

DENTAL ADVISOR™

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Digital Dentistry Update





Digital dentistry has evolved significantly over the last decade, increasing the effectiveness and capabilities of dental procedures and outcomes. Digital technologies not only change the workflow for the clinician but increase the patient experience as well. In fact, more and more patients expect to see digital equipment in your office due to what they see their friends or family share on social media.

For the past 15 years I've been lecturing on digital dentistry, and while much has changed, many things have not. Like many clinicians, I still find use for impression material. I have a few digital scanners, but I do not plan on milling in-office as I defer that to my lab. 3D printing is an area of great interest, and I'm still investigating a potential future purchase. You'll find in this issue that I'm not alone. Many of my colleagues have incorporated scanning, milling, and 3D printing in their practices. In this issue you will also hear about one of our Clinical Consultants, Dr. Matthew Miller's journey in digital dentistry. As always, we thank you for reading, and we welcome you to reach out to us with any questions at connect@dentaladvisor.com, or to me personally at drbunek@dentaladvisor.com.

— *Sabiha S. Bunek*

PUBLISHER: DENTAL CONSULTANTS, INC.

John M. Powers, Ph.D.
Sabiha S. Bunek, D.D.S.

CHIEF EXECUTIVE OFFICER

Sabiha S. Bunek, D.D.S.

CONTRIBUTING AUTHOR

Matthew R. Miller, D.D.S.

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Please send inquiries and address changes to:

DENTAL ADVISOR

Ann Arbor, MI 48103
Call: 800.347.1330 - 734.665.2020
Fax: 734.665.1648
Email: connect@dentaladvisor.com
Website: dentaladvisor.com

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IN-OFFICE DIGITAL WORKFLOWS

INTRAORAL SCANNER



IMPRESSION SCAN



OR

Software Design

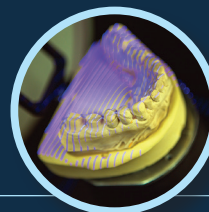


3D PRINTING

OR



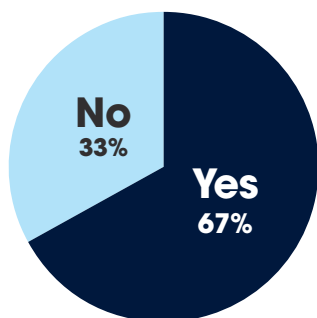
MILLING



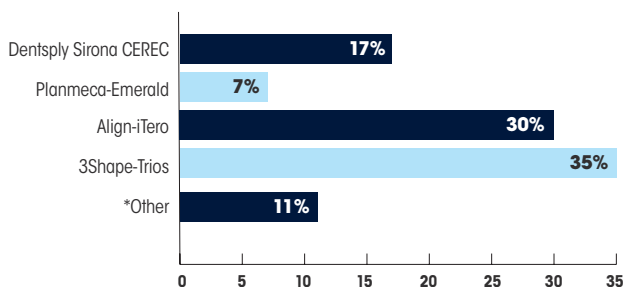
BY THE NUMBERS

We asked our consultants their opinion on Digital Dentistry

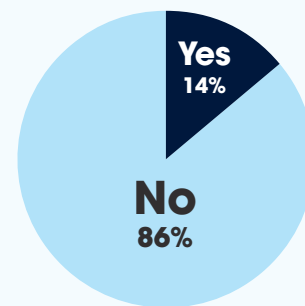
Are you currently using **intraoral scanners** in your office?



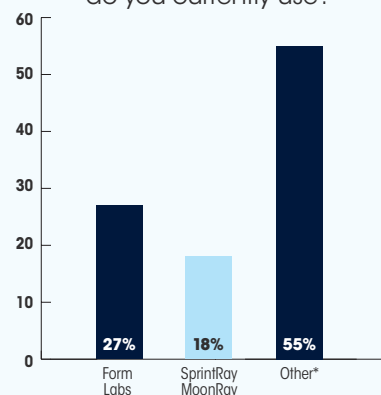
If you are using **intraoral scanners** in your office, which brand do you currently use?



Are you currently using a **3D printer** in your office?

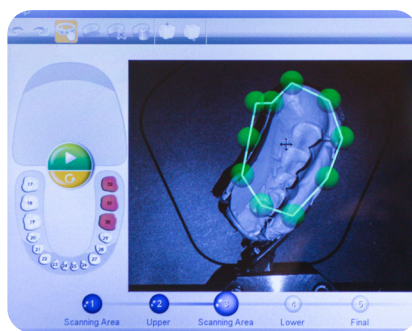
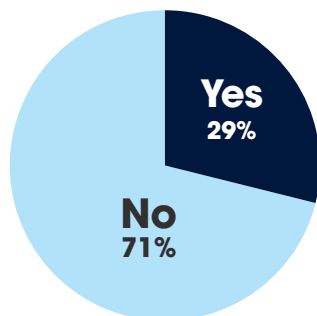


If you are using a **3D printer** in your office, which brand do you currently use?

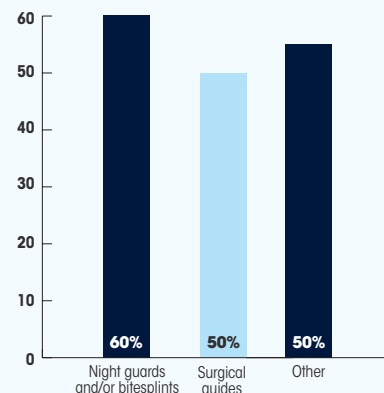


*Other 3D printers currently used are: Elegoo Mars, Phrozen Sonic Mini, and Asiga

Are you currently using **impression scanners** in your office?

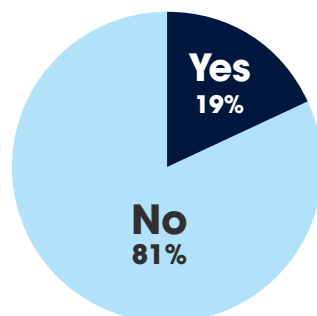


If you are using a **3D printer** in your office, what indications are using it for?

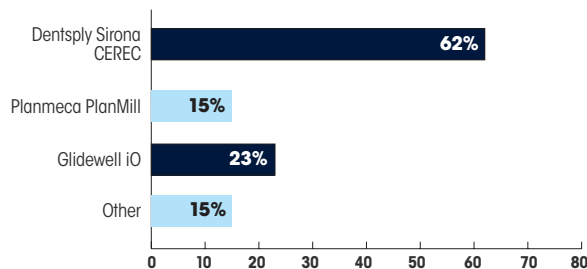


*Other Indications currently used are: Custom tray, record base, denture and crown, study models, dies, deprogrammers, temps and education

Do you currently use an **in-office mill** in your office?



If you are using an **in-office mill** in your office, which brand do you currently use?



*Other in-office mills currently used are: None specified



Digital Dentistry Update

One clinical advisor's journey in digital dentistry

By Dr. Matthew R. Miller, DDS
DENTAL ADVISOR Clinical Consultant

My goal as a dentist has always been to help others and do what is best for my patients. Providing excellent dental treatment and outcomes not only depends on the provider's skill and training, but also their team, and the technology utilized to elevate the care delivered.

Implementing digital technology has elevated my dentistry and made me a better clinician. I have always held a high standard of care, but now I can achieve it (and even take it to the next level) faster, more efficiently, and with more precision. From a business standpoint, digital technology increases case acceptance by improving the communication and education with patients, and it adds value to the care being provided.

We invest so much in ourselves with our education that it is also important that we invest in the right technology to suite our individual needs and philosophy. I routinely get asked by colleagues what technology I am currently using, what technology I am planning to utilize in the future, as well as what technology I think is going to be emerging or developed.

I have been exploring 3D printers, photogrammetry, and dynamic guided systems that we feel could provide more benefit overall to our practice, as well as looking into softwares that offer assisted or artificial intelligence to help provide consistent and accurate analysis and interpretation of images and data. Not every clinician or practice has the same need or use for various technologies; and even within the practice, each member of the team may use it differently and to varying degrees. Regardless of which technology you choose to consider, it must align with your practice mission and vision for it to be worthwhile.

Deciding on and implementing new technology can sometimes be a daunting task, and another challenge is keeping up with its rapidly changing landscape. **Some decision factors to consider are:** What problem does it solve, expense, training, ease of use, workflow, upside



Dr. Matthew Miller consults using a chairside CERC Primescan from Dentsply Sirona.

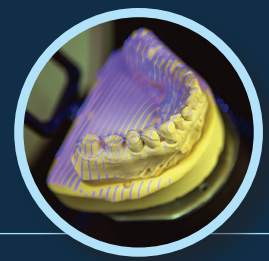
Keep in mind that there is an actual cost associated with doing nothing. It is easy to continue to do business as usual and maintain our personal status quo; however, sometimes that can cost more than the cost of taking action in the long run, so it is important to realize the cost of change versus the cost of doing nothing.

gain vs. downside loss, warranty and support, and is the timing right? Keep in mind that there is an actual cost associated with doing nothing. It is easy to continue to do business as usual and maintain our personal status quo; however, sometimes that can cost more than the cost of taking action in the long run, so it is important to realize the cost of change versus the cost of doing nothing. I have always taken the approach of asking myself: "Does this technology improve the quality of care for my patients and do so in an efficient fashion? And does it make financial sense for my practice?"

In 2005, I used my first intraoral scanner and

Dr. Matthew Miller graduated with high distinction from the NYU College of Dentistry. He serves as a Key Opinion Leader for several organizations and is the recipient of the American Academy for Aesthetic Dentistry Award, as well as the Northeastern Society of Periodontics Award. Dr. Miller consults and lectures on 3D Imaging Technologies, Endodontics and Advanced Restorative Techniques. He maintains a private practice in Huntersville, NC





We utilize digital technology for **clinical applications, practice management and analytics, and laboratory and patient communication**. Software and digital technology allow our practice to be advanced and to function as optimally and planned as possible.

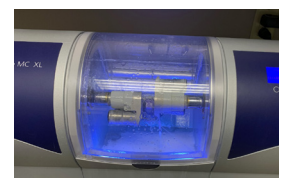
milled a composite onlay for a patient. I had to coat the teeth with powder, and the small milling unit was attached to the scanning unit. I went on to an upgraded system that still required you to powder coat the teeth but allowed me to mill a lithium disilicate restoration and custom stain and glaze it within an hour (Wow! I thought). Milling times decreased significantly with improved milling units, but the process was still lengthy and required a good amount of training for my team. At the time, it seemed so advanced; but looking back, it is amazing how far we have come with scanning, milling, and now 3D printing. Since that time, I have owned two "point and click" image acquisition scanners (one of which I still have), and currently have three optical video-based scanning systems. We opted not to upgrade our milling unit and sintering oven for a few reasons including cost and logistics. Not only did we lack the space needed to accommodate enough milling units and ovens, but we also wanted to get away from in office milling and focus our attention elsewhere on other emerging technology. I believe that a high-quality lab can provide a more customized and lifelike restoration than I can, so I prefer to use my time more meaningfully.

Our practice is built around technology and software, and we try to incorporate it as much as possible. This is all done in an effort to provide an exceptional patient experience and high quality care, along with an efficient workflow. We utilize digital technology for clinical applications, practice management and analytics, and laboratory and patient communication to name a few. Software and digital technology allow our practice to be advanced and to function as optimally and planned as possible. However, when one is heavily reliant on technology, it can be disastrous when it does not work. You can leave work with everything working and come in the next day with it not, and this unpredictability can be maddening - no matter how infrequent it may occur. Moreover, one must find a balance between being at the forefront and cutting edge of technology versus the bleeding edge.

That being said, I could not do the kind of dentistry I strive to provide without cutting edge digital



Dr. Chad Paterra performs a consult for dual arch fixed hybrid surgery and prostheses.



Using the Dentsply Sirona inLab MC XL milling unit (above) to fabricate an onlay.

A Dentsply Sirona Orthophos SL 3D cone beam (left) is included along with digital radiographs and introrals scans to aid in the diagnosis planning process.

technology. For example - digital photography, intraoral scans, and digital 2D and 3D radiography allows us to not only document our cases, but it allows us to effectively communicate with the dental laboratory and complete cases in fewer appointments with greater accuracy and predictability. In the past I would use conventional analogue methods when treating cases and even perform a lot of lab work in house. Now my digital photography can be paired with my intraoral scans and CBCT images to plan and execute even the most complex comprehensive cases with much more efficiency. While I can still provide excellent dental care without digital technology, I much prefer it and have become reliant upon it.



Digital Dentistry Update

Intraoral Scanners

When DENTAL ADVISOR last polled our network of over 300 clinical consultants nationwide in 2019 only 37% of them had intraoral scanners (IOS) in their offices while 63% did not. **Now, in 2022 we are finding that most offices have embraced this technology with 67% of consultants reporting that they do have IOS with only 33% saying that they do not.** Intraoral scanners have become faster, easier to use, and are easy to integrate into the practice. With the boom of clear aligner therapy in general offices and orthodontic offices alike, intraoral scanning has made incorporation of this treatment more accessible.

What are the advantages of introral scanning?

Time savings: Once the technique is mastered, digital impressions can be taken in a matter of minutes and files are immediately delivered to a laboratory or in-office mill.

Accuracy: Intraoral scans are extremely accurate and reduce the need for redos. Also, if there are any issues such as not enough occlusal reduction, the program can inform you right away allowing for adjustments at that appointment, rather than calling the patient back in for adjustments and a new impression.

Patient experience: Most patients enjoy seeing a computer screen image of the procedure and feel more like part of their treatment planning. Also, comfort is increased in most cases as patients do not have to take goopy impressions.

Some considerations when choosing an intraoral scanner:

Cost: There are a variety of high-quality scanners at a range of prices on the market which allow for offices at any budget to integrate digital dentistry into their offices. However, low-cost scanners also might have less functionality, less support, and might have additional charges or ongoing fees like subscriptions and membership fees to watch out for.

What treatments you want to offer: when deciding which scanner is right for you it is important to think ahead about what future treatments you might want to offer. If you are thinking of offering clear aligner therapy, for example, different brands of aligners might only work with certain scanning systems. The same goes for mills and software integrations.

Open or closed source: does your lab work with the scanner system you are considering? What file format are they comfortable with? STL is the file type most commonly exported but many scanners also export OBJ and PLY color files. Some brands do not enable third party scanners to be used with its software, so this is an important consideration.

Scanner size and ease of use: this is important not only for patient comfort, but also for training staff.



In-Office Mills

As with intraoral scanning, in-office milling has existed since the 1980s. What evolved is the paradigm shift in terms of delivering a crown same day. Some dental practices have realized that shifting schedules and workflows isn't for everyone, and with the evolution of 3D printing materials we may see a shift in practice mill sales decreasing and 3D printers increasing.

In-office mills have seen slight improvements in size and speed. Materials have been shifting away from needing sintering furnaces and becoming more esthetic. Fully sintered zirconia is now available along with the exciting introduction of a Lithium Disilicate-based millable glass block which requires no crystallization.

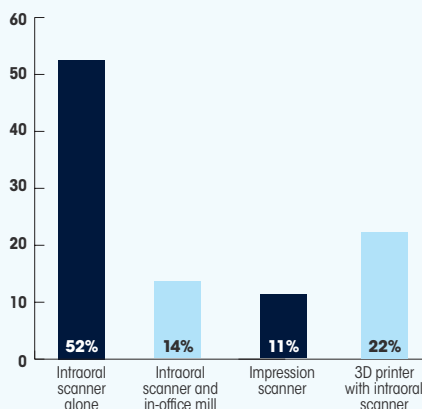
What's New: AI (Artificial Intelligence)

Artificial intelligence has already existed in intraoral scanning for years; however, we are seeing newer developments that are making existing scanners easier to use and more functional allowing for new programs such as smile design. Probably one of the most exciting technologies to come out of AI this year was the first FDA-cleared AI radiologic detection aid that can help dentists identify numerous common dental conditions, including tooth decay, calculus, and root abscesses. This kind of technology is starting to be seen across the dental landscape and can significantly help dentists in treatment planning and acceptance.

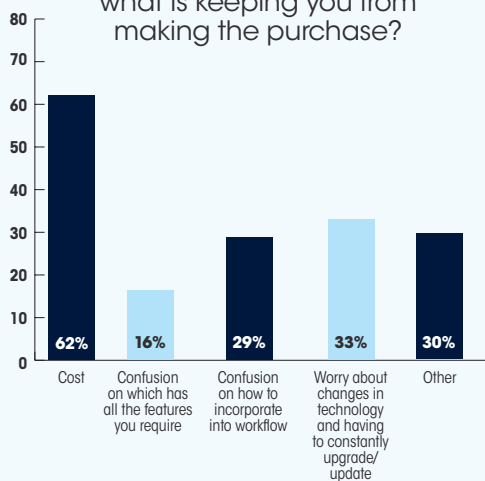
BY THE NUMBERS

We asked our consultants their opinion on Digital Dentistry

If you had no **digital dentistry technology** in your office and were going to make a technology purchase, of the options below, what would be your first priority?



If you have not purchased a **digital dentistry piece of technology** that you want to incorporate into your office what is keeping you from making the purchase?



Digital Case Planning

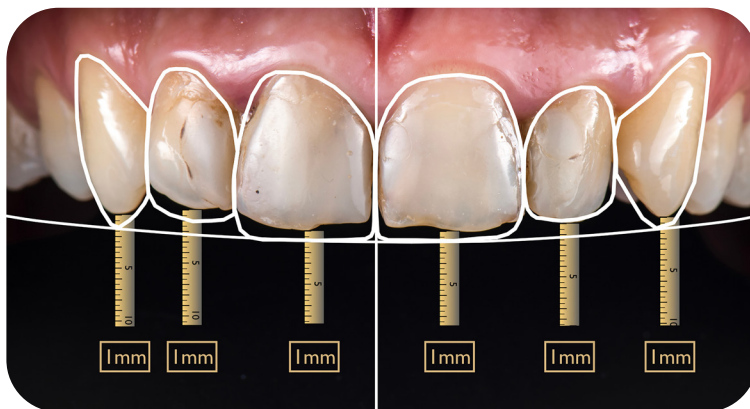
Ortho Integration

As scanners have evolved, each scanning company has a solution for dental practices who wish to integrate a digital platform into clear aligner cases. Most involve a digital impression, 3D printed models, and a case succession so that practitioners can make trays in their own offices or be provided with a set of trays.



CBCT Integration

Many of the scanners on the market offer case planning for complex implant cases using software which overlays the CBCT scan with the digital impression. This assists in custom abutment and implant supported crown and bridge design. Some CBCT scanners offer the ability to scan a traditional impression and import into the CBCT software. This is especially helpful for interdisciplinary case planning.



Smile Design

With the evolution of intraoral scanners, CBCT, and now the addition of AI, smile design software is becoming more user friendly and available to dental offices. Some intraoral scanner (IOS) software has these programs "a-la cart" when choosing software programs to go with your IOS purchase. Intraoral scanner with ortho integration can produce treatment simulators quickly and easily after scanning, while other programs can simulate comprehensive treatment that includes both restorative, and whitening. This is becoming more popular as it aids in patient acceptance rates for comprehensive treatment plans.



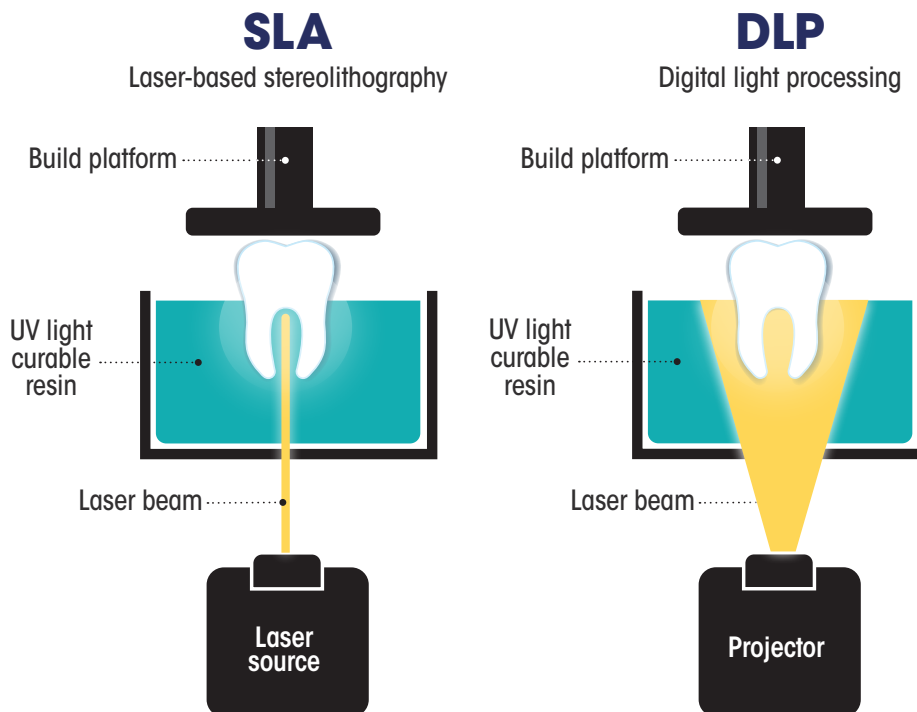
Digital Dentistry Update

In-Office 3D Printing

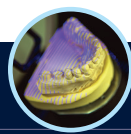
Most clinicians have heard the term and are excited about the possibilities. Many do not understand the process and how it fits into office workflow.

The market for 3D printing has been expanding rapidly and has become much more accessible to dental offices. Additive manufacturing (3D printing) is the most recent piece of the digital dentistry workflow that is steadily becoming a logical business choice for dental practices to incorporate in-house. This is because it utilizes a streamlined workflow to produce a high quality appliances using less materials than subtractive manufacturing (milling), and at lower costs.

The most common dental 3D printers work by selectively exposing liquid resin to a light source—SLA a laser, and DLP a projector—to form very thin solid layers of plastic that stack up to create a solid object. The two main types of printers used for in-office 3D printing are SLA (laser-based stereolithography) and DLP (Digital Light Processing) Printers.



There are many options on the market based on your individual practice needs. Some basic 3D printers can only produce diagnostic models, while more advanced systems can manufacture highly accurate crown and bridge models, surgical guides, and castable/pressable restorations; long-term and biocompatible dental products like splints, retainers, or digital dentures, as well as orthodontic appliances such as clear aligners and Hawley retainers by thermoforming over a 3D printed model. Some materials have now been FDA 510(k) cleared for definitive restorations, securing this technology as the future for in-office digital dentistry.



3D Printer basics

| Printer type | Process | Print/finish quality | Range of applications |
|---------------------------------------|---|---|--|
| SLA (Stereolithography) | Liquid photopolymer resin is selectively exposed to a laser beam across the build plate, solidifying resin in specific areas. | Excellent: Smooth finish | Excellent |
| DLP (Digital Light Processing) | Digital light processing operates with the same chemical process as SLA but uses a digital projector as a light source to solidify the resin, rather than a laser. | Good: Some voxel lines will remain | Excellent |
| MJP (Material Jetting Process) | Work similarly to inkjet printing, but instead of jetting drops of ink onto paper, they jet layers of liquid resin onto a build tray and cure them instantly using a light. | Good: Some layer lines will remain | Limited: Models and devices that do not require more than 24 hrs in the mouth (ie. surgical guides, indirect bonding trays, denture try-ins). |

**Each technology can deliver the precision and accuracy needed for dental applications, but quality, build volume, and applications can vary among different machines and systems.*



16 CLINICAL EVALUATORS

98% CLINICAL RATING

Key features: Dental scrap metal refining service • Process that accurately values scrap metals • Straight to refinery service, cutting out middleman

Description

Kulzer Precious Metal Refining:

- State-of-the-art refining facility in Wartburg, TN
- Offers Pre-Paid shipping and insurance
- Free shipping containers
- Does all processing and refining under one roof
- Eliminate the middleman
- No accountability charges
- No Assay charges

Indications

- **Collection of scrap precious metals from:**
 - PFM tooth extractions
 - Crowns & Bridges replaced when determined by DDS
 - Partial
 - Silver alloy (Pellets or powder)
 - Inlays/onlays
 - Metal implants
 - Anything that is perceived as precious metal or may have precious metal



Unique Attributes

- Directly working with the metal refinery and not working with a middleman that takes part of the profit and sends the metals to the metal refinery.
- Payouts are based on a complete four metal assay (gold, palladium, platinum and silver).
- Inductively Coupled Plasma Emission Spectrometer (ICP) is used to determine the exact precious metal type and quantity in the scrap, not a guess based on weight and color.

"FAST, PROFESSIONAL, AND VERY HONEST."

Evaluators' Comments

"I should have used this company all of my dental life. Other companies have taken advantage of me."

"Prompt service. I was notified quickly of amount of payout."

"Exceptional communication and very quick turnaround time."

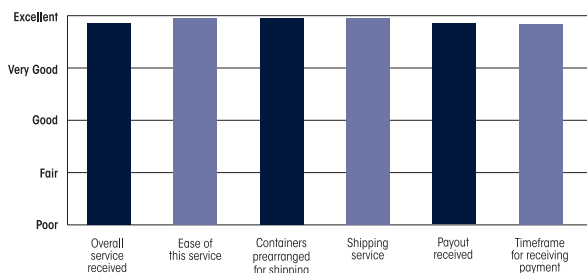
"Loved getting the actual percentage breakdown and weight."

"The financial return I received was much better."

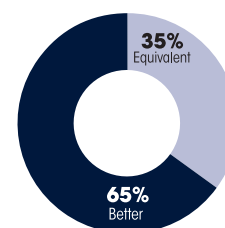
"Appreciated the emails I got from them, so it was 'personal'."

"Would be great if there was faster shipping."

Evaluation Summary:



Compared to Competitive Products:



Consultants who would:
100% Recommend to a colleague

Consultants who would want to stock in office:
79% Yes, instead of current service
21% Yes, in addition to current service



36 CLINICAL EVALUATORS

525 TOTAL USES

92% CLINICAL RATING

Key features: Bulk-fill flowable composite • No capping layer required
• One shade matches shade A1-D4

Description

Venus Bulk Flow ONE is a flowable one-shade bulk-fill composite:

- Adaptive light matching technology
- Bulk-fill cavities up to 4 mm
- No capping layer necessary
- High radiopacity of 250% AL
- Self-leveling effect of flowable composite

Unique Attributes

- This material is the first one-shade bulk-fill composite in a flowable viscosity.
- The ability to use this material in the posterior without a capping layer can save a lot of time in placement.

Photos courtesy of Dr. John Hamerick



Teeth #10 and 11



Teeth #10 and 11 after with application of Venus Bulk Flow ONE



Indications

- All clinical cases where a flowable viscosity is ideal
- Class I, II, III, and V cavity preparations

Clinical Tips

- Deep posterior Class II fillings would definitely benefit from a blocker for getting a good shade match.
- Keep your hand pressure steady on the plunger, don't loosen it and press again or you might get some bubbles.

"THE SHADE MATCHING WAS VERY GOOD."

Evaluators' Comments

"Nice chameleon, color match and polishability."

"Good viscosity compared to other brands of bulk-fill flow. Stayed where I put it."

"I currently don't use a flowable bulk- this is a nice addition."

"Worked great for placement of deep Class I restorations, small interproximal boxes, and multi-surface restorations."

"Very good material that has excellent handling, shade matching, and no capping needed."

"I would like it if it were just a bit thicker."

"Bulk fill ability, viscosity was amazing."

Consultants who would:

73% Recommend to a colleague

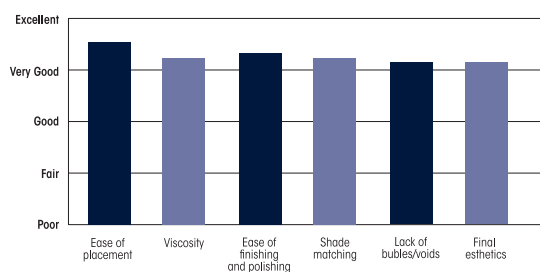
Consultants who would want to stock in office:

16% Yes, instead of current product

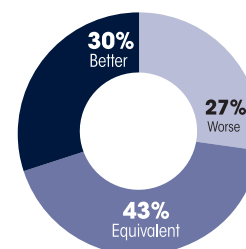
49% Yes, in addition to current product

24% I might want to order this product for certain cases

Evaluation Summary:



Compared to Competitive Products:





16 CLINICAL EVALUATORS
62 PATIENT EVALUATORS
572 TOTAL USES
91% CLINICAL RATING

Key features: Take-home whitening kit • Professionally dispensed
 • Wireless device with patented controlled warming mouthpiece

Description

The **GLO PRO POWER At Home Wireless Teeth Whitening Device Kit** is a take-home whitening kit with:

- A professional-strength 10% hydrogen peroxide whitening gel
- Patented controlled warming mouthpiece (universal size)
- Wireless technology
- Quick induction charging
- Optional Bluetooth connectivity to the **GLO Whitening App**

Unique Attributes

- Controlled heating & illuminating intra-oral mouthpiece for accelerated results without sensitivity.
- Four-day complete treatment at only 16 minutes (two 8-minute sessions) per day.

Indication

- Professional at-home teeth whitening.

Photos courtesy of Dr. Anthony Valentine



Before



After

Photos courtesy of Dr. Ashton Prince



Before



After



Clinical Tips

- Instruct your patients that they can continue to use for up to 8 days in a row to see continued whitening results if desired.
- Instruct your patients that they can swallow as normal while whitening with the device.
- Instruct your patients to store and charge the mouthpiece inside the induction charging case when not in use.
- Instruct your patients that they only need to apply a thin layer of gel to their teeth and to avoid the gingiva.

**"LESS TIME,
NO SENSITIVITY,
QUICK RESULTS."**

Evaluators' Comments

"Effective whitening in short amount of time."

"The patient has used many whitening systems and thought this was the easiest and most effective by far."

"This was an easy-to-use product and I was able to see major improvements in the brightness of my smile after a short time using it."

"The wireless mouthpiece is very portable!"

"Sleek packaging and design. I could see a lot of Instagram and TikTok out of it."

"The patient felt like the mouthpiece was too much for their mouth."

"Enjoyed using. Worked better than previous things I've tried. Just experienced issues with the power button occasionally."

Consultants who would:

73% Recommend to patients

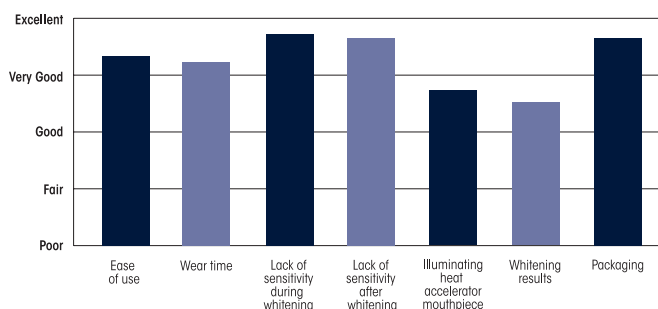
69% Recommend to a colleague

Consultants who would want to stock in office:

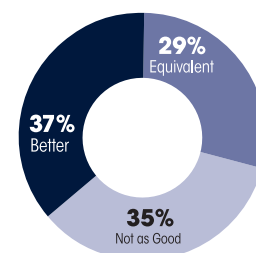
59% Yes, instead of or in addition to current product

22% I might want to order this product for certain cases

Evaluation Summary:



Compared to Competitive Products:



3M™ RelyX™ Universal Resin Cement with 3M™ Scotchbond™ Universal Plus Adhesive



dentaladvisor.com

RATING SYSTEM: Excellent + + + + Very Good + + + + Good + + +

3M

3M.com/RelyXUniversal

Description

3M™ RelyX™ Universal Resin Cement is a dual-cure universal cement with an innovative syringe design

- It can be used in either the adhesive or self-adhesive mode for cementation
- Kit contains **3M™ Scotchbond™ Universal Plus Adhesive** for adhesive cementation
- Available in shades A1, WO, A30, and TR, which coordinate with the **3M™ RelyX™ Try-In Pastes**
- Innovative syringe and tip design to minimize waste
- Excellent bond strength performance in DENTAL ADVISOR Biomaterials Lab testing



Clinical Evaluation Protocol

A total of **309 restorations** were clinically placed and observed over a one-year period. Areas for consideration and evaluation were lack of debonds, color stability, and lack of marginal stain.

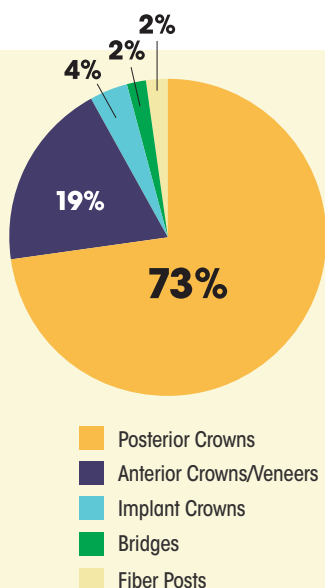


Fig. 1: Distribution of types of restorations bonded or cemented, recalled at one year.

| | |
|---|-----|
| Posterior Crowns | 215 |
| Anterior Crowns/Veneers | 56 |
| Implant Crowns (anterior and posterior) | 11 |
| Bridges (anterior and posterior) | 6 |
| Fiber Posts (anterior and posterior) | 5 |

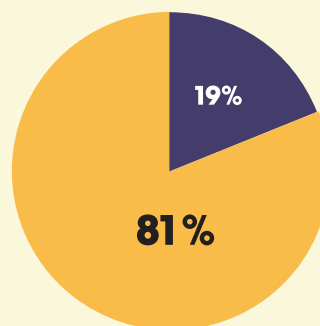
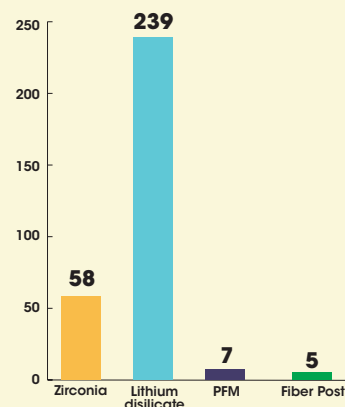


Fig. 2: Mode of Adhesion:

- Adhesive Mode
- Self-Adhesive

Fig. 3: Type of Substrate



Clinical Observations

Lack of Debonds

All restorations remained intact, with no debonds occurring over the 1 year period.

Color Stability

Initial shades remained stable and restorations looked very natural. No discoloration of restorations over time were reported.

Lack of Marginal Stain

All restorations were observed to have smooth margins with no visible stain, indicating no marginal leakage at the restoration/tooth interface.

Esthetics

All restorations exhibited excellent esthetics, retaining color and life-like appearance.

ADHESIVE MODE



1-year post-op, #7-10 e.max veneers



1-year post-op, zirconia anterior crowns

SELF-ADHESIVE MODE



1-year post-op, #12 e.max crown



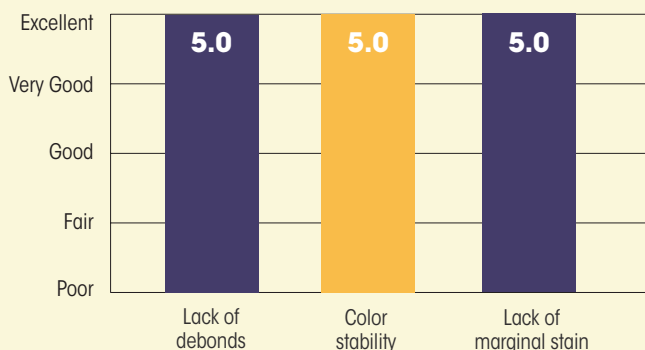
1-year post-op, #9 zirconia implant crown

All photos courtesy of Dr. Sabiha Bunek

Evaluators' Comments

- "No debonds or sensitivity at 1 year."
- "It was great to see that the restorations held up as well at 1 year in parallel to the independent lab testing."
- "These crowns and veneers look as natural as they did at the seat date."
- "It's convenient to have one cement with options for self-adhesive and adhesive bonding."
- "The kit included the perfect amount of shades for a variety of cases."
- "Clean up is easier with this version than the previous version."

Fig. 4: Results of *RelyX™ Universal Resin Cement* with *Scotchbond™ Universal Plus Adhesive* at 1-Year



Restorations were evaluated on a 1-5 rating scale:
1 = poor, 2 = fair, 3 = good, 4 = very good, 5 = excellent

Laboratory Evaluation of Procodile Q Endodontic Files

M. Cowen, J.M. Powers

Number 160 – November, 2022

Introduction:

This study evaluated the cyclic fatigue resistance and cutting efficiency of 2 types of reciprocating files, the new **Procodile Q** from Komet® and **WaveOne Gold** from Dentsply Sirona. The heat-treated **Procodile Q** features a variable tapered core for increased flexibility toward the shank while the cutting edges are uniformly tapered for a uniform canal excavation. The cutting edges feature a double S curve for improved evacuation of debris while cutting.

A **Promark Endo Motor** (Dentsply Sirona) was used with the **WaveOne** setting (170° CCW cutting, 50° CW motion) for tested file sizes 020, 025, 035. The cyclic fatigue test using the DENTAL ADVISOR Cyclic Fatigue Platform featuring a 80° and 5 mm radius was conducted until file failure. Cutting efficiency and durability was assessed using plastic blocs with canals instrumented in sequence with 3 canals per file, until unwinding or file damage occurred, with the time to instrument each canal measured.

Conclusion:

Procodile Q files lasted between 197 % and 325% longer in the cyclic fatigue test than **WaveOne Gold**. **Procodile Q** files also instrumented the training blocs about 16% faster overall with less file damage detected, and with more debris removed coronally.

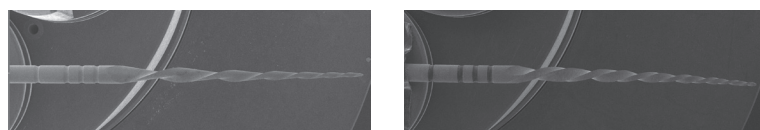
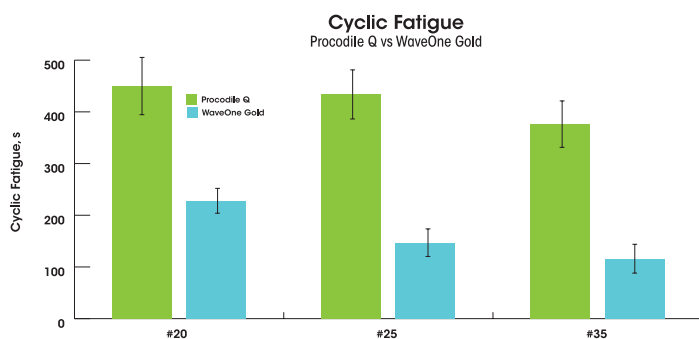


Fig 2. Full Length views of **Procodile Q** and **Wave One Gold** #025 primary files.

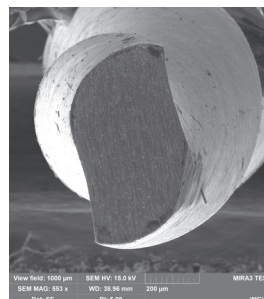
Tests:

Cyclic Fatigue Resistance (n=10): 10 files of 3 different sizes were tested as received. Canals precision milled into hardened stainless steel with 5 mm radius and 80° angle in the DENTAL ADVISOR Cyclic Fatigue Platform was used using the **WaveOne Gold** setting for all files without irrigation. Time until fracture was recorded, and means with standard deviations reported in the results.



Cyclic Fatigue Resistance Summary: **Procodile Q** files lasted between 197 % and 325% longer in the cyclic fatigue test than **WaveOne Gold**. The combination of the heat treatment, lack of surface defects and variably tapered core likely contributes to higher cyclic fatigue resistance for **Procodile Q** files.

Procodile Q



WaveOne Gold

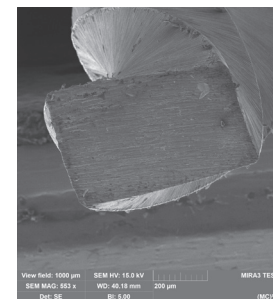


Fig 1. Cross-sectional views of #035 medium files. **Procodile Q** files feature a more acute cutting angle with a ~106° cutting edge. **WaveOne Gold** files feature a parallelogram design with ~85° cutting edge resulting in more of a scraping mode of instrumentation.

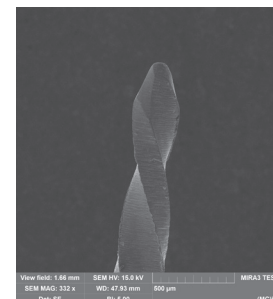
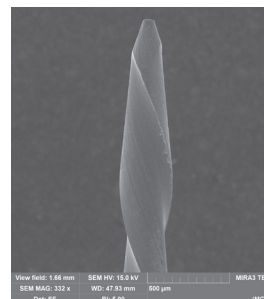


Fig 3. Magnified views of tip design

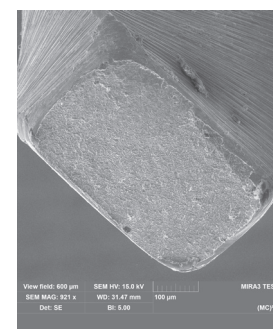
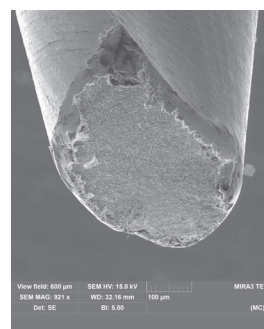
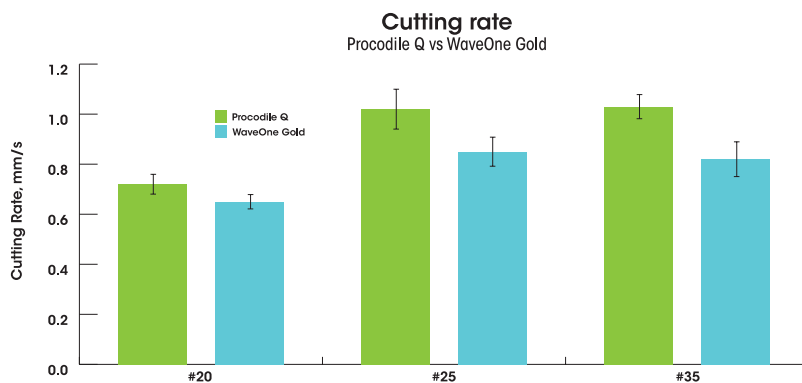


Fig 4. Size 025 Primary files after cyclic failure. Note the smoother surface and difference in core texture versus of the **Procodile Q** (left).

Cutting Efficiency and Durability (n=5): After practice and familiarization with the materials, canals were instrumented root canals of Endo-Training-Bloc (Ref: A0177, Dentsply Sirona) with light water irrigation to remove excess debris using a light pecking motion when resistance was felt. The working time to reach the apex was measured for each instrument in sequence and the sum of the working times for each file used was calculated for #020 to #035 files. The cutting rate was calculated by dividing the working time by the working length (10 mm) to the apex. Three canals were instrumented in sequence by each set of files. Microscopic evaluation under 40x magnification next to new files were conducted before continuing to detect the presence of unwinding.



Cutting Efficiency and Durability Summary: Overall cutting rate for **Procodile Q** was 16% faster than **WaveOne Gold** with full sequence instrumenting taking an average of 33.5s for Procodile Q to 39.5s for **WaveOne Gold**. All Files survived past 2 canals. Detectable unwinding was detected after the 3 canal instrumented with **WaveOne Gold** in three #020, three #025, and one #035 **WaveOne Gold** files, and in only two #035 **Procodile Q** files.

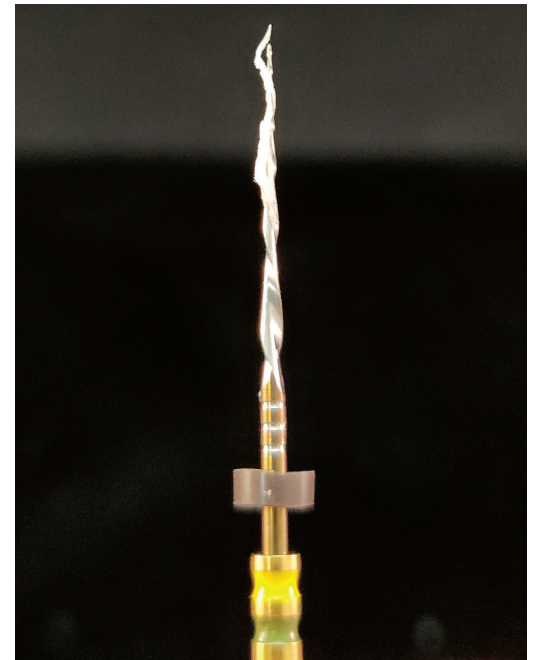


Fig 5. **Procodile Q** removes a large amount of debris after use.

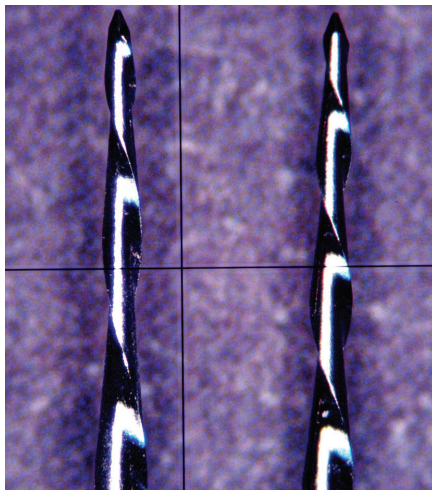


Fig 6. Procodile Q 035 File with slight unwinding after 3rd canal (unused file on right for comparison)

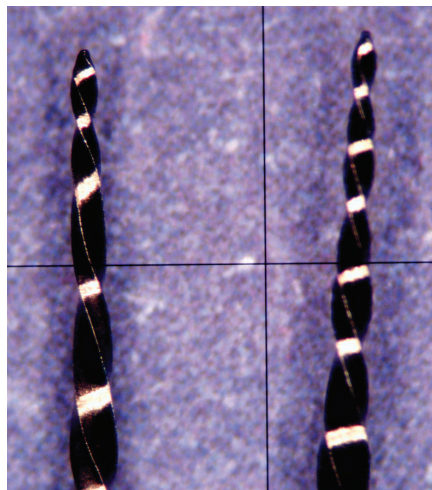


Fig 7. Wave One Gold File 025 with unwinding after 3rd canal

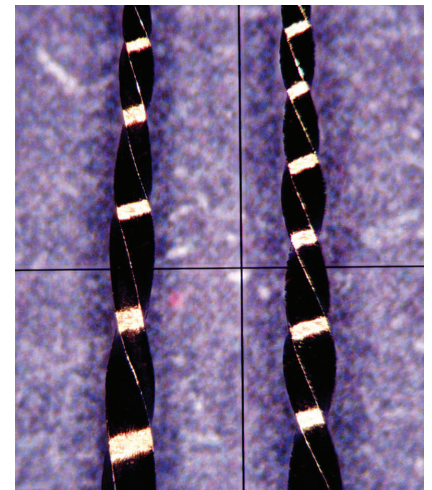


Fig 8. Wave One Gold 020 File with unwinding after 3rd canal

GC Initial LiSi Blocks with G-CEM ONE (GC America)

Introduction

Speed, efficiency, durability, and ease of use with high-quality esthetics are all requirements that we have when creating a system of treatment for our patients. We have found the use of **GC Initial® LiSi** lithium disilicate blocks with **G-CEM ONE** self-adhesive resin cement and the use of the **Adhesive Enhancing Primer** provides us with these desired characteristics. When used together, with proper cleaning and the **G-Multi PRIMER**, reliable restorations can be created and predictably seated even in areas where ideal retention is compromised.



Description

GC Initial® LiSi blocks involve fully crystalized High-Density Micronization lithium disilicate for their blocks that allow for a restoration to be milled in 8-14 minutes in our CAD/CAM mill with high flexural strength without the need to fire the restoration. This creates a saving of 20-30 minutes in the treatment process when compared to other milling and firing procedures. This provides the patients with an additional "Wow!" experience as they are already impressed by the ever-improving CAD/CAM systems. The restoration can then be polished, chemically treated, and ready to seat in as soon as 3-4 minutes after the milling is complete. In areas where we are limited with proper mechanically retentive preparations, we have used the AEP (Adhesive Enhancing Primer) to create faster curing of the self-adhesive cement to obtain an optimal bond.

Clinical Procedures, Results, and Cases

Whether treating teeth for the initial time or replacing restorations that have failed, our office's protocol is to utilize a caries indicator to ensure no caries remain once the tooth has been prepared and any failing restorations have been removed. This helps us establish confidence that bonding protocols are performed onto a stable surface. Build-ups provide as ideal a foundational as possible, with proper reduction and rounded edges. The proper preparation design is easier on scanners and mills, resulting in better restorations. The **GC Initial® LiSi** block is indicated for full coverage crowns, veneers, inlays, and onlays so one can feel confident that this material can be used almost anywhere.

Once the scan and milling processes are complete, the restoration is tried-in, and a "pre-cementation" radiograph is obtained to ensure complete marginal seal for a quality outcome. Finally, the occlusal contacts and excursions are tested and adjusted as necessary for proper form and function, as well as to avoid future occlusion complications.

With a properly fitting and comfortable restoration fabricated, it is then polished and/or stained. In our office, we use the Dialite polishing system from Brasseler followed by a **Goats Wheel** to reduce the surface roughness. The intaglio surface of the **LiSi** restoration is then treated with HF acid (9.5%) for 20 seconds followed by the application of **G-Multi PRIMER**, which contains silane to further enhance bonding with the **G-CEM ONE** cement. Sandblasting this material is not indicated as microfractures may occur.



Case One: Before: fractured teeth #7 and 8 DILF



Case One: After: teeth #7 and 8 restored with LiSi blocks and cemented using the G-CEM ONE cementation process.

Case Two: Milled and polished LiSi Block crown is cemented using G-CEM ONE cement. Excess cement (right) is dislodged from the buccal and lingual of the restoration using light pressure, and removed with a cotton forcep.

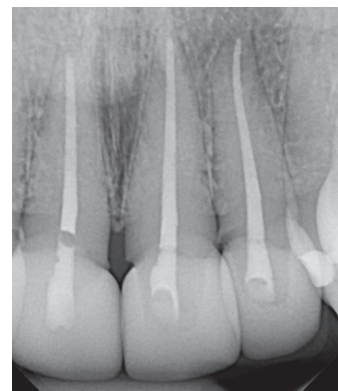


The tooth is then isolated and selectively etched with phosphoric acid (37%) for 15 seconds on any existing enamel, followed by thoroughly rinsing and lightly drying the entire tooth surface. The **Adhesive Enhancing Primer (AEP)** can be used on the tooth surface in areas with little to no retention, greatly increasing the bonding success of the restoration. This material can even be used in areas with saliva contamination, which has allowed us to seat restorations without rubber dam isolation. The **AEP** is applied to the tooth and allowed to settle for 10 seconds before thoroughly drying for 5 seconds.

The use of the **AEP** will accelerate the self-cure of the cement. **G-CEM ONE** is then placed around the margin and within the intaglio of the restoration, followed by immediate seating. An excess of cement placement into the intaglio surface of the restoration, with this very thin (5 µm) material, is ideal to achieve a "bleed out" of the cement upon seating. There is no need to worry about a separation gap at the margin with **G-CEM ONE**, and placing excess into the intaglio surface ensures sufficient material under the crown to create a proper bonding seal without internal voids. With the excess cement still present, a 1-second tack light cure is performed buccal and lingual, while moderate pressure is simultaneously applied to the restoration. Interproximal contacts are quickly cleaned out with floss that is pulled out horizontally from the contact to provide predictable contact cleaning without dislodging the restoration. An explorer is then used, with light pressure to remove the excess cement from the buccal and lingual aspects of the restoration in one piece. This allows for easy removal of the excess with cotton forceps, preventing any tenderness to be experienced by the patient (Case2). A full curing of the material can then be accomplished with a curing light, or the material can be allowed to self-cure for 4 minutes with continued pressure being applied. The process of a 4-minute set-up time is still followed in our office, even with curing, to ensure the material cures in all areas, even those that may not have been adequately polymerized by the curing light. The occlusal contacts and excursions are confirmed after cementation. To this point, no post-op sensitivity has been reported in our office utilizing this protocol, and the blend of material with the tooth is impressive. Examples of the use of these materials in our office include Case 1, which shows a before and after of a fractured #7 DILF and #8 DILF that have been restored with LiSi blocks, with simple polishing utilizing the Dialite system, and cementation using **G-CEM ONE**. Case 3 required the removal of existing PFM restorations and placement of stained **LiSi** full coverage crowns for #7-10, also with the **G-CEM ONE** process.



Case Three: Before: radiograph of teeth #7-10 showing existing PFM restorations.

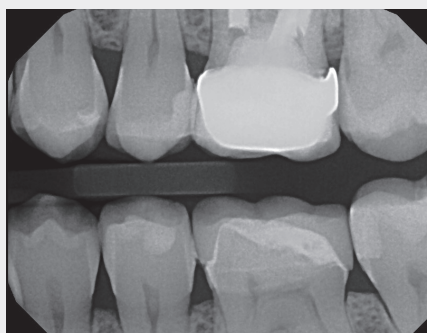


Case Three: After: radiograph showing placement of LiSi block full-coverage crowns for #7-10 cemented with the G-CEM ONE process.

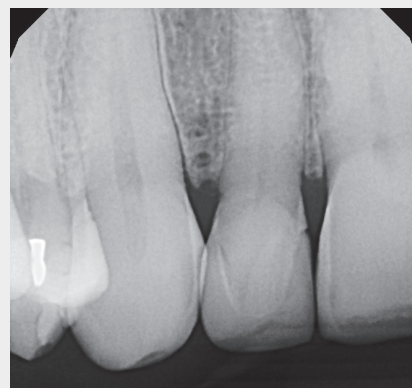
Discussion:

Patients are expecting reliability and quality esthetics in their restorations, and we as dentists are expecting long-lasting results in a timely manner. All of these desires are achieved when using these GC products. We love to hear patients use phrases like "We are done already?!" while also saying "Wow! These look great!" The advancements in these dental materials are allowing dentists to have the safety net of non-technique-sensitive protocols, which make our working days less stressful, more profitable, and more predictable.

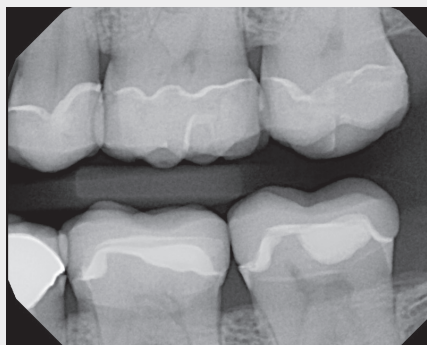
Clinical photos: Cases 4-7 (right) all show radiographic results of simple to complex cases that involve the use of the **GC LiSi** blocks with **G-CEM ONE** and AEP as our bonding process. We have been extremely satisfied with these materials and the resulting outcomes.



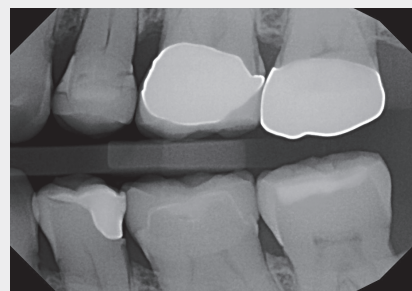
Case Four: Tooth #19



Case Five: Tooth #7



Case Six: Teeth #13, 14, 15, 18, and 19



Case Seven: Tooth #19

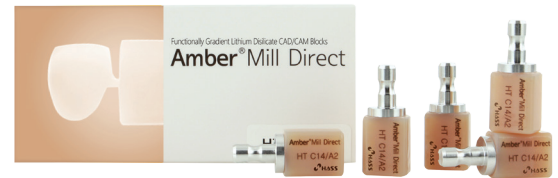


Flexural Strength and Marginal Integrity of Amber® Mill Direct

M. Cowen, J.M. Powers

Introduction:

Amber® Mill Direct is the newest offering from Hass Corporation that is a Lithium Disilicate-based millable glass block which requires no crystallization. The block has graded translucency and the additional option of modifying the translucency by additional crystallization at $>840^{\circ}\text{C}$ from the initial HT translucency to LT. This study tested the flexural strength of the block in the Incisal, Middle and Cervical areas. The Cervical area has the highest strength as this is where the most stress fractures occur from occlusal loading, and the incisal area has higher translucency for aesthetics. Crowns were also milled to examine the marginal integrity and any appearance of chipping.



Conclusion:

Amber® Mill Direct graded lithium disilicate has a range of flexural strength from 311 to 393 MPa without additional crystallization. **Amber® Mill Direct** shows minimal machining damage when examined under scanning electron microscopy.

MATERIALS:

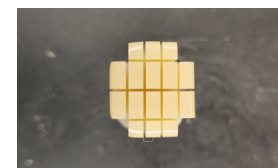
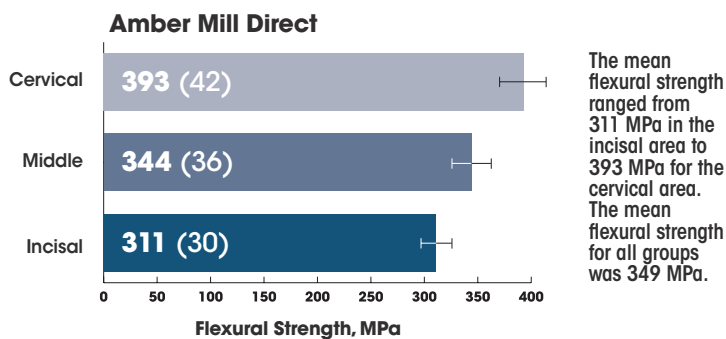
CAD/CAM Materials: **Amber® Mill Direct** (Hass Corp)

Mills: **VersaMill 5X400** with Lithium Disilicate milling strategy

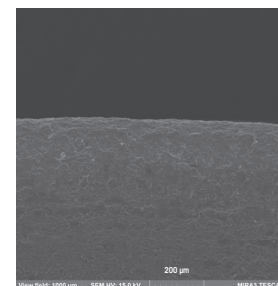
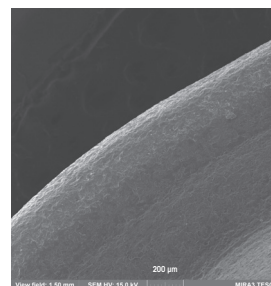
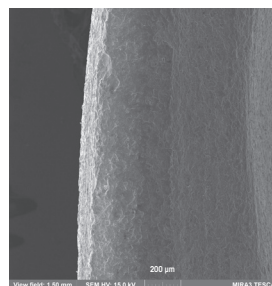
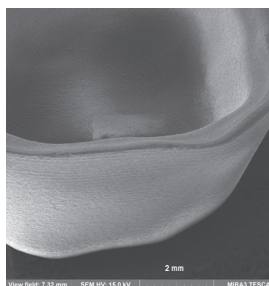
Burs: 2.5 mm, 1.5 mm and 1.0 mm OEM diamond burs (Versamill Part Number: DG-52, DG-53, DG-54)

Methods and Results:

Flexural Strength: Three groups of flexural strength bars ($n=10$) were tested ($16 \times 2 \times 4$ mm). Bars were tested in the groups: 2 mm from incisal edge, 2 mm from the cervical side and bars through the middle, with groups fabricated initially by cutting with a slow-speed wafer blade to minimize damage according to ISO 6872:2015 methods and polished through 600 grit. Bars were loading in 3-pt bend with a 12 mm span and 1 mm/min crosshead speed on a Shimadzu AGX-V universal test frame.



Diamond cut bars from the block. Either end has 2 mm bars cut for the Cervical and Incisal test groups.



Milled posterior crowns with a 0.5 mm margin thickness and 1 mm walls were assessed under SEM. Minor shallow flakes of under 10 micron in depth were observed, with more than 98% of the margin intact with no flaws.

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Clinical Evaluators (19 years or less):

D. Aaron Matatiyah, CA · A. Albright, NY · B. Argersinger, NC · R. Arif, OH · P. Arsenaault, MA · G. Ash, MI · S. Baker, GA · M. Bannan, NC · B. Barricklow, OH · L. Bartoszewicz, MI · B. Bauer, IL · J. Bechtel, MI · J. Bechtel, MI · M. Best, MI · L. Bishop, MI · T. Bizga, OH · G. Bloomfield, MI · G. Bonior, MI · C. Brown, LA · E. Brust, MI · S. Bunek, MI · J. Bunek, MI · J. Bush, PA · H. Cadorette, MI · M. Capalbo, RI · M. Caligiuri, CA · P. Campo, NY · P. Cacciolo, MI · D. Chacko, TN · P. Chaiken, IL · R. Cherry, FL · R. Chuang, CA · M. Connelly, MI · S. Crawford, MI · J. Curley, NC · W. K. Dancy, GA · S. Dillingham, NY · K. Dobracki, MI · S. Doniger, IL · J&E Duski, MI · A. Duiko, MI · M. Egbaria, IL · M. Elford, MI · O. Erdt, MI · K. Evanoff, MI · M. Evers, OH · F. Facchini, MI · F. Falcao, FL · L. Feldman, NJ · G. Fink, DE · M. Frankman, SD · M. Glovis, MI · C. Goldin, MI · M. Grant, MI · A. Green, MI · R. Green, MI · B. Greenwood, UT · J. Griffin Jr., MO · K. Grindling, MI · P. Gronet, KY · R. Grossman, PA · H. Gulati, MA · F. Haddad, MI · G. Haddad, CA · J. Haddad, MI · A. Hakhamian, CA · J. Hamerink, MI · W. Hanna, MI · A. Harris, OH · J. Hastings, CA · A. Hodges, NC · C. Huang, CA · M. Huberty, WI · J. Ireland, MI · S. Irwin, NJ · C. Jaghab, MI · J. Jaghab, MI · W. Jenkins, MI · T. Jolly, TN · R. Juluri, IL · M. Kachi-George, MI · D. Kapp, NY · J. Kane, MI · Y. Kang, MA · J. Karam, MI · G. Karouzaz, MI · E. Kelly, GA · J. Kelly, GA · L. Kemmet, MN · M. Koczarski, WA · L. Knowles, MI · B. Kolb, MI · G. Krishnan, CA · E. Kuns, OH · C. Laird, OR · T. Lam, CA · R. Le, NC · I. Levine, NY · E. Lowe, BC · J. LueYen, GA · A. Malkis, NY · C. Manduzzi, MI · J. Mangutz, MI · K. Mantzikos, NY · B. Mayday, MI · T. McDonald, GA · J. McLaren, MI · M. McMullin, MI · G. Meylan, MI · M. Migdal, MI · M. Miller, NC · J. Mills, MI · J. Minsky, CA · L. Montes, NY · A. Moore, NC · L. Motyl, MI · M. Murphy, MI · M. Murrell, MI · L. Musgrave, MI · M. Nasif, MI · B. Neren, NY · J. Neuman, MI · J. Olitsky, FL · J. Olsen, MI · E. O'Neil, MI · F. Orlando, NY · S. Owens, MI · A. Paal, TX · P. Panchal, NC · R. Parikh, IL · J. Parrott, MI · U. Patel, CA · D. Perkins, MI · N. Pelachyik, MI · B. Peterson, MD · W. Phillips, MI · S. Picazio, NJ · B. Picot, NC · C. Pike, MI · C. Piontkowski, MI · B. Pittsley, MI · J. Poskowitz, IL · B. Pournaras, SC · A. Prince, UT · D. Radtke, MI · G. Ramos, NY · C. Ramsey, FL · G. Rashall, TX · S. Reddy, MI · N. Rego, CA · J. Riggs, MI · M. Rojas, IL · J. Rowe, AR · J. Rubin, DC · A. Saddy, MI · S. Salhadar, MI · P. Saurer, OH · P. Scalia, MI · C. Scanlon, MI · J. Schau, MI · K. Schier, MI · A. Schraner, NY · V. Scola, CA · L. Seluk, MI · R. Selvan, NJ · Y. Shaheen, MI · M. Shapiro, MI · A. Shemesh, IN · E. Simanion, CA · S. Simos, IL · J. Slatkoff, FL · J. Smith, MI · C. Stevens, OK · B. Stieper, MI · R. Surana, CA · G. Sutton, CA · G. Tarantola, FL · T. Teel, IN · C. & L. Thorpe, MI · L. Trost, IL · S. Uchil, MI · A. Valentine, MI · H. Vann, MS · C. Vinkovich, OH · J. Weinfield, MI · B. Wilk, PA · K. Wilson, MI · D. Wolf, MA · W. Wright, CA · Y. Yi, MA · D. Young, MI · S. Yun, MI · M. Yurth, WA · J. Zanetti, MI · A. Zucker, OH

Laboratory Consultants: Apex Dental Milling, MI