

DENTAL ADVISOR™

Product insights you can trust.

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Cements & Universal Bonding Agents

**HOW TO SELECT
WHICH CEMENT TO
USE FOR YOUR PREP**

**IS IT OKAY TO
MIX-AND-MATCH
CEMENTS AND
BONDING AGENTS?**

**HIGH PERFORMERS
FROM THE
BIOMATERIALS
LABORATORY**





One of the most requested topics here at Dental Advisor is information on cementation and bonding. This month, we look at all of the different types of cements on the market and discuss their clinical applications, as well as bonding and surface treatments. We offer clinical tips for using different types of cements, and share some of our laboratory results on the highest performing cements in our independent testing. We welcome your comments and suggestions; as always please reach out to me at drbunek@dentaladvisor.com or to our team at connect@dentaladvisor.com. Thank you for reading!

— *Sabiha S. Bunek*

How to Choose What to Use



CERAMIC STRENGTH	PREPARATION	Resin-Modified Glass Ionomer	Self-Adhesive Resin	Adhesive Resin	Esthetic Resin (DC & LC)	Universal Resin	Bioactive
LOW <small>(feldspathic, leucite-reinforced)</small>	Retentive			✓	✓	✓	
	Non-retentive			✓	✓	✓	
MEDIUM <small>(lithium disilicate)</small>	Retentive	✓	✓	✓	✓	✓	
	Non-retentive			✓	✓	✓	
MODERATE-HIGH <small>(highly translucent zirconia)</small>	Retentive	✓	✓	✓	✓	✓	
	Non-retentive			✓	✓	✓	
HIGH <small>(zirconia)</small>	Retentive	✓	✓	✓	✓	✓	✓
	Non-retentive			✓	✓	✓	

Often, there are one or more applicable cements to use in a given clinical situation. The decision tree should begin with the type of ceramic you are using, closely followed by the retentiveness of the preparation.

GLASS IONOMER & RESIN-MODIFIED GLASS IONOMER

These cements are considered excellent choices when fluoride release is desired, and moisture control is an issue. Resin-modified glass ionomers (RMGIs) are typically more esthetic than traditional glass ionomers. Resin-modified glass ionomers also have improved physical properties. Both glass ionomers and resin-modified glass ionomers chemically bond to enamel and dentin and have a thermal expansion similar to tooth structure. Additionally, no bonding agent is required.

Choose GI or RMGI for highly retentive cases with:

- Metal
- Metal-ceramic
- High-strength ceramic (Zirconia)

Clinical Tips for GI and RMGI:

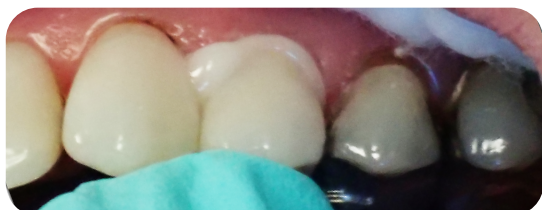
- Light cure RMGIs from the buccal and lingual aspects to allow cleaning of excess cement in the gel phase.
- Do not use in the esthetic zone with ceramics as these cements tend to be opaque.
- Avoid excessively drying the tooth. Bond to tooth structure is significantly reduced when the tooth is excessively dried, and can lead to post op sensitivity. Lightly moisten dentin so it is slightly glossy with no water pooling on the surface.

Product	Rating
GC FujiCEM® Evolve (GC America Inc.)	+++++ (96%)
RelyX™ Luting Plus (3M)	+++++ (96%)



SELF-ADHESIVE RESIN CEMENTS

Product	Rating
Maxcem Elite Chroma (Kerr Corporation)	+++++ (96%)
Bifix SE (VOCO)	++++½ (94%)
SpeedCEM (Ivoclar)	++++½ (93%)



Self-adhesive resin cements do not require a bonding agent and are simple and easy to use. However, they typically offer lower bond strength than adhesive resin cements and as such should be used for highly retentive cases. These cements tend to have a lower incidence of sensitivity than other cements as well.

Choose Self-Adhesive Resin Cements for retentive cases with:

- Medium-strength ceramics (i.e., Lithium Disilicate)
- High-strength ceramics (Zirconia)

Clinical Tips for Self-Adhesive Resin Cements:

- Remove excess during tack cure phase.
- Isolate well to avoid saliva contamination.
- If retention is low, consider using a bonding agent and priming the restoration

ADHESIVE RESIN CEMENTS

Product	Rating
Multilink Automix (Ivoclar)	+++++ (97%)
Duo-Link Universal (Bisco)	++++½ (93%)
Visalys CemCore (Kettenbach)	++++½ (93%)



Adhesive cements require a bonding agent and are the best choice when retention is a concern. They offer the highest bond strengths and are often combined with universal bonding agents to provide a choice between self-, total-, and selective-etch modes. Adhesive resins are the most versatile cement, and can be used with almost any clinical case. They do require more steps but offer the best retention, especially when combined with surface treatments. A bonding agent is necessary, and surface treating the restoration will offer a higher bond strength.

Choose Adhesive Resin Cements for retentive cases with:

- Low-strength ceramics
- Medium-strength ceramics (i.e., Lithium Disilicate)
- High-strength ceramics (Zirconia)

Clinical Tips for Adhesive Resin Cements:

- Tack cure for no more than 5 seconds, it is difficult to remove excess once it has set.
- Make sure to follow the instructions for use for the specific application.
- Take a follow-up radiograph to check that all excess cement is removed.
- Separate components into what normally gets used versus what rarely gets used.

ESTHETIC RESIN CEMENTS

Esthetic Resin Cements also require a bonding agent and are only used in the esthetic zone, in particular on thin restorations such as veneers. Some clinicians may choose to utilize them on anterior crown cases as well. They are typically dual- or light-cured and often have try-in pastes so color shift does not occur after final cementation. Light cured cements also do not contain an amine catalyst, which can cause a shade shift over time. The light and dual cured functionality increases working time, which is essential on bigger esthetic cases. Esthetic resins are the most time consuming and technique sensitive, but do offer good bond strength.

Choose Esthetic Resin Cements for retentive cases with:

- Low-strength ceramics
- Medium-strength ceramics
- High-strength ceramics

Clinical Tips for Esthetic Resin Cements:

- Perform clean-up in the rubbery phase, around three minutes after mixing.
- Do not use with lower-strength glass ceramics.
- Store at room temperature.

Product	Rating
Variolink® Esthetic LC (Ivoclar)	+++++ (99%)
NX3 Nexus™ Third Generation (Kerr Corporation)	++++½ (91%)
Panavia Veneer LC (Kuraray Noritake Dental Inc.)	Excellent Lab Results





UNIVERSAL RESIN CEMENTS

Product	Rating
3M™ RelyX™ Universal Resin Cement (3M)	+++++ (99%)
PANAVIA™ SA Cement (Kuraray Noritake Dental Inc.)	+++++ (98%)
G-CEM ONE (GC America Inc.)	++++½ (93%)



These cements offer the best of all worlds and can be utilized on most every type of restoration. Due to the addition of a universal bonding agent, the clinician can select a mode of bonding that is best for any clinical case; either self-, total-, or selective-etch. They offer high bond strengths when used in adhesive mode. They can also be used in self-adhesive mode, which cuts down on the amount of inventory necessary for the office.

Choose Universal Resin Cements for cases of any retention type:

- Low-strength ceramics
- Medium-strength ceramics
- High-strength ceramics

Clinical Tips for Universal Resin Cements:

- Do not allow cement to cure too much when tack curing or it will be very difficult to remove excess.
- The most difficult thing about resin cements is cleaning up interproximally. Clean interproximal areas first, whenever possible.
- Place the mixed cement in the crown, and wipe the mixing tip along the margins to ensure cement on the margins. Place the crown and put floss between the contacts. Light cure the buccal and lingual to a count of five, pull the floss, and use an explorer to remove excess cement. Continue the light curing.

BIOACTIVE CEMENTS

These cements are typically self-adhesive in nature, and contain bioceramic luting agents that promote hydroxyapatite formation and are antibacterial with fluoride release. They also contain an alkaline base which is non-irritating to the pulp.

Choose Bioactive Cements for highly retentive cases with:

- High-strength ceramics

Clinical Tips for Bioactive Cements:

- Perform clean-up in the rubbery phase, around three minutes after mixing.
- Do not use with lower-strength glass ceramics.
- Store at room temperature.

Product	Rating
Theracem (Bisco)	+++++ (97%)
Ceramir Crown and Bridge Quickcap (Ceramir)	++++½ (95%)



Bonding Agents



Most companies have now transitioned to Universal Bonding Agents, which allow the user to select the mode of etching that is indicated for each clinical situation. This decreases inventory in the office, as well as simplifies use.

For a bonding agent to be truly universal, it should meet at least two of the following criteria:

- Compatible with different etching techniques: total-, self-, and selective-etch
- Compatible with dual- and self-cured materials without the use of a separate activator
- Can be used as a primer for silica-based, zirconia, and metallic restorations.

The table lists Universal Bonding Agents clinically evaluated by DENTAL ADVISOR. As with any new dental material, be sure to thoroughly read the manufacturer instructions prior to use.

Product	Indicated for all etching modes (Total-, Self-, and Selective-etch)	Separate dual-cure activator required (with dual-cure materials)	Primes Silica- and Zirconia-based ceramic and metal restorations	Clinical Rating
CLEARFIL™ Universal Bond Quick (Kuraray)	Yes	Yes*	Yes**	+++++ (98%)
iBOND® Universal (Kulzer)	Yes	No	Yes**	+++++ (98%)
3M™ Scotchbond™ Universal Plus Adhesive (3M)	Yes	No	Yes	+++++ (96%)
All-Bond Universal (Bisco)	Yes	No	Yes***	+++++ (96%)
Futurabond® U (VOCO)	Yes	No	Yes	+++++ (96%)
OptiBond™ Universal (Kerr Corporation)	Yes	Yes*	Yes	+++++ (96%)
Adhese Universal (Ivoclar)	Yes	No	Monobond Plus Recommended	++++½ (93%)
Zipbond Universal (SDI)	Yes	No	Yes	++++½ (93%)
Tokuyama Universal Bond (Tokuyama)	Yes	No	Yes	++++½ (92%)
Ambar Universal APS (FGM Dental Group)	Yes	No	Yes	++++½ (91%)
G2-BOND Universal (GC America Inc.)	Yes	Yes*	Yes**	++++½ (91%)
HugeBond (VinciSmile)	Yes	No	Yes**	++++ (86%)

* Dual-Cured Activator is not required if adhesive is paired with resin cement from same manufacturer

** Use of ceramic primer is recommended for silica-based ceramics

*** Separate primer not required if bonding agent is light-cured

Product Highlights

All-Bond Universal

(Bisco)

All-Bond Universal is the culmination of over 30 years of adhesive research at BISCO. As a universal adhesive it can be used with direct and indirect restorations and is formulated to be compatible with light-, dual- and self-cured materials. The versatility of All-Bond Universal makes it an indispensable part of any dental practice. Simplify your restorative procedures with All-Bond Universal.



Evaluator Comments:

- "Easy to use and works for everything!"
- "Less technique sensitive than other adhesives."

Online: www.bisco.com

Ambar Universal APS

(FGM Dental Group)

Ambar Universal APS is a self-etching light cure adhesive system for enamel and dentin. It has excellent performance in any level of dentin moisture and even better in intracanal application. It has a colorless aspect, ideal for esthetic restorations or cementation and is compatible with dual, self-curing or light cure cements.

The colorless aspect present in Ambar Universal APS adhesives comes from an exclusive technology by FGM: APS Technology (Advanced Polymerization System).

As a result, the procedures acquire greater esthetics, without color interference in restorations and cementations. In addition to this benefit, the APS technology offers excellent performance on wet dentin, great polymerization efficiency and a high level of adhesion!



Evaluator Comments:

- "Lack of color is great for anterior restorations."
- "I experienced zero sensitivity and had no de-bonds with this product."

Online: www.fgmus.com

CLEARFIL Universal Bond Quick

(Kuraray Noritake Dental Inc.)

CLEARFIL Universal Bond Quick is a fluoride-releasing, universal adhesive with MDP monomer and amide monomer chemistry that provides rapid bond technology. The amide monomer rapidly permeates dentin and enamel, eliminating wait time after application. In addition, it is more hydrophilic than HEMA and absorbs less fluid. When mixed with CLEARFIL DC Activator, this bonding agent becomes dual-cure and has universal use with both self- and dual-cured resin cements and core build-up resins.



Evaluator Comments:

- "Perfect viscosity. Ease of use and speed were great."
- "I love the unit dose – so easy to use, and there was plenty of adhesive for most procedures in each one."

Online: www.kuraraydental.com

OptiBond™ Universal

(Kerr Corporation)

OptiBond™ Universal is a single-component light cure adhesive, providing excellent adhesion to a variety of surfaces and substrates for direct and indirect applications - even indirect metal-based restorations when used with NX3 or Maxcem Elite resin cement. OptiBond Universal simplifies the bonding procedure, making it less technique sensitive.



- One coat application
- Can be used with self-etch, selective etch, and total-etch techniques
- Direct / Indirect Use - Excellent dental adhesive for enamel, dentin, porcelain and ceramics
- Low film thickness creates a better fit of final restorations (~5 microns)
- Delivery options include Bottle Kit, Refill (Bottle), or Unidose®

Evaluator Comments:

- "Versatile bonding agent. It can be used for all surfaces for direct and indirect adhesion."
- "Nice to get quality chemistry into a single bottle."

Online: www.kerrdental.com

Surface Treatments

Clinicians can often be confused when deciding how to treat the intaglio surface of silica-and zirconia-based restorations prior to cementing. Surface treatments improve bond strength at the ceramic-cement interface. Micromechanical treatment is increasing the surface area of indirect restorations. Hydrofluoric acid (HF) or sandblasting with 50 µm alumina can be utilized. Chemical treatment is using silane or ceramic primers with MDP.

	Micromechanical Treatment: HF or Sandblasting	Chemical Treatment: Silane or Ceramic Primer w/ MDP
Silica-based glass ceramic (laboratory)	HF (laboratory will generally etch)	Silane
Silica-based glass ceramic (milled chairside)	HF	Silane
Zirconia-based restoration cemented with self-adhesive cements	Sandblast with 50 µm alumina	Self-adhesive and adhesive resin cements usually contain an acidic monomer (MDP) - therefore no need to use a ceramic primer if preparation is retentive
Zirconia-based restoration cemented with adhesive resin cements and esthetic resin cements	Sandblast with 50 µm alumina	Ceramic Primer w/MDP

DA / Q&A

Is it ok to mix-and-match resin cements and bonding agents from different manufacturers?

Companies have optimized their chemistry so that bonding agents and cements work more effectively together and results are predictable.

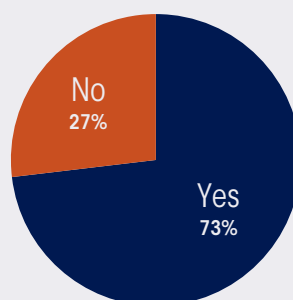
However, many clinicians ask about mixing and matching products from different manufacturers. One caution is that dual-cured cements may require separate activators to allow compatibility of the dual-cured cement with acidic, self-etching bonding agents. Several universal bonding agents claim compatibility with dual-cured resins without a special dual-cured activator.

The most common incompatibility involves the adhesive combination with chemical curing materials as the acid in self-etching adhesives may cause cements or core materials to not fully polymerize at the interface. This involves many factors, including the specific initiators being used, the timing of the light curing, some of the cements can buffer the pH better than others, some of the etchants in the adhesives may have a low pH (acidic) but are also buffered to react slower.

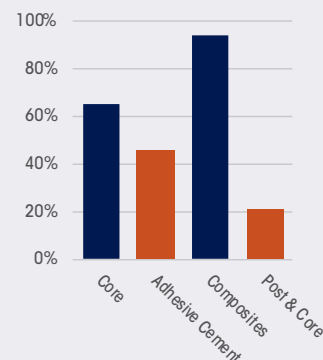
Many adhesives have an optional dual-cured activator to make them more compatible with chemical curing restoratives, but some problems with DCAs have been reported as well.

We asked our consultants...

Do you mix and match brands when bonding and cementing resin materials?



Which resin systems do you mix and match?



High Performers

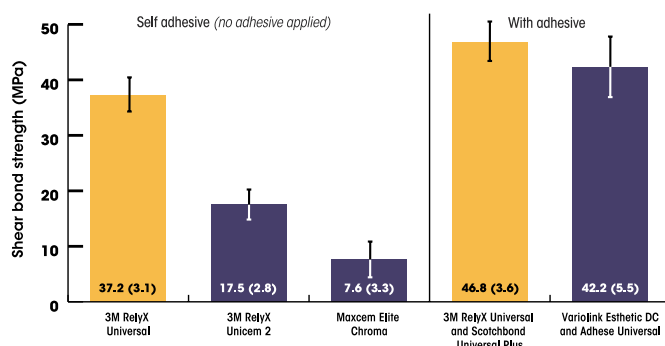
in DENTAL ADVISOR'S Biomaterials Laboratory



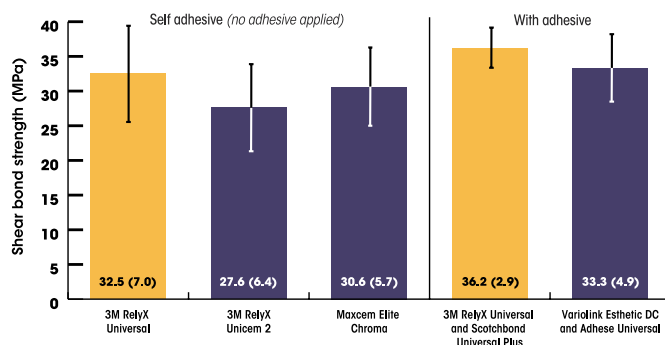
3M™ RelyX™ Universal with 3M™ Scotchbond™ Universal Plus (3M)

Self-adhesive bond strengths of the 3M cements to dentin, enamel and zirconia substrates are the highest of any self-adhesive cements tested with this method by DENTAL ADVISOR. Adhesive bond strength to dentin and enamel was excellent, and in particular, the zirconia bond strengths are the highest among the universal adhesives tested in DENTAL ADVISOR Biomaterials Lab.

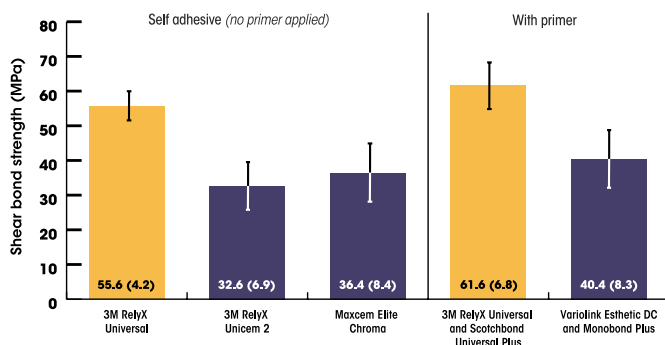
Dentin



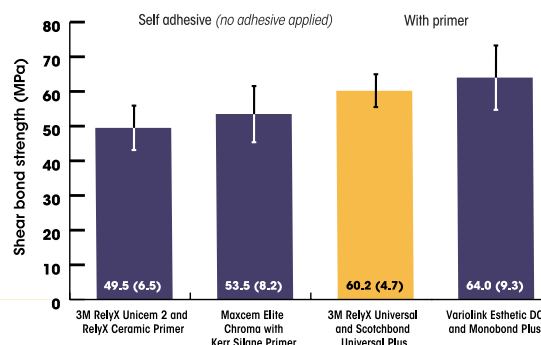
Enamel



Zirconia



IPS e.max CAD



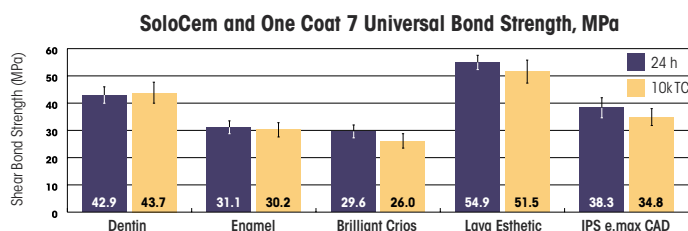
High Performers in DENTAL ADVISOR'S Biomaterials Laboratory



SoloCem with ONE COAT 7 UNIVERSAL

(Coltene/Whaledent, Inc.)

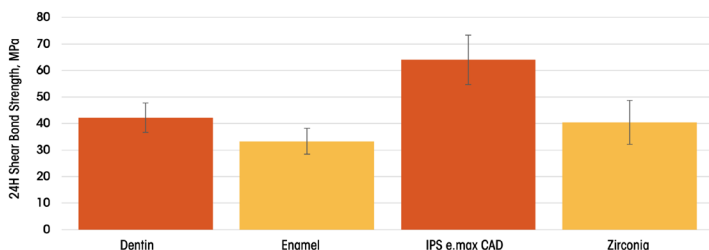
SoloCem is a radiopaque, dual-cured, self-adhesive resin cement. **ONE COAT 7 UNIVERSAL** is a light-cured, single-component bonding agent that can be used with the self-etch, selective-etch and total-etch technique. No bond incompatibility was detected and results are consistent with a high bond strength in the self-cured adhesive cement mode. There was no consequential drop in bond strength after thermocycling or change in failure mode for any substrate indicating a high bond durability.



Variolink® Esthetic DC with Adhese® Universal & Monobond®

(Ivoclar)

Variolink Esthetic DC is a radio-opaque dual-cure adhesive resin cement with Ivocerin, a unique amide-free polymerization initiator system which virtually eliminates color change over time. In combination with Adhese Universal to tooth structure and Monobond Plus or Monobond Etch and Prime to ceramics, this system achieves a consistently strong bond to all surfaces. Adhese Universal is also available with a unique applicator, the VivaPen® which provides more applications per mL of adhesive in a precise ergonomic form factor.

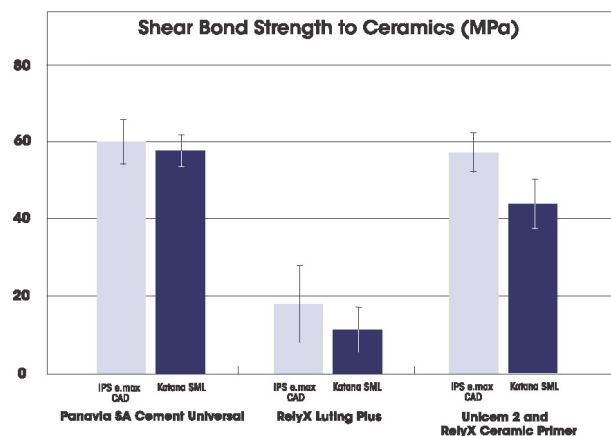
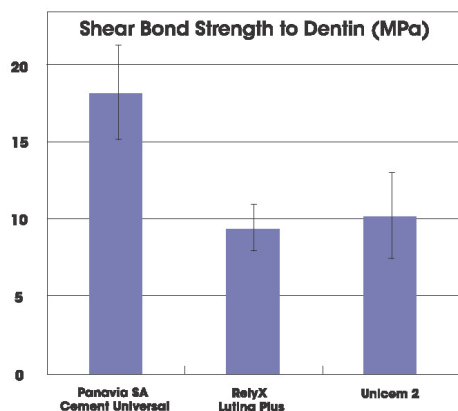
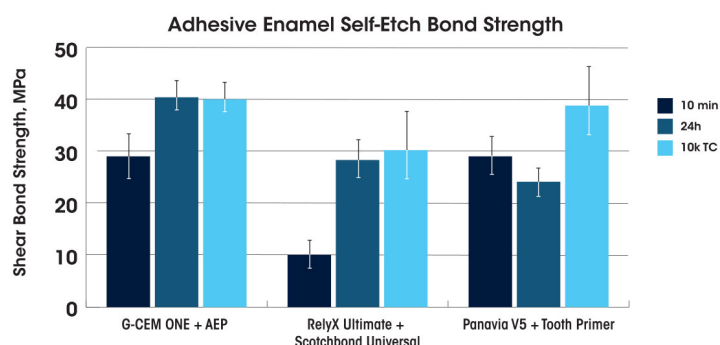
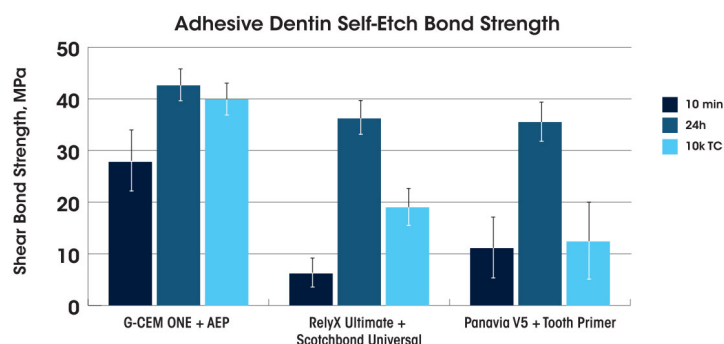




G-CEM ONE™ with Adhesive Enhancing Primer

(GC America Inc.)

G-CEM ONE has exceptional bond strength durability after thermocycling to all substrates tested, and high initial bond strength after limited curing time in combination with the Adhesive Enhancing Primer including touch curing technology.



Panavia SA Cement Universal

(Kuraray Noritake Dental Inc.)

In this study, the initial self-cured bond strength of 3 cements to dentin, zirconia and lithium disilicate substrates were measured after 24 hours of storage.

Panavia SA Cement Universal with an incorporated silane primer has exceptional initial bond strength to dentin, lithium disilicate and zirconia.

Panavia SA Cement Universal can also be used with adhesive systems like CLEARFIL Universal Bond Quick when extra retention is required.

Product Highlights

Panavia SA Cement Universal (Kuraray Noritake Dental Inc.)

PANAVIA SA Cement Universal is a self-adhering resin cement that contains a proprietary DUAL-MONOMER TECHNOLOGY and bonds to all restorations and tooth structure. This simplifies cementation procedures and eliminates the need for zirconia or silane/ceramic primers.



Evaluator Comments:

- "Amazing viscosity, tack cure-ability and very easy clean-up."
- "Great color match and I liked the universal ability to work with so many substrates."

Online: www.kuraraydental.com

TheraCem (Bisco)

TheraCem is a dual-cured, calcium and fluoride-releasing, self-adhesive resin cement indicated for luting crowns, bridges, inlays, onlays and posts (prefabricated metal/non-metal/fiber posts).

Delivering a strong bond to Zirconia and most substrates, along with easy clean-up and high radiopacity, TheraCem offers the clinician a reliable and durable cementation of indirect restorations.



Evaluator Comments:

- "Excellent cement and super easy to use."
- "It tack cured quickly. Clean-up was perfect and there was no sticky residue."

Online: www.bisco.com

G-CEM ONE™ (GC America Inc.)

G-CEM ONE is a truly universal, non-technique sensitive, versatile and reliable product that gives the flexibility of being effective in all cementation procedures for any type of restorations. In addition, the optional Adhesive Enhancing Primer (AEP) and its innovative GC Touch Cure feature provides optimal bond strength in challenging clinical situations, such as low retentive surfaces.



Evaluator Comments:

- "Very easy to cement, sets predictably, and the excess cleans off easily."
- "Truly universal for all dental restorations and posts, especially considering the increased bond strength with the Adhesive Enhancing Primer."

Online: www.gc.dental

Variolink® Esthetic (Ivoclar)

Variolink Esthetic is an adhesive cement for the permanent cementation of ceramic and composite restorations. Variolink Esthetic is available in light-cure (LC) and dual-cure (DC) versions. Variolink Esthetic LC is indicated for use with glass-ceramic, lithium disilicate and composite inlays, onlays, and veneers with a material thickness of less than two millimeters and sufficient translucency for light penetration. Variolink Esthetic DC is designed for cases in which full light curing cannot be achieved, including opaque ceramic and composite inlays, onlays or partial crowns, and crowns and bridges. Each formulation has five shades available: Light+, Light, Neutral, Warm, and Warm+.



Evaluator Comments:

- "I was able to get precise shade matching with **Variolink Esthetic**."
- "Easy clean-up."

Online: www.ivoclar.com

GC FujiCEM® Evolve

(GC America Inc.)

GC FujiCEM Evolve is a radiopaque resin-reinforced glass ionomer cement in a syringe delivery with a tack-cure feature and high radiopacity. It can be used for cementation of a variety of substates and different types of indirect restorations. New tack-cure feature reduces cleanup time to seconds and its high radiopacity allows for easy visualization. GC FujiCEM Evolve also features rechargeable fluoride release and moisture tolerance.

Evaluator Comments:

- "Easy to use and easy to clean excess cement with tack-cure feature."
- "I liked the way it dispensed much better than what I use now."

Online: www.gc.dental



Duo-Link Universal

(Bisco)

Duo-Link Universal adhesive resin cement is specially formulated for cementation of indirect restorations. It is intended for use with adhesives that are compatible with all dental materials, including all BISCO adhesives.

Duo-Link Universal is compatible with all dental materials, however when coupled with BISCO's adhesives, Z-Prime Plus and Porcelain Primer is the ultimate product combination for all indirect restorations.

Evaluator Comments:

- "I can use this to cement all of my indirect restorations."
- "Tack curing makes removal of excess cement easy."

Online: www.bisco.com



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6 CLINICAL EVALUATORS

16 TOTAL USES

90% CLINICAL RATING

Key features: Digitally Fabricated • Precision Matrix • Unique delivery

Description

3M™ Filtek™ Matrix is a unique customized anterior matrix system that is designed for predictability, efficiency and conservative dentistry. The digitally produced matrix fits your patient and allows for direct placement, creating easy to place anterior composite restorations.



Indication

- Anterior composite restorations.

Unique Attributes

- Additive manufacturing allows for minimally invasive dentistry as opposed to ceramic restorations.
- Large windows in the matrix allow for the use of universal composites and help the user view the fill level.
- Doors on the matrix compress the composite and shape the facial contour. The doors also have engineered vents that allow for easy removal of excess.
- Precise gingival trim allows the user to remove flash prior to curing.

Photos: Dr. Sabiha Burek



Pre-op full smile



Placing 3M™ Filtek™ Supreme Ultra Universal Restorative Composite into 3M™ Filtek™ Matrix



Final result

Clinical Tips

- Place and cure **3M™ Filtek™ Supreme Flowable Restorative** at the gingival margin to help minimize the potential for voids.
- Be sure to watch the instruction video - the process is extremely easy.
- Avoid excessively overfilling the matrix as it may lead to more difficult removal after light curing.
- Great for large case composite veneers and ideal, if freehand veneers are new to you.
- Use digital impressions to avoid the need to ship impressions and eliminate the time required for digitization.
- Try a few cases; I suspect the process gets easier and easier.



"THE FINAL RESTORATION WAS VERY ACCURATE AND LOOKED EXACTLY LIKE THE MOCKUP."

Evaluators' Comments

"Having that initial shape is wonderful. It looks like it would be hard to trim after you open the doors, but it trims very quickly."

"3M™ Filtek™ Matrix reduced my chairside time into less than half and gave amazing veneer like results in a very conservative way."

"The final contours and esthetics of the composite veneers was great. My patient and I were both very pleased with the result."

"I was pleasantly surprised at how there was not much excess composite interproximally."

"This could be extremely helpful to clinicians who do not feel comfortable freehanding composite veneers."

"The actual matrix was brittle and difficult to remove."

"The lingual piece of the matrix was challenging to place."

Consultants who would:

83% Recommend to a colleague

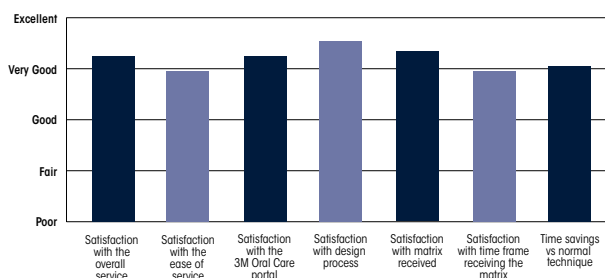
Consultants who would want to stock in office:

33% Yes, replacing my existing technique

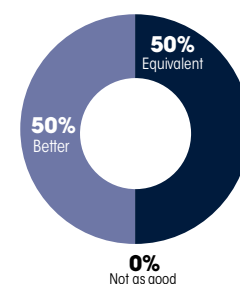
50% Yes, in addition to my existing technique

17% I might want to order this product for certain cases

Evaluation Summary:



Compared to Alternative Techniques:





35 CLINICAL EVALUATORS

1074 TOTAL USES

87% CLINICAL RATING

Key features: Unique cutting design • Corrosion resistant
• Autoclavable

Description

MANI Carbide Burs are carbide burs which are:

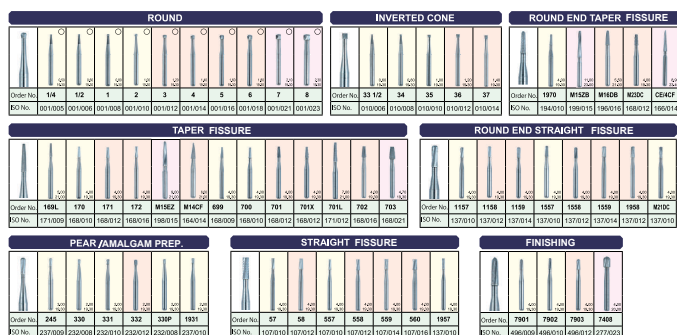
- Cutting efficient
- Corrosion-resistant
- Autoclavable
- Available in 58 shapes

Indications

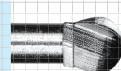
- All restorative procedures requiring reduction, finishing, or polishing.
- All surgical procedures requiring cutting.
- All endodontic procedures requiring reduction and finishing.

Unique Attribute

- Improved blade geometry for effective cutting



Number
CA-4



Use as the low speed CA/RA Burs.
Available from number 1/4 to 8.



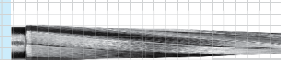
Number
330P



Use as the Multi-function-burs.
Efficient cutting, increased durability.



Number
M15ZB



Use as the Surgical-burs.
Special design for sectioning teeth.



Clinical Tips

- The 1557 burs with rounded edges are perfect for composite preparation and placement for proximal boxes.
- Loved the taper on the amalgam prep (245) bur. I did the main prep accessing the decay with the 330 and then I would use the 245 to clean up the walls.
- We dip the burs in surgical milk prior to sterilization and got great cutting efficiency even after sterilization.
- You do not need as much pressure to cut with these burs.

"THE BURS WERE VERY EFFICIENT & DURABLE."

Evaluators' Comments

"The shapes are perfect, and they do not discolor or corrode after autoclaving."

"No vibration and clean cutting with limited debris build-up on burs."

"Remained sharp, even after sterilization."

"This is the best bur I've ever used for crown removal; little wobble and cuts like butter."

"The packaging should have a perforated line across the back of the well that each bur is encased in."

"The neck of the shank just before the carbide head seemed thin, which worried me about durability, especially after sterilization."

Consultants who would:

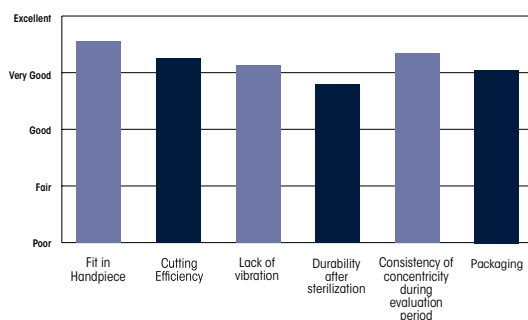
88% Recommend to a colleague

Consultants who would want to stock in office:

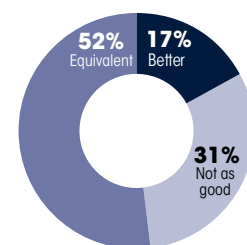
29% Yes, instead of current product

54% Yes, in addition to current product

Evaluation Summary:



Compared to Competitive Products:





35 CLINICAL EVALUATORS

786 TOTAL USES

91% CLINICAL RATING

Key features: Autoclavable • Multi-Use • Color-Coded



Description

DIA-BURS are:

- Autoclavable, reusable diamond burs available in five grits
- Available in numerous shapes and sizes

Indications

- All operative procedures for direct and indirect restorations requiring reduction of tooth structure or restorative materials

Unique Attributes

- Diamonds plated with electroplating technology; this minimizes or eliminates diamond particles separating from the shank after repeated use
- Various shapes and sizes of diamond particles enhance sharpness



Clinical Tip

- Although I don't use the shape regularly, I found the SF-41 diamond very helpful in several applications including crown prep and slots for extra coronal splinting

"MAINTAINS SHARPNESS, EVEN WHEN REMOVING FAILED ZIRCONIA RESTORATIONS."

Evaluators' Comments

"Consistency of the cut stayed the same, even after 3-4 uses."

"Great, efficient cutting diamonds. They cut well even after autoclaving."

"Diamond particles did not fall off like other brands."

"I was very impressed at how sharp they stayed."

"Packaging did not hold burs well. Recommend a change to single packaging."

91%

Consultants who would:

Recommend to a colleague

15%

Consultants who would want to stock in office:

Yes, instead of current product

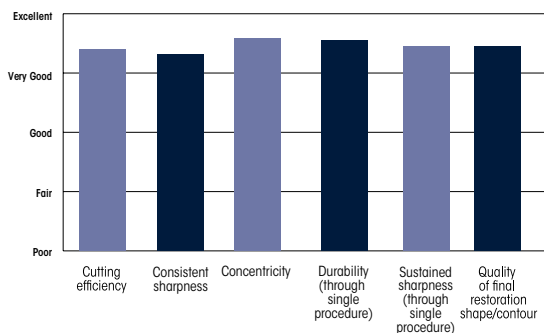
65%

Yes, in addition to current product

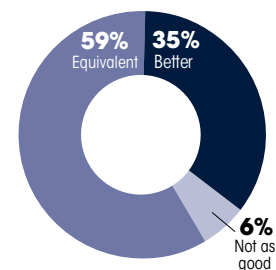
12%

I might want to order this product for certain cases

Evaluation Summary:



Compared to Competitive Products:





27 CLINICAL EVALUATORS

468 TOTAL USES

86% CLINICAL RATING

Key features: Self-curing composite • Gap free • Unlimited depth of cure
• Two steps • Available in syringe or capsule delivery

Description

Stela properties:

- Self-curing composite
- Unlimited depth of cure
- Contains fluoride, calcium and strontium

Photo by Dr. Matthew Miller



Core build-up using Stela composite

Indications

- Class I, II, III, & V
- Core Build Ups
- Base/Liner
- Sealer for endodontic access openings

What procedures did you use this product for?

Answer Choices	Responses
Class I restoration	52%
Class II restoration	52%
Class III restoration	7%
Class V restoration	30%
Core build up	82%
Base/liner	33%
Sealing endodontic access openings	41%



Clinical Tips

- Use proper isolation as this is a self-cured material.
- For Class II restorations, use a metal matrix so you can sculpt the material.

Unique Attributes

- Self-cured primer and composite
- Only two steps: prime then restore
- Gap free: primer initiates curing process at restoration interface
- Unlimited depth of cure
- 15 second preparation, sets in 4 minutes
- High flexural and compressive strength
- Can be used on all tooth shades in non-esthetic zones
- Anterior for A2/A3 Patients
- BPA and HEMA Free

"FAST SETTING
TIME, GOOD
ESTHETICS."

Evaluators' Comments

"The self-curing capability is great, especially in deep access cavitations where lack of confidence is found in light curing."

"It did not take more time than incremental additions of light-cured composite."

"Large depth of cure, plenty of time to shape and sculpt, minimal steps."

"Very easy to polish. Material wasn't chalky like other materials."

"Set time was inconsistent and took too long for my taste."

Consultants who would:

63% Recommend to a colleague

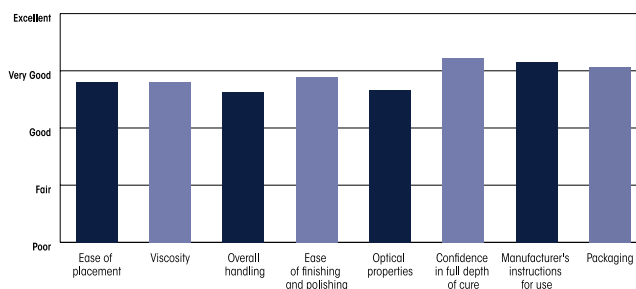
Consultants who would want to stock in office:

11% Yes, instead of current product

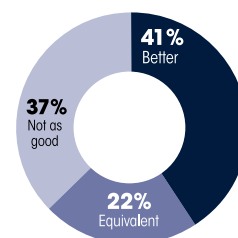
41% Yes, in addition to current product

18% I might want to order this product for certain cases

Evaluation Summary:



Compared to Competitive Products:



Bond Strength Testing of a Universal Cement System to Teeth

M. Cowen, D. Graham, J.M. Powers

Introduction:

G-CEM ONE is the latest in a series of universal cements which may be used with or without an additional primer to a variety of surfaces.

As a follow up study to RR 154 (Novel Universal Cement Bond Strength to Multiple Substrates), we tested the combination of **G-CEM ONE** and **G-Premio BOND** to examine how the system performs in terms of bond durability and compatibility in the self-curing mode to tooth structure.

This study used a modified ISO/TS 11405:2015 method for testing cement indirect bond strength by using a single sided PTFE tape to create a 3 mm interface and cement is bonded to an opaque metal disc to test the self-curing capabilities of the cement. We tested this cement system to human dentin and enamel, at 24 hours to provide a baseline to compare with the bond strength after artificial aging of 10,000 thermocycles.

Experimental Design:

Materials: **G-CEM ONE** with **G-Premio BOND** and **G-CEM ONE Adhesive Enhancing Primer** (AEP) (GC America), **RelyX Ultimate + Scotchbond Universal** (3M), **Panavia V5 + Tooth Primer** (Kuraray)

Tests:

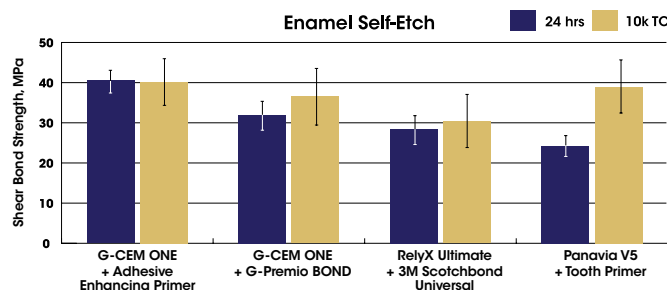
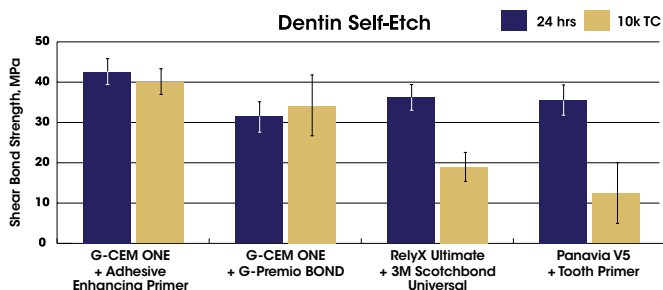
Substrates: Human superficial dentin, human self-etched enamel

Storage Conditions: 24 hours in water and 10,000 thermocycles

Methods:

Indirect Shear Bond Strength [n=8] to dentin, enamel: Molars, sterilized in a 1% chloramine solution, and stored in deionized water were embedded in acrylic resin discs and ground through 600-grit SiC paper to form bonding substrates of superficial dentin and ground enamel. Test groups for adhesive bonding had their surfaces treated. Specimens were then prepared in which single-sided adhesive PTFE tape, ~0.10 mm thick, with an approximately 3 mm diameter hole is placed over the bonding site and burnished into place. 10 mm diameter metal cylinders were ground with 60 grit SiC Paper, sandblasted, and primed to simulate an indirect restoration which should have a higher bond strength than the substrate being tested. A dab of the cement was placed in the center of the metal cylinder and the cylinder gently applied concentric with the hole with finger pressure before being placed in a loading jig where a 1 kg weight was applied at room temperature. The excess cement was removed by cotton without light and the load was removed then transferred to a 37°C, 100% R.H. oven carefully and dwelled for 10 minutes. They were then transferred to a container with 37 °C water for 24 hours. One group was then additionally thermocycled for 10,000 cycles between 5 and 55°C water before testing. The shear bond strength test was performed on a universal testing machine (Instron model 5866) at a crosshead speed of 1 mm/min. Means and standard deviations of bond strength were calculated and reported in the results section.

Results:



Conclusions:

G-CEM ONE with **G-Premio BOND** showed no decrease in bond strength after artificial aging.

Research supported by GC America

Laboratory Evaluation of FQ Rotary Files

M. Cowen, J.M. Powers

Introduction:

This study evaluated the cyclic fatigue resistance and cutting efficiency of 2 types of rotary files, the new **FQ Endodontic System** from Komet® and **ProTaper Ultimate** from Dentsply Sirona. The heat-treated FQ Files features a variable tapered core for increased flexibility toward the shank while the cutting edges are uniformly tapered for smooth canal excavation. The cutting edges feature a double S curve for improved evacuation of debris while cutting.

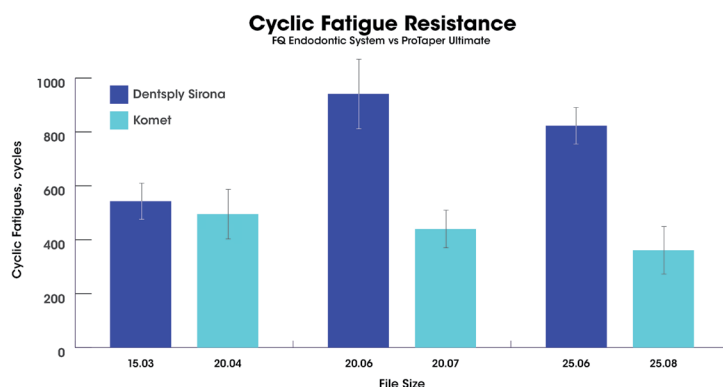
A **Promark Endo Motor** (Dentsply Sirona) was used at 400 RPM and torque settings listed in the IFU for tested file sizes #15.03, 20.06, 25.06 for the FQ Files and 20.04, 20.07, 25.08 with 25 mm length. The cyclic fatigue test using the DENTAL ADVISOR Cyclic Fatigue Platform featuring an 80° and 5-mm 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. Additionally, the amount of cutting debris that is removed with the files was also measured to compare claims of increased debris removal of the FQ files.

Conclusion:

The **FQ File System** had between 110% and 228% of the cyclic fatigue resistance of the **ProTaper Ultimate** system in the cyclic fatigue test. The **FQ files** also instrumented the training blocs about 24% faster overall with no file damage detected, and with more debris removed after use.

Methods:

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 at 400 RPM. Time until fracture was recorded, and means with standard deviations reported in the results. Representative images of files that failed after cyclic fatigue testing were imaged under SEM.



Cyclic Fatigue Resistance Summary: **FQ File System** had between 110% and 228% of the cyclic fatigue resistance of the **ProTaper Ultimate** system or between a 10% and 128% increase, with the largest differences in the larger file sizes. The combination of the heat treatment, lack of surface defects and variably tapered core likely contributes to higher cyclic fatigue resistance for **FQ File System**.

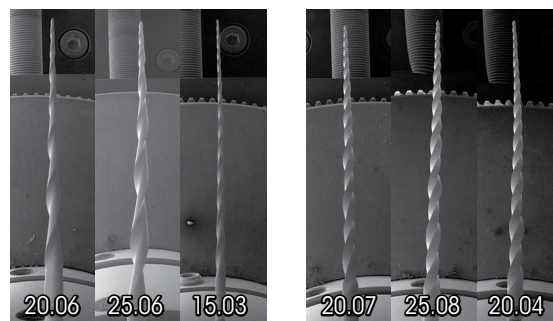


Fig 1. Full Length views of **FQ Rotary Files** and **ProTaper Ultimate** files.

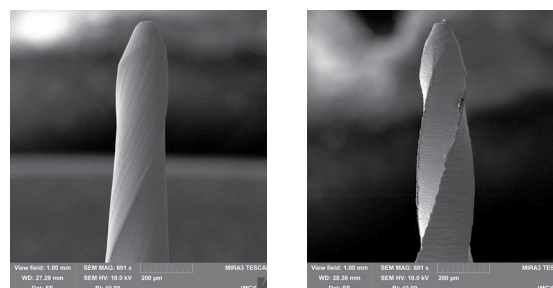


Fig 2. Magnified views of tip design, **FQ Rotary File** 20.06 and **ProTaper Ultimate** 20.07.

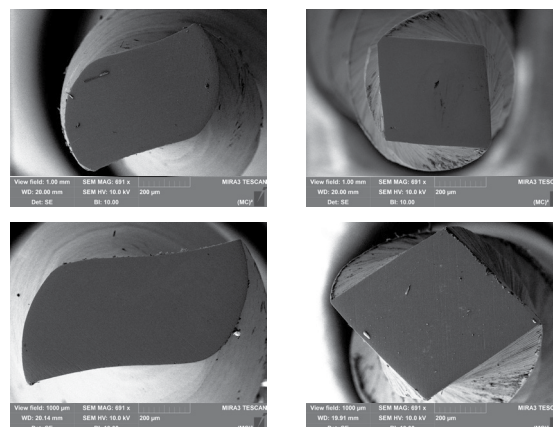
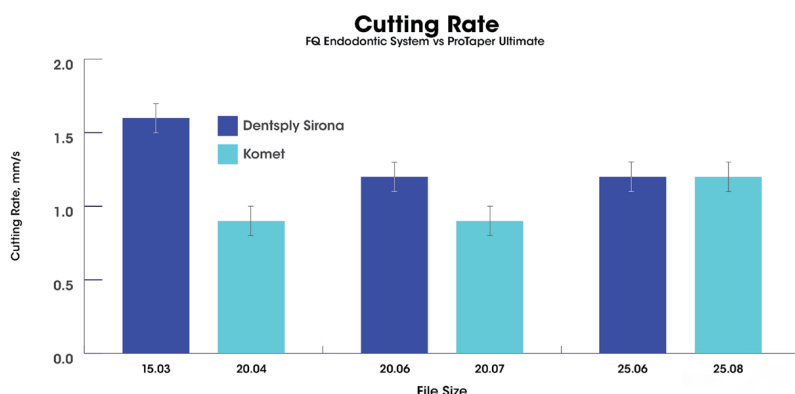
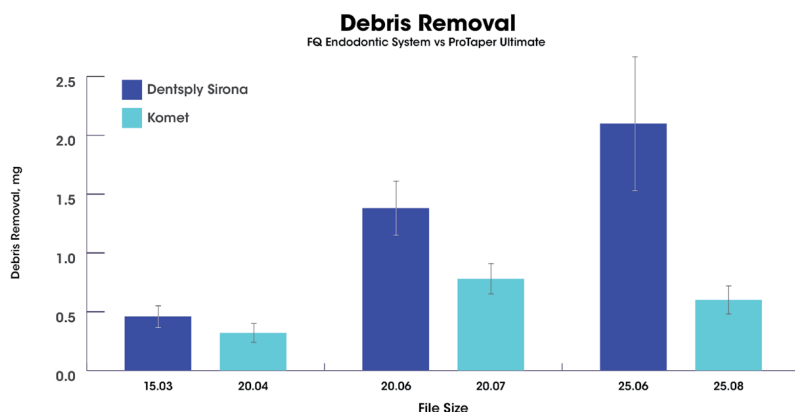


Fig 3. Cross-sectional views of 20.06 **FQ** and 20.07 **ProTaper Ultimate** rotary files sectioned at 8 mm and 13 mm from the tip. **ProTaper Ultimate** files feature a parallelogram design with a variable ~85-105° cutting edge. **FQ** rotary files feature a more acute cutting angle with a ~110-130° cutting edges with 2 smooth lands in an S-Shape which function to reduce transportation, screw-in effect and aid in debris removal. **FQ Files** (shown above) have a 0.23 and 0.35 mm² cross-sectional area and 0.7 mm and 1.0 mm diameter at 8 mm and 13 mm distance from the tip compared to 0.17 and 0.28 mm² area and 0.6 and 0.8 mm diameter for the **ProTaper Ultimate**.

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 files listed in the materials section. Canals were first prepared using the 16.02 file for **ProTaper Ultimate**, and 20.08 Opener for Komet **FQ**. Three canals were instrumented in sequence by each set of files at 400 RPM, and with torque limits set suggested by each manufacturer's instructions. Microscopic evaluation under 40x magnification next to new files were conducted before continuing to detect the presence of unwinding. Files were weighed before and after their first use to measure the mass of debris which was removed attached to the files with 5 replications each of the first cutting test.



Cutting Efficiency and Durability Summary: Overall cutting rate for **FQ Endo Files** was 24% faster than **ProTaper Ultimate**. All Files survived past 3 canals instrumented. The canal opening file 20.08 allowed less resistance for the initial 15.03 file for FQ which may have contributed to the subsequent values. There was little resistance found with the 15.03 glidepath file until the apex as it is primarily used to clean the apex after use of the coronal canal opener file.



Debris Removal: **FQ Rotary** files removed significantly more debris attached to the files. Longer strips of debris were generally created due to the grooves of the S-shaped canal design compared to **ProTaper Ultimate** which tended to shred the canal into more fragments. The larger outside surface area of the **FQ Rotary Files** and larger lands and deeper grooves may contribute to the higher measured debris removal.

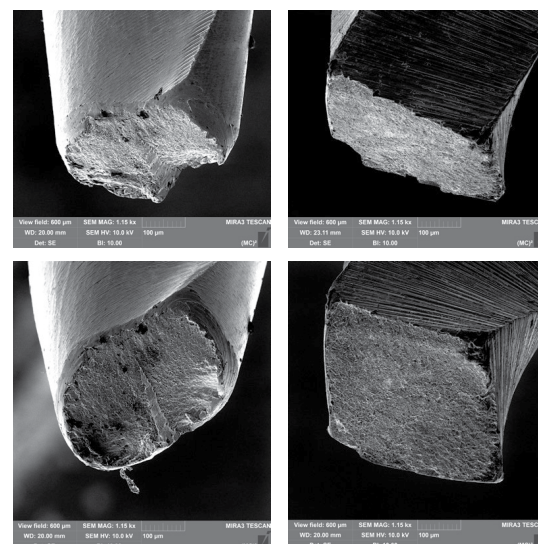


Fig 4. Size 25.06 and 25.08 files after cyclic failure. Note the smoother surface and difference in core texture of the **FQ Endodontic Files** (left). Failure tended to initiate at the corners of the **ProTaper Ultimate** files.

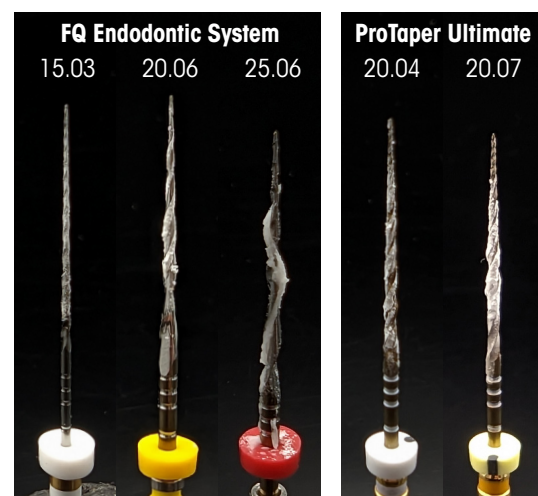


Fig 5. Images of debris removal after cutting evaluation. The mass of debris left on the file varies with how much debris is removed from water irrigation in the simulated canal.

Veneer Cement Bond Strength Durability and Resistance to Toothbrush Abrasion

M. Cowen, J.M. Powers

INTRODUCTION:

Veneer Cements are specialized cements for demanding esthetic cases in which any color change over time is the most apparent and mechanical retention and bonding surface area is at a minimum. Ideally, esthetic veneer cements should have a long working time, curing on demand, excellent color stability, and high strength.

Veneer restorations, inlays and onlays differ from other indirect restorations in that there is a relatively larger margin exposed compared to the size of the restoration, while more margin is often directly exposed to toothbrush abrasion rather than being protected by gingiva. Over time, toothbrush abrasion and chemical attack may wear enough of the cement margin to allow increased staining to occur, bacteria to accumulate or present a change in gloss which can show an unsightly cement margin. Self-cured and dual-cured cements tend to suffer from increased shade shift overtime compared to light-cured only cements. This is a reason why many veneer cements are light-cured only; to achieve the highest possible color stability as chemical curing initiators and adhesive monomers can increase color change. This also allows light-cured only cements to have higher filler loading and increased strength as they don't need to have a viscosity low enough to allow mixing with a dual-barrel syringe.

In this study, we compared the bond strength of three veneer cements after six months of artificial aging to Dentin, Enamel, **IPS e.max CAD** (Ivoclar Vivadent, Inc.) and **KATANA™ STML** (Kuraray Noritake Dental, Inc.) Zirconia. Bond strength test was conducted by curing through 1.5 mm of Zirconia to test the worst-case scenario of limited light penetration through an indirect restoration. We also tested the resistance to toothbrush abrasion, simulating about 5.5 years of regular toothbrush use while measuring the depth of wear, change in surface roughness and gloss.

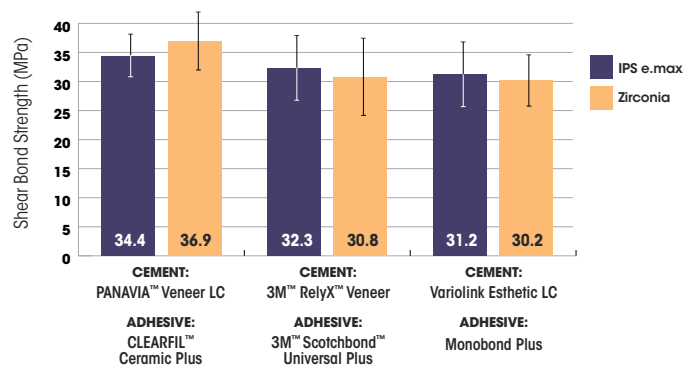
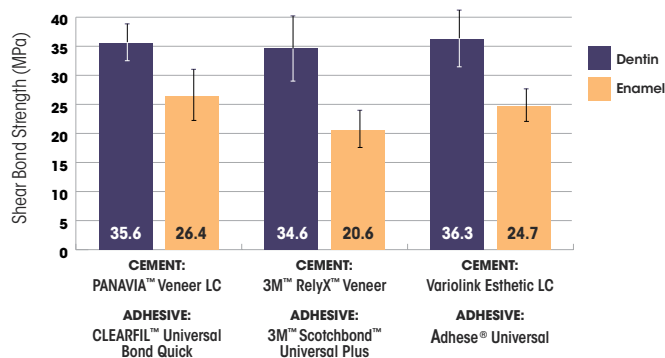
Bond Strength to multiple substrates:

Our test method for bond strength of cements for indirect restorations is based on an ISO/TS 11405 method in which a 100-micron thickness by 3 mm diameter space is created using single-sided PTFE tape for the cement between two substrates. In this study, one side of the test was always an approximately 1.5 mm thickness x 6 mm diameter disc of zirconia in which the light polymerization of an **Elipar Deep-Cure S** curing light with ~1470 mW/cm² irradiance was used, while the other side of the cement interface was different substrates including human dentin, enamel, **IPS e.max CAD** and **KATANA™ STML**. The critical bond interface we were interested in was on the side of the prepared substrate of dentin, enamel, lithium disilicate and zirconia, while the zirconia disc we were cementing to it, simulated a worst-case scenario of light attenuation to determine if the cements can cure with only ~80% of the applied light reaching the cement.

Thermocycling: The bonded specimens were then subjected to artificial aging by cycling the specimens between 5°C and 55°C for 5000 cycles and a 20-second dwell time. This stresses the bond due to the contraction and expansion of the two temperatures and is estimated to simulate about 6 months of in vivo use. This is a helpful screening test for determining if there is inefficient polymerization or compatibility issues between the products, as well as highlighting differences in performance between products.

Bond strength is calculated by dividing the overall force required to dislodge the disc from the surface by the surface area of the bonded interface to give a final result in MPa. While this may make it seem that the bond strength should be independent of the bonded area, we shouldn't directly compare the numerical results from different bond strength test methods as many factors can affect the overall value of the bond strength. However, the rankings of the materials should be consistent between tests assuming factors such as the surface treatment, and curing mode are consistent.

Bond Strength Results



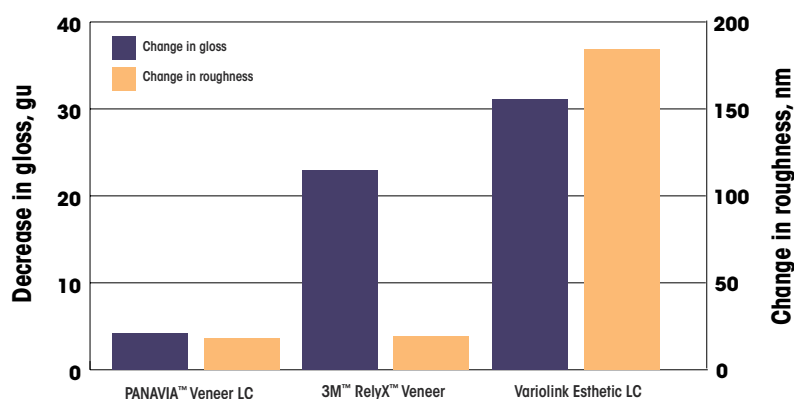
Panavia™ Veneer LC with **CLEARFIL Universal Bond Quick** and **CLEARFIL Ceramic Primer Plus** had equivalent or higher bond strength to the Dentin, Enamel and Lithium Disilicate substrates tested after six months of thermocycling simulated aging to the other two cement systems. **Panavia™ Veneer LC** with **CLEARFIL Ceramic Primer Plus** has the highest bond strength to zirconia (ANOVA and Tukey multiple comparison test, $p > 0.05$). All cement systems showed good adhesion after thermocycling, indicating sufficient curing light penetration through the zirconia disc used in this study.

Wear Resistance after Toothbrush Abrasion:

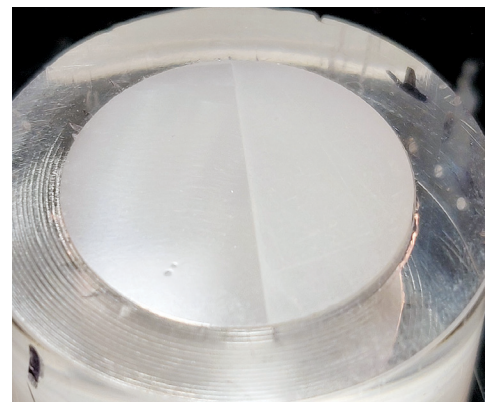
We prepared large discs of the cement and polished them with very fine-grit paper and then polished them with the **3M™ Soflex Diamond Polishing System** to produce a baseline of ideally polished specimens. Vickers hardness indents were made on the side to be brushed as the change in dimensions of the indent can be used to estimate how much wear was produced. Half of the cement discs were then covered with single sided tape to preserve the original surface, and the gloss was measured. The specimens were subjected to 30,000 strokes (5.5 years) of toothbrush abrasion which brushed the surface in a figure-8 pattern, with an average 180 g load and **Colgate Optic White Enamel** toothpaste.

After toothbrush abrasion, the surfaces were analyzed. We remeasured the gloss to determine how the wear of the surface changed the reflection of light. Having a cement margin that is less glossy than the tooth and ceramic around it may be more apparent as a matte line, as well as being an indication of increased wear. Surfaces were measured using an Atomic Force Microscope (Veeco Dimension Icon), which is a kind of surface profilometer with an extremely fine stylus of ~20 nm in width that traces over the surface to generate a 3D map of the surface. This is the most accurate way to characterize the surface roughness change on both sides of the specimen. We also measured about 40 microns on either side of the interface created by the tape in the middle which showed less overall wear than the large flat surfaces due to the tape protecting it as the figure-8 is traced from one side or the other. This interface may more accurately represent the situation in the mouth as a circular toothbrushing pattern wouldn't necessarily be directly applied to the cement margin.

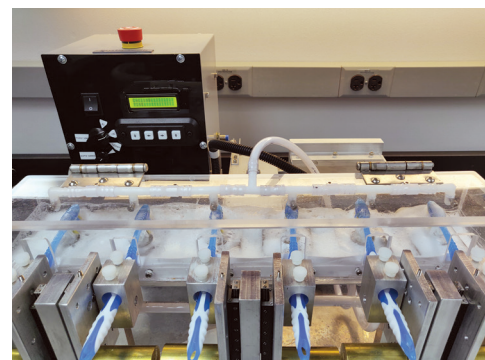
Change in Gloss and Roughness after Toothbrush Abrasion



PANAVIA™ Veneer LC had the best gloss retention of the three cements tested and a very even wear pattern. Having limited surface roughness after toothbrush abrasion can help lower staining and bacterial adhesion, with an average roughness of under 100 nm being ideal to prevent staining and bacterial adhesion. The final roughness after abrasion was under 50 nm for both PANAVIA Veneer LC and **3M™ RelyX™ Veneer**, while **Variolink Esthetic LC** had a roughness of over 200 nm. **Variolink Esthetic LC** had the presence of up to 3-micron diameter surface voids after toothbrush abrasion, likely due to larger filler clusters being removed.



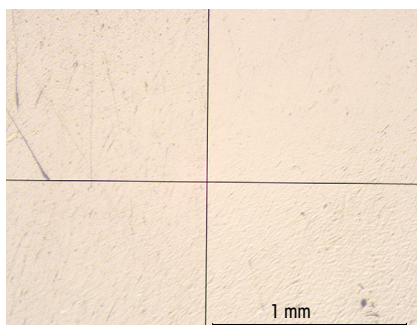
Example of a cement specimen after toothbrush abrasion, with the polished surface (~86 gu) on the left, and abraded surface (~63 gu) on the right.



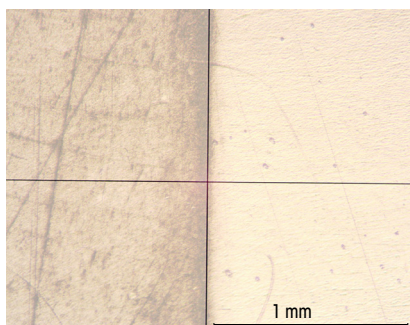
Proto-tech Advanced Toothbrush Simulator

Gloss is the reflection of light measured by shining a fixed beam of light at an angle to determine how much light is reflected at an equal and opposite angle. A high gloss for restorative materials is generally considered to be >70 gloss units (gu).

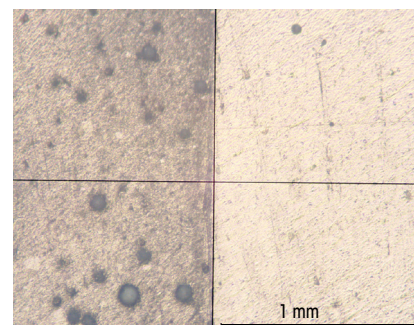
PANAVIA™ Veneer LC



3M™ RelyX™ Veneer



Variolink Esthetic LC

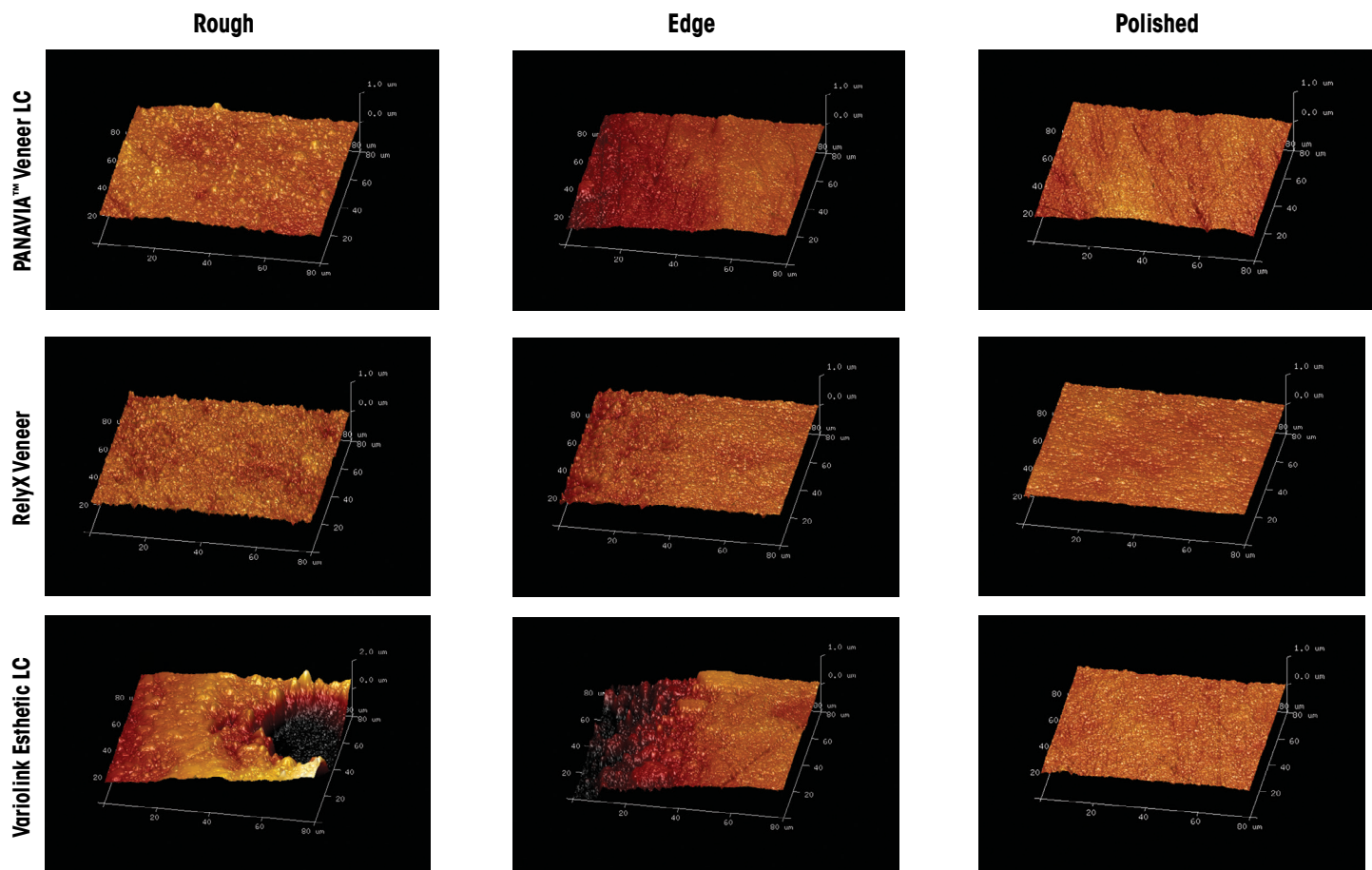


Appearance of surface gloss at 10X magnification after toothbrush abrasion (initial right, final left) **PANAVIA™ Veneer LC** has almost indistinguishable gloss difference after toothbrush abrasion.

PANAVIA™ Veneer LC and **3M™ RelyX™ Veneer** had similar depth of wear that was less than **Variolink Esthetic LC**. The depth of wear at the interface of the tape may better represent the clinical situation of a cement margin than the larger flat areas. Given that cement margins can often be 20 – 100 microns in thickness, the wear depth of a few microns isn't going to affect the clinical situation as much as the change in surface roughness; however, these values can indicate the overall resistance to abrasion. Abrasion can potentially also come from mastication of food particles as well. **PANAVIA™ Veneer LC** consists of spherical silica fillers and nano cluster fillers which allows a high overall filler load increasing the density to prevent excessive wear. The smaller diameter fillers have the added benefit of allowing easy application from the syringe and flowability for minimal film thickness. The Hardness of the cements are similar and within the range for flowable composites, cements and core materials.

Depth of Wear and Hardness			
Cement	Edge Depth of Wear within 40 µm of tape, µm	Average Depth of wear from Hardness Indents, µm	Vickers Hardness, HV/0.1
PANAVIA™ Veneer LC	0.7	1.8	49 (2)
3M™ RelyX™ Veneer	0.7	1.9	56 (2)
Variolink Esthetic LC	2.3	3.3	53 (4)

As seen from the AFM scans, **PANAVIA™ Veneer LC** has a largely flat surface after abrasion with some bumps from filler clusters that haven't been removed yet. This allows it to have an even glossy surface after abrasion compared to **3M™ RelyX™ Veneer** which has a more regular bumpy pattern despite similar average surface roughness. Putting it another way, **PANAVIA™ Veneer LC** has higher peaks on a nanoscale (but small enough to not present a problem clinically), while **3M™ RelyX™ Veneer** has slightly lower peaks, but more of them, which scatters light more lowering the gloss.



Representative 80 x 80-micron AFM scans of the Rough, Edge and Polished regions. Note, the **Variolink Esthetic LC** rough example has a different scale to show features of filler cluster being removed from the surface.

CONCLUSION:

PANAVIA™ Veneer LC cement system showed excellent adhesion properties and exceptional gloss retention and wear resistance. Due to its excellent properties, **PANAVIA™ Veneer LC Paste** can meet the most challenging esthetic conditions of veneer cementation.

Research supported by Kuraray Noritake Dental, Inc. Special thanks to the University of Michigan College of Engineering and the Michigan Center for Materials Characterization for use of the instruments and staff assistance.

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eBook



Motion Graphic Video



Motion Graphic Video



Motion Graphic Video



Clinical Video

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