentists make more educated decisions regarding investing in and implementing the newest generation of chairside CAD/CAM and digital scanning technologies.

Forums - Discussion and Q&A with the CadCamCan community

Lava Ultimate Veneers

Dr. Tony Soileau

I have a different take on Lava Ultimate I would like to share. I have about 300 units in the mouth now. 90% of them are veneers. I don't compare LU to porcelain but instead as a replacement for layered composite. A typical LU case for me is a patient comes in and wants a new smile. We offer them porcelain and they can't afford it. So then we offer them LU at a lower cost. My hygienist sells the case and swipes their credit card for $3-4000. I come in and roughen the teeth in 5 minutes. Hyg or assistant takes impression. We scan the impression and then pour model. My assistant and/or myself make the veneers during the day between patients. Patient comes back at 4:30 and we cement the case by 5PM. About 35 minutes of my time with the patient and an additional $4000 in my account. I am never doing layered bonding again!!!!!!!!!

Note: This topic was created from a reply on the Best E4D® Case Challenge! topic.

Roberta Tibbles

How thick are these veneers? Are you using HT Or LT? What is the procedure to bond them on?

Dr. Tony Soileau

Roberta, these were all milled at .3 to .8mm in thickness. After adding some anatomy and polishing they are .2mm near the gum line to .5mm toward the incisal. These were milled with BL Lava Ultimate that currently only comes LT. However the LT is still pretty translucent at this thickness. I bond them on just as I would a porcelain veneer. For these I used Nexus 3.

Here is a case I did two weeks ago.Orthodontist moved canines into lateral position. Mom was furious with the result. These cases are soooooo hard to make look natural again. And mom insisted I barely prep her teeth. Stood over my shoulder while I prepped :(She was not really happy with the little I did prep. Just a bad situation. And the gum issue just made it worse. But in the end the 15 year old was smiling again and mom hugs me now when she sees me. Not the most aesthetic outcome but this case shows just how thin you can mill these veneers. All milled at .2-.4mm

Note: This topic was created from a reply on the Best E4D® Case Challenge! topic.

D4D Technologies introduces E4D version 4.5 featuring E4D Sky

_With the release on of E4D DentaLogic™ software version 4.5 featuring E4D Sky™, D4D Technologies announced the creation of a truly open network of chairside restorative solutions for patient treatment. The E4D Sky communication network enables E4D system operators to exchange case data via the Internet with internal and external service providers, greatly extending the range of treatments they can provide their patients.

"With E4D v 4.5 and E4D Sky, a dental office has total flexibility and a full range of options for assistance with more complex cases, for some extra help at busy times, or for additional material options to those that are typically milled in office, like zirconia," said Gary Severance, DDS, D4D Technologies.

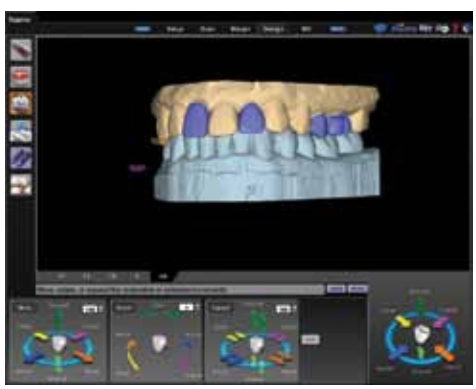
E4D Sky is supported by Henry Schein's DDX (Digital Dental Exchange) and connects E4D systems running version 4.5 software with a variety of outsourcing options for restoration design and fabrication:

- E4D Digital Services experts design, mill or complete restorations, as well as make models or bridges
- E4D Certified Laboratories offer a variety of services
- Any third party provider can be sent an .stl open platform file

"E4D Sky takes the E4D system to the next level while supporting the launch of our E4D Solo scan only options. Operators will also be able to exploit the flexibility of the .stl open platform file export to access numerous other services with their scanned data," said Glen Freeman, D4D Technologies. "We are pleased to announce that the expanded capabilities of E4D DentaLogic software version 4.5 with E4D Sky are now available to all new and current customers."

For more information, visit *www.e4d.com.*

Photo/Provided by D4D Technologies



_About D4D Technologies

D4D Technologies is taking the dental profession to a higher level of productivity, patient comfort and convenience with its E4D restorative solutions. DentaLogic software in the E4D Design Center enables the operator to customize a virtual restoration before it is sent to the robust E4D Mill for fabrication.

With the introduction of version 4.5 and E4D Sky, each of these system components is now also available for custom configurations and interfaces to meet the needs of any dental office or laboratory.

E4D Sky communicates with E4D Digital Services, certified E4D dental laboratories, and any third-party provider accepting open format files (.stl) for a full range of production and delivery options. E4D Compass™ integrates E4D restorative designs with cone beam data to plan and communicate restoratively driven implant therapies.

E4D Compare™, the latest addition to the E4D suite of products, employs adaptive learning technology to dental education. Headquartered in Richardson, Texas, a suburb of Dallas, D4D Technologies has partnerships with major corporations in the dental profession: Henry Schein Dental is responsible for global sales and distribution; 3M ESPE and Ivoclar Vivadent provide restorative materials.

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Introducing a new financing option from the Citi Health Card program.

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Minimum payments required.

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Plus, your practice will enjoy:

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Speak with a Patient Financing Specialist today.

Call 1-800-443-2756 or email hsfs@henryschein.com.

*24 Month No Interest Plan requires minimum $1,000 purchase. Promotional Merchant Fee of 9.99% valid now through March 31, 2013. The standard Merchant Fee of 13.99% will be effective April 1, 2013. **Merchant Fee is the cost to your practice and is calculated as a percentage of the total sale.

E4D Solo scan-only system

_D4D Technologies recently announced the launch of E4D Solo scan-only digital impression system. E4D Solo, in conjunction with the E4D Sky™ communication network enables E4D Solo operators to send scanned restorative case data via the internet to internal and external service providers, for design and fabrication of restorations, models and bridges.

(Photo/Provided by D4D Technologies)

E4D Solo offers new options for offices that want to introduce highly accurate digital impressions and enhance their patients' comfort and convenience. By connecting with E4D Sky, E4D Solo provides access to a truly open network of services, including E4D Digital Services, where experts will design, mill and finish restorations, or fabricate models or bridges.

E4D Sky can also connect offices to E4D Certified Laboratories offering a full range of services. An additional option is to export an .stl open platform file of the scan data that can be downloaded to any third party provider.

Offices that already use the full E4D system can expand their capabilities by adding an E4D Solo and then designing and fabricating in house or using E4D Sky services at busy times or for more complex cases. E4D Solo is available in a cart configuration for intraoral, model or impression scanning as well as a desktop configuration for model and impression scanning only.

"E4D Solo is the solution for clinicians who are not ready to adopt full chairside CAD CAM in their practices, as well as for those who have already experienced the benefits of this technology and are ready to grow their capacity," said Gary Severance, DDS. "We are pleased to announce that E4D Solo is now available to all new and current customers."

For more information, *visit www.e4d.com._*

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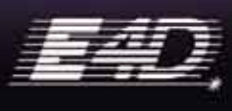

submissions
formatting requirements

Please note that all the textual elements of your submission:

- complete article
- figure captions
- literature list
- contact info (e-mail addy please)
- author bio

must be combined into one Microsoft Word document. Please do not submit multiple files for each of these items. In addition, images (tables, charts, photographs, etc.) must not be embedded in the text document.

All images must be submitted separately, and details about how to do this appear below.

If you are interested in submitting a C.E. article, please contact us for additional instructions before you make your submission.

_Text length

Article lengths can vary greatly — from a mere 1,500 to 5,500 words — depending on the subject matter. Our approach is that if you need more or less words to do the topic justice, then please make the article as long or as short as necessary.

We can run an extra long article in multiple parts, but this is usually discussing a subject matter where each part can stand alone because it contains so much information. In addition, we do run multipart series on various topics. In short, we do not want to limit you in terms of article length, so please use the word count above as a general guideline and if you have specific questions, please do not hesitate to contact us.

_Text formatting

Please use single spacing and do not put extra space between paragraphs. We also ask that you forego any special formatting beyond the use of italics and boldface, and make sure that all text is left justified.

If you would like to emphasize certain words within the text, please only use italics (do not use underlining or a larger font size). Boldface should be reserved for article headlines, headers and subheads please.

Please do not "center" text on the page, add special tab stops or use underlines in your text as all of this must be removed manually before layout. If you require a special layout, please let the word processing program you are using help you to do this formatting automatically rather than doing it manually.

If you need to make a list or add footnotes or endnotes, please let the word processing program do it for you automatically.

There are menus in every program that will help you apply all sorts of special formatting.

_Image requirements

Please number images consecutively by using a new number for each image. If it is imperative that certain images are grouped together, then use lowercase letters to designate the images in a group (i.e., Fig. 2a, Fig. 2b, Fig. 2c).

Insert figure references in your article wherever they are appropriate, whether that is in the middle or end of a sentence, but before the period rather than after. Our preference is to have figure references noted in the appropriate place within the text as it helps the readers to orient themselves when moving through the article. In addition, please note:

- We require images in TIF or JPEG format
- These images must be no smaller than 4 x 4 inches in size at 300 DPI
- Images should be 1 MB in size each

If you have an image that is greater than 1 MB, please do not bother "sizing it down" to meet our requirements, but send us the largest file size available. The larger the starting image is in terms of bytes, the more leeway the designer has in terms of resizing the image to fill up more space should there be room available).

Also, please remember that you should not embed the images into the body of the text document you submit. Images must be submitted separately from the textual submission.

You may submit images through a zipped file via e-mail, unzipped individual files via e-mail or post a CD containing your images directly to us (please contact us for the mailing address as this will depend upon where you will be mailing them from).

Please do not forget to send us a head shot photo of yourself that also fits the image requirements noted above so that it can be printed along with your article.

_Abstracts

An abstract of your article is not required. However, if you choose to provide us with one, we will print it in a separate box.

_Contact info

At the end of every article is a contact info box with contact information along with a head shot of the author.

Please note at the end of your article the exact information you would like to appear in this box and format it according to the previously mentioned standards.

A short bio (50 words or less) may precede the contact info if you provide us with the necessary text.

_Questions? Comments?

Please do not hesitate to contact us for our International C.E. Magazine Author Kit or if you have other questions/comments about the article submission process:

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† M. Kern et al. "Ten-year results of three-unit bridges made of monolithic lithium disilicate ceramic"; Journal of the American Dental Association; March 2012; 143(3):234-240.

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